

# 8. Research Experience with Tools to Involve Farmers and Local Institutions in Developing More Environmentally Friendly Practices

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## 1 INTRODUCTION

As a response to the increasing public focus on the externalities of intensive farming and the resulting pressure to strengthen public regulation for farming practices, Danish farmers, within their own farming organisations, have begun to formulate their own goals and intentions for the development of environmentally friendly farming. Moreover, the number of organic farms is increasing all over Europe and the EU is presently trying to harmonise the organic rules. However, this coupling of a still more centralised formulation of organic rules and a broader group of farmers not involved in the original value debates in the organic movement might threaten to reduce the potential environmental benefits of conversion to organic farming. For these reasons, there seems to be a need for tools facilitating both conventional and organic farmers to reflect on their current practices and values in the light of society's demands for environmental goods and nature values.

With the overall aim to facilitate a learning process for farm families, the ethical accounting consists of group dialogues (to help the family clarify its own values and goals in the light of interests existing in society), a yearly accounting with indicators of resource use, environmental impact and animal welfare, and so on, and a MODS procedure ('multi-objective decisions support') for strategic planning on the farm including the new criteria on which the family might want to focus. On the basis of an evaluation of the 20 participating farmers' attitudes toward ethical accounting, a theoretical understanding of the important factors influencing the farmers' involvement in the reflection and farm development process was developed. This approach was subsequently used to structure a questionnaire concerning farmers'

interests in decision aids, resource use and the environmental impact of farming. The questionnaire was mailed to about 1000 organic farmers. Results from this analysis will be presented and discussed in the light of the overall theme of possibilities for involving farmers in the development of farming practices in relation to local environmental goals. Finally, this topic will be discussed using preliminary results from a project using a social network theory to research 40 neighbouring farmers' possibilities of and motivation for developing environmentally friendly practices in a small region with sensitive groundwater resources.

With this background, the goal of this chapter is to present an empirical and theoretical reflection on how interactive decision tools can contribute to the involvement of farmers in developing more environmentally friendly farming practices.

## 2 DESCRIPTION OF THE DECISION AID: ETHICAL ACCOUNTING FOR A LIVESTOCK FARM AND STRATEGIC PLANNING USING ETHICAL ACCOUNTING (ETHICAL MODS)

The Danish Institute of Agricultural Sciences has developed an 'ethical accounting system' for livestock farms in a multidisciplinary project comprising agronomists, animal scientists, veterinarians, social scientists, professional philosophers and a group of farmers (Jensen and Sørensen 1998). The overall idea was that it would be beneficial for the farm family and for the farm as an enterprise to reflect on the farm's impact on relevant interests of different stakeholders (Pruzan and Thyssen 1990). From a systems point of view, this argument can be interpreted as the farm manager's need to reflect on his current management in the light of changes in the perception of farming on the part of the outside world (Kristensen and Halberg 1997). The stakeholders were broadly defined as present and future generations, the farm animals and the farm family (Jensen and Sørensen 1998). The ethical accounting consists of several components with the overall aim to facilitate a learning process for the farm family:

- A yearly account for each farm, including indicators of resource use, environmental impact, product quality and animal welfare in addition to the traditional technical-economic results.
- Group dialogues between farmers, with the aim of helping each family clarify their own values in light of the ethical conflicts in agriculture and letting the family formulate farm-specific personal goals to be included in the account.

The yearly account was used as a basis for a dialogue between researchers and the farm family regarding different possible interpretations of the results and the potential impact on other stakeholders' interests. For a description of the indicators, see Sandøe et al. (1997) and Halberg (1999). Most of the indicators were chosen in order to reflect the results of the farming practice. They should reflect changed management practice and thus be quantifiable and not just descriptions of the farmers' current practices (Halberg 1997).

### 3 STRATEGIC PLANNING USING THE ETHICAL ACCOUNT

One purpose of the group dialogues and the yearly accounts was that the families should clarify their own values and objectives in relation to the dimensions of animal welfare and environmental impact and so on. On this basis, they might want to include some of these aspects in their planning and management, especially in long-term (strategic) planning. However, because of the many new indicators of the results of their present farming practices, the families needed information about their alternatives to be able to decide whether they should change their practice and, in the affirmative, how. Moreover, the farmers could not be expected to have clear goals and preferences concerning these new dimensions of animal welfare and environmental impact.

Therefore, the farm families were invited to participate in an iterative multi-objective planning procedure based on ideas from multi-criteria decision making (MCDM) (see Romero and Rehman 1989; Bogetoft and Pruzan 1991). More specifically, an iterative procedure was set up allowing the participating families to clarify and change their goals and preferences when confronted with the predicted consequences of alternative plans (Bogetoft and Pruzan 1991). Thus, the learning process was assumed to be more important than a quick arrival at a specific plan:

The choice of an alternative corresponds to the culmination of a learning process where values, objectives, criteria, alternatives and preferences continually interact and redefine each other and lead — explicitly or implicitly — to a compromise, which dissolves the intra-personal conflict. From this perspective, preferences are context dependent and therefore dependent on the set of alternatives being considered. (Bogetoft and Pruzan 1991, p. 49)

The procedure of this multi-objective decision support was as follows:

1. Each of the 14 interested families formulated ideas for a change in their current practice — in the form of goals they wanted to pursue or in the

- form of alternative production plans following the distinctions between a so-called 'Prior Articulation of Preferences' method or a 'Prior Articulation of Alternatives' method (Bogetoft and Pruzan 1991).
2. The consequences of each alternative plan for the different dimensions were described by the researchers using predicted values for the indicators used in the ethical accounting. Some consequences, especially regarding animal welfare, could only be predicted in terms of the direction of change (that is, plan Y results in fewer cows with leg disorders compared to plan X).
  3. The alternative plans and their predicted consequences were then discussed with the family, who were asked to give priorities to some of the plans or to give weight or to set goals for some of the indicators. With information about the family's preferences, the researchers reformulated alternative plans before returning to the family for a second and third time. In each round, some plans were given up and the direction in which to search for interesting solutions became clearer. The farm family decided when to stop the search. Thus, no mathematical modelling of the farmers' preferences was attempted and the search for optimal solutions used the farmers' indications of directions in which they wanted the plans to be changed and the relative importance of the different criteria. An example of how this procedure was carried out on a specific farm is presented in Halberg (1998).

The farmers' general evaluation of their experiences with ethical accounting was positive. After each visit for presentation of the ethical accounting all farmers were phoned and asked for their experiences with and opinion of the ethical accounting. On a scale from 1 to 9, with 9 as best, the outcome of the participation in the project on average was evaluated to be about 7 (Table 8.1). This evaluation of the project also reflects different perceptions of ethical accounting and the use of ethical accounting. Due to this quantitative evaluation by the farmers, there is hardly any difference between the various groups of farmers, but the conventional dairy farmers seem a bit more positive than the other farmers.

As already described, the indicators were selected from a scientific, ethical perspective, and the interviews reflect the farmers' different perceptions of these indicators. Some farmers find them very meaningful. Some of the organic farmers find that the indicators do not capture the idea of organic farming, and one finds them too theoretical. One of the pig producers finds the environmental indicators an expression of romanticism far removed from modern agriculture. The different attitudes towards the indicators reflect a different perception of the environment. This means that the indicators cannot

Table 8.1 The farmers' general evaluation of the ethical accounting on a scale from 1 to 9, with 9 as best

	N	Mean Score
Organic dairy farmers	9	6.9
Conventional dairy farmers	5	7.2
Pig farmers	5	6.8
All	19	6.9

Source: After Michelsen (1998, p. 118).

be selected to fit everyone, and, from a voluntary point of view, that the discussion of indicators is a very important part of the ethical accounting.

Many of the farmers stated that they feel more confident when the technical and economic situation of the farm serves as the point of departure for a discussion of what can be done with the other aspects of the accounting. Several farmers also found that the aggregation of otherwise scattered information into a coherent evaluation ('whole-farm-oriented') was a positive quality of the ethical accounting. It was a help to combine the different perspectives of the farm management.

Experiences from the presentation of the accounting to the farm families indicate different ways of using the ethical accounting. While some families reflected on the results and on how to improve in one or several aspects, a few farmers felt no need to change their management (but they were happy with the documentation, which they got via the accounting). Thus, not all farmers intend to use the ethical accounting to reconsider their ideals and goals in the light of the present results, for they find that they are already doing what they can. Some organic farmers, for instance, find that they are ahead compared with conventional farmers. Others have involved themselves in a search for solutions to cut down energy use or fodder import (Halberg 1998).

These experiences are supported by the qualitative interviews. Through the interviews, three different kinds of reaction to the ethical accounting can be identified: (1) Reflections, where farmers/farm families use the ethical accounting to reflect on their present farming practice. (2) As documentation – many of the farmers think they are doing quite well and see the accounting as a tool to document this for the surrounding society. (3) Rejection of the whole concept or parts of it. All three kinds of reaction were identified within all groups of farmers.

The group dialogue was met with very different reactions, too. During the interviews, many of the farmers/families referred to the group dialogue as a

very interesting and inspiring part of the project. The confrontation of farmers with totally different values has been especially fruitful for the farmers' reflection on their own values. Other farmers said that they find that these group dialogues infringe on their privacy and that they do not want to discuss their values in such a context. Moreover, a few of the organic farmers claimed that they had already been through such value reflections and that the dialogues did not add anything new.

Of the 20 farmers co-operating in the project, 14 families decided to participate in the strategic planning process, the rest not finding themselves in a position to consider the long-term development of their farm. An average of 5–6 farm-specific plans was presented to each family, beginning with the family's choice of aspects to focus on. On all of the 11 dairy farms, changes of the stables were considered to improve animal welfare. Moreover, most families requested suggestions for reduction of energy use or other types of negative environmental impact, including the possibilities for a conversion to organic farming.

The farmers' responses were very different. It appears that for some farmers it is very difficult to formulate ideas to alternative plans or preferences, they are restricted to what they actually find realistic. Other farmers easily come up with several ideas for alternative plans. An explanation of these differences is the farmers' different ways of managing the farm. Some farmers do not think of alternatives to plans or preferences. These farmers have a clear perception of how their farm should be developed and managed. They do not seek alternatives, but strive to improve their specific way of farming. Other farmers are used to thinking in alternative solutions, they relate their goals and values less to the farming processes than to the outcome in terms of money, spare time, flexibility, and so on.

The interviews reflect that the attitude towards the ethical MODS tool and an involvement in a strategic planning process was more connected to the farmers' interest in actual relevance than to the concern with ethical aspects. This supports the hypothesis that the farmers' interest in such tools is much more linked to management strategies than to the farmers' environmental and ethical concerns.

The above evaluation shows that the farmers involved have a positive attitude to their participation in ethical accounting in general, but it also indicates very different ways of perceiving the concept and of applying it to the whole farm management process. This hypothesis is tested below in a survey among organic farmers using the 'farming styles' approach.

#### 4 ETHICAL MODS AS A TOOL FOR THE ORGANIC FARMERS

Organic farming in Denmark, as in many other places in the 1980s, was formulated by farmers as values and objectives for organic farming. Some of these values and objectives were formulated as the rules we associate with organic farming today. The idea of a MODS tool based on ethical accounting could be relevant for organic farming when reflecting on the connection between objectives formulated for organic farming and the actual outcome. The organic farmers' motivation for using an ethical MODS tool is analysed in a survey of all organic farmers converted in the period 1995–97. A questionnaire was mailed to the 1004 registered organic farmers, of which 592 were returned completed.

To get a more in-depth analysis of the heterogeneity of interest in ethical MODS and to explore the above findings, the survey was analysed using a 'farming styles approach' which builds on a theoretical understanding of farm management as a socio-technical practice constructed through social processes (van der Ploeg 1995). In this chapter, styles of farming are defined as self-creating and self-organising communicative systems where the goals and significance of farming are created through communicative social processes. The theoretical and empirical foundations of the farming styles approach employed in this chapter are elaborated in the Ph.D. thesis by the author (Noe 1999). The farming styles approach has thus far only been applied to the group of dairy farmers in the Danish context. Therefore, the following farming styles analyses are only based on the sub-group of dairy farmers.

The classification builds on two pairs of opposing communicative systems. The first is a 'craft' versus a 'business' communication and the other is a 'turnover' versus an 'economic' communication. The pairs of communications are mutually dependent on each other to make each other meaningful and the individual farmers' orientations towards these communications are alternative to each other. The tension between these opposing communications is described in table 8.2.

Based on these communications, columns of value statement about farm management are formulated for the questionnaire. Factor analysis with an 'Oblimin'<sup>1</sup> rotation is used to extract the two fields of tensions and the factor scores are interpreted as the respondents' relative orientations toward these communications. The factor analysis simply reduces strongly correlated variables to factors, and the factor scores are the value of each observation regarding this new factor (Kim and Mueller 1994).

Table 8.2. Classification of opposing communicative systems

<b>Craft →</b>	<b>← Business</b>
'You have to be skilful as a farmer to make a living of it'	'You have to be flexible and market orientated to make a living of it'
Specialisation – Own skills and experience – Individual cow – Optimisation of production –	– Flexibility – Updated knowledge – Herd – Economic optimisation
<b>Turnover →</b>	<b>← Economic</b>
'You need to have a high turnover to develop the farm and make an income of it'	'Saved is earned'
Newest technology – Abrupt growth on borrowed capital – Rationalisation of size –	– Second hand – Gradual growth on own savings – Go simple

Based on these new variables of factor scores, four clusters of orientations were obtained by quick cluster analyses. This clustering procedure is a relatively rough categorising, but usable for analysing the connections between differences in management and attitudes towards MODS. The following descriptions of some of the key features of these farming styles are based on the Ph.D. thesis by the author (Noe 1999).

- The craftsman style is characterised by an orientation towards the values connected to a high yield per cow and personal skills where intuition and experience play a central role. The family and family labour play an important role and, finally, the style is characterised by a desire to be self-financing and less dependent on market fluctuations.
- The business style is characterised by a desire to be market orientated. Farmers orientated towards this style identify themselves more as business managers than as farmers. In the business communication the competent farmer can explore the financial possibilities of the market and quickly adapt production accordingly.
- The entrepreneur style is characterised by strong ideas and goals in farming and the development of the farm; choices are made with a long-term perspective. In this communication size, technology and, consequently, rationalisation of the farming processes are of great



importance. In contrast to the business style, farmers within this communication identify themselves very much as farmers.

- The intensive production style. This style is characterised by an orientation towards a large and intensive production and a clear vision of the enlargement of the production. Though skill orientated, this style is much more focused on technology than the craft style, and its orientation towards knowledge is linked to technology, for example complete feed mixer. This communication is mainly concerned with specialisation and rationalisation and is not particularly orientated toward market opportunities.

In the questionnaire the farmer was asked: To what extent do you think that a MODS tool would help improve farm management in general, and to what extent would you apply an ethical MODS tool in farm management in order to improve the environmental impact of your farming if such a tool were available?

If we look at the whole group of respondent organic farmers we find that approximately 25 per cent of the farmers have positive attitudes toward the possibility of applying a MODS tool, approximately 30 per cent are not sure, while the rest are not interested or do not believe in such a tool at all (Figure 8.1(a)). This picture does not change much for the attitudes towards an ethical MODS tool, although the percentage of farmers that 'might be interested' in such a tool has increased and the percentage of farmers that 'do not need such a tool' has decreased compared to the group of farmers that 'have enough tools'. The results suggest that approximately 25 per cent of the respondent organic farmers are likely to use an ethical MODS tool but only 10 per cent for certain, and that another 30 per cent of the farmers could possibly be motivated to apply such a tool. No such survey has yet been made among conventional farmers, but there is reason to believe that their attitude to MODS tools will not differ dramatically.

We will now take a closer look at the group of organic dairy farmers among the respondents. The survey provides an opportunity to analyse the relation between farm management and attitudes towards MODS from a farming styles perspective introduced above. Table 8.3 shows Parson's correlation between the attitudes towards MODS and ethical MODS and five variables constructed from the questionnaire. The first variable expresses the farmers' perception of the fulfilment of the organic goals on their own farm. The second variable expresses to what extent these goals are focused on their own farm. The third variable is an expression of the farmers' perception of their own general possibility of improving the farm management in relation to the organic goals. The last two variables are drawn from farming styles presented above.

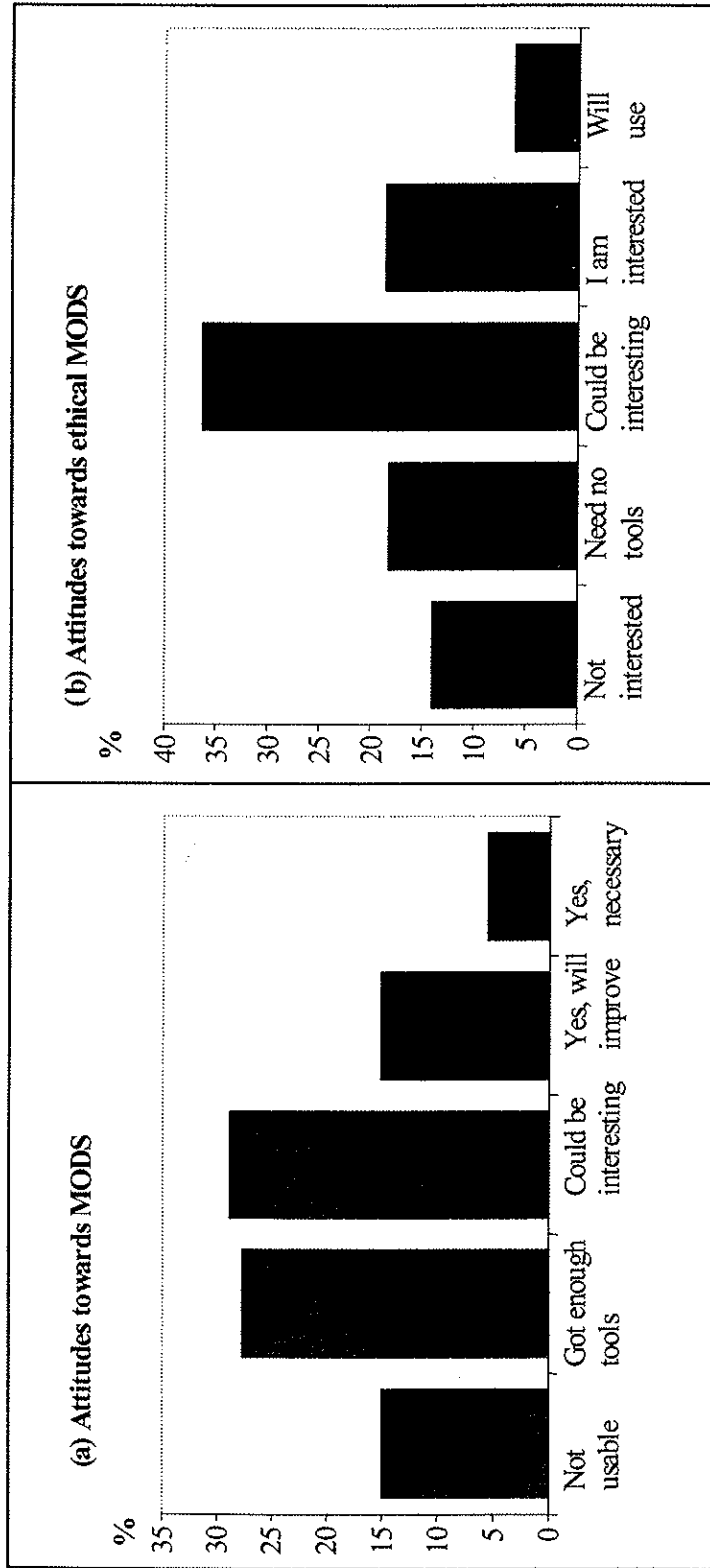


Figure 8.1 Farmers' attitudes towards implementation of MODS tools (a) and the degree to which they expect to use a tool like ethical accounting if it were available (b) (N=512)

Table 8.3 Correlation coefficients between organic farmers' expected use of ethical MODS, conception of environmental problems and farm management

Pearson correlation	Attitude towards MODS	Attitude towards ethical MODS tools	Perception of fulfilment of the organic goals	Organic goals in focus in management	Perception of possibilities to fulfil goals
Attitude towards MODS <sup>(a)</sup>	1.00				
Attitude towards ethical MODS tools <sup>(a)</sup>	0.57 **	1.00			
Perception of the fulfilment of the organic goals <sup>(a)</sup>	0.07	0.04	1.00		
Organic goals in focus in management <sup>(a)</sup>	-0.06	-0.08 *	0.66 **	1.00	
Perception of possibilities to fulfil goals <sup>(a)</sup>	-0.06	0.00	0.55 **	0.62 **	1.00
Economic versus turnover <sup>(b)</sup>	0.25 **	0.26 **	0.23 **	0.21 **	0.21 **
Craft versus business <sup>(b)</sup>	0.37 **	0.45 **	0.24 **	0.21 **	0.20 **

Notes:

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

(a) N = 537-597.

(b) N = 169-178.

Table 8.3 shows the extent to which the farmers find problematic areas within their farming and the extent to which they focus on these problems in their management. There is apparently no correlation between attitudes towards ethical MODS and the perception of the environmental situation of the farm. Furthermore, there is no correlation of the attitudes towards ethical MODS and the farmers' perception of their possibility of doing something about it in their management. This supports the findings of the qualitative evaluations of the MODS above that the attitudes towards ethical MODS are not correlated to environmental concerns but to the question of how such a concept fits into farm management.

This conclusion is supported by the very strong correlation between the attitude towards ethical MODS and the management dimension established from the farming styles approach. The highest correlation is found between the business-orientated farmers and ethical MODS. In the following, this will be analysed in the context of farming styles of the subgroup of dairy farmers within this group (Table 8.4).

*Table 8.4 The attitudes of the dairy farmers orientated towards the different farming styles (in per cent)*

Attitude towards ethical MODS tools	Strategy of farm management				
	Business	Craft	Entrepreneur	Production	Total
Not interested	3	12	3	9	7
Need no tool	18	36	5	5	17
Could be interested	37	38	31	58	41
I am interested	39	14	44	26	29
Will use	3		18	2	5
N of respondents	38	50	39	43	170

Compared to the whole group of respondents, the attitudes of this group of dairy farmers show the same patterns. Although a little more positive, still only about 25 per cent of the farmers have positive attitudes. The percentage of 'could be' is a little larger. If we look at the differences between the four styles, clear differences in attitudes can be explained by the differences in logic and values of the styles.

The craft style holds by far the most negative attitude towards an ethical MODS tool. Only 14 per cent of the farmers clustered into this style claimed an interest in an ethical MODS tool and none of the farmers in this group

claimed that they would use such a tool for certain. This fits nicely with the description of this style as orientated towards one's own skills and experience. Their management is performed in the stable and not at the desk. The entrepreneur style, on the other hand, shows very positive attitudes towards MODS. This fits into the picture of this style as both orientated towards big enterprises, where management tools are needed, and towards external knowledge. The intensive production-orientated farmers show a mixed reaction to an ethical MODS tool. Almost 60 per cent hold a 'could be' attitude. This can be explained by the fact that, despite their large-size farms, these farmers are more focused on technology than on knowledge.

Table 8.4 shows clear differences between the different farming styles and their attitudes towards MODS tools. Craft and intensive production-orientated farmers will hardly make use of such a tool voluntarily, simply because it does not fit into their way of managing their farms.

## 5 FROM FARM LEVEL TO MICRO REGION/WATER CATCHMENT

Through their own farm organisations, Danish farmers have formulated goals and intentions of good farming practice – an introduction to integrated farming presented in a pamphlet called 'Good farming practice year 2000'. This introduction is primarily to be seen as a reaction to the environmental debate and as an effort to prevent more regulation. These goals are complementary to the organic movement's declarations of goals and include objectives to reduce pollution in agriculture, to minimise nutrient losses and to maintain biodiversity and landscape values. The hypothesis was that the ethical accounting could help farmers to pursue such goals within their economic and practical constraints.

There are, however, some obstacles to such a voluntary approach. First, as described above, only approximately 30 per cent of the farmers can be expected to employ such a tool. Another 30 per cent might be engaged, but this would probably require some kind of extension or pressure. Secondly, many aspects of a farm's environmental impact can only be evaluated in relation to locally defined goals for landscape and environment and in relation to the conditions on the neighbouring farms. Likewise, important environmental and landscape values can only be furthered if several farmers in a small region change production methods in the same direction. Therefore, the success of a voluntary approach might depend on co-operative strategies and farmers networking that might again require extensionists or external facilitators to support the process.

The evaluation of the possibilities for the development of a small region must, therefore, be based on the understanding of the farmer's motivation for participation in a co-ordinated implementation of some of the goals of good agricultural practice. This was also shown in an evaluation of the attempts to establish green corridors in two Danish counties (Just et al. 1996). Personal contact and public plans adjusted to local farmers' interests thus proved to be better than a simple introduction of general economic incentives to introduce environmentally friendly production methods (Wiborg 1997). Röling (1994) suggests the creation of local platforms for dialogue. Experience from different European projects suggests that the creation of a common understanding of problems and possible solutions among stakeholders in an area is a prerequisite for a fruitful development (Deffontaines et al. 1993; Hubert et al. 1993; van der Ploeg and Long 1994).

To research this potential for profiting from local resources when defining environmental problems of agriculture, and to find possible solutions, a project (the Fabjerg project) has been started in a small area with 40 neighbouring farms. Eight of these farmers have agreed to be pilot farmers. The area is situated in a region with important interests in drinking water and a traditional landscape undergoing changes. The work will use experience from the ethical accounting, including the group dialogues and the combination of natural and social science.

The main research topics are:

1. to develop farming systems that are economically viable and environmentally friendly in terms of locally defined goals,
2. to study the motivation of different types of farmers for including local goals for landscape and environment in their management,
3. to find ways to create a platform for dialogues between different stakeholders in the area, that is, intensive farmers, part-time farmers, local authorities, and so on,
4. to research the importance of farmers' networking for the implementation of environmentally sound agricultural systems.

In a first round of interviews the farmers in the area claimed to live up to the goals and intentions behind 'Good farming practice year 2000'. They reported that they have already done a lot to reduce the use of pesticides and the amount of fertiliser, and that they have applied new technology to improve the nitrogen utilisation of the organic manure. Generally speaking, the farmers interviewed stated that they see new problems in the present way of farming. Two of the farmers have recently converted to organic farming. The motivation for these farmers to convert was not any kind of critique of conventional farming, but rather they had converted primarily for economic

reasons and in order to create a more positive image of agriculture. Obviously, the local farming discourse asserts that the present conventional farming is environmentally sound and that the problem is that the farmers have to convince the rest of society of the fact – a discourse shared by the local advisory centre and probably not far from the general agricultural discourse. This means that one of the major barriers for a voluntary change of farming practices toward a more environmentally sound approach is the farmers' perception of the ethical and environmental impact of their present farming practices. Therefore, any voluntary change must include a process of problem identification.

One of the main intentions behind the Fabjerg project is to involve local human resources and knowledge in such a process. The idea is to involve the farmers collectively in the discussion and improve environmentally friendly farming practices. To analyse the possibilities of such a collective local strategy, a network approach is employed (Wiskerke and Oerlemans 1998). A network analysis shows that farmers are not primarily forming technical-social networks within this narrow area but in a much larger regional area. Several factors play a role in the explanation of the weak local networking of both a social and a technical character. One of the factors apparently most important to stress here is the structural development, which here as elsewhere results in a tension between farmers in the competition for farmland. The network analysis therefore leads to the conclusion that the advisory centre is the only local social and technical platform that includes almost the whole group of farmers.

The Fabjerg project is centred around two kinds of tools: the already described MODS tool based on developed ethical accounting, and a GIS-based tool as a platform for identification and discussion of the problems of the area. Both tools need data from the farms in the area. The ethical MODS tool is employed in a process of interactions with the eight pilot farmers as a point of departure for discussion of the possibilities of improving the environmental impact of the farms. The results of these interactions with the individual farmers will be one of the inputs in the local discussion.

Another input will be a GIS-based tool to illustrate the geographical situation of different problems. As the central interest of the area is groundwater, the first figures presented to the actors involved in the project at a local meeting will be the nitrogen balance of the area, both at farm and field level. An example of such a visualisation of the problematic situation is presented in Figure 8.2, an ArcView map showing the estimated nitrogen surplus at field level.

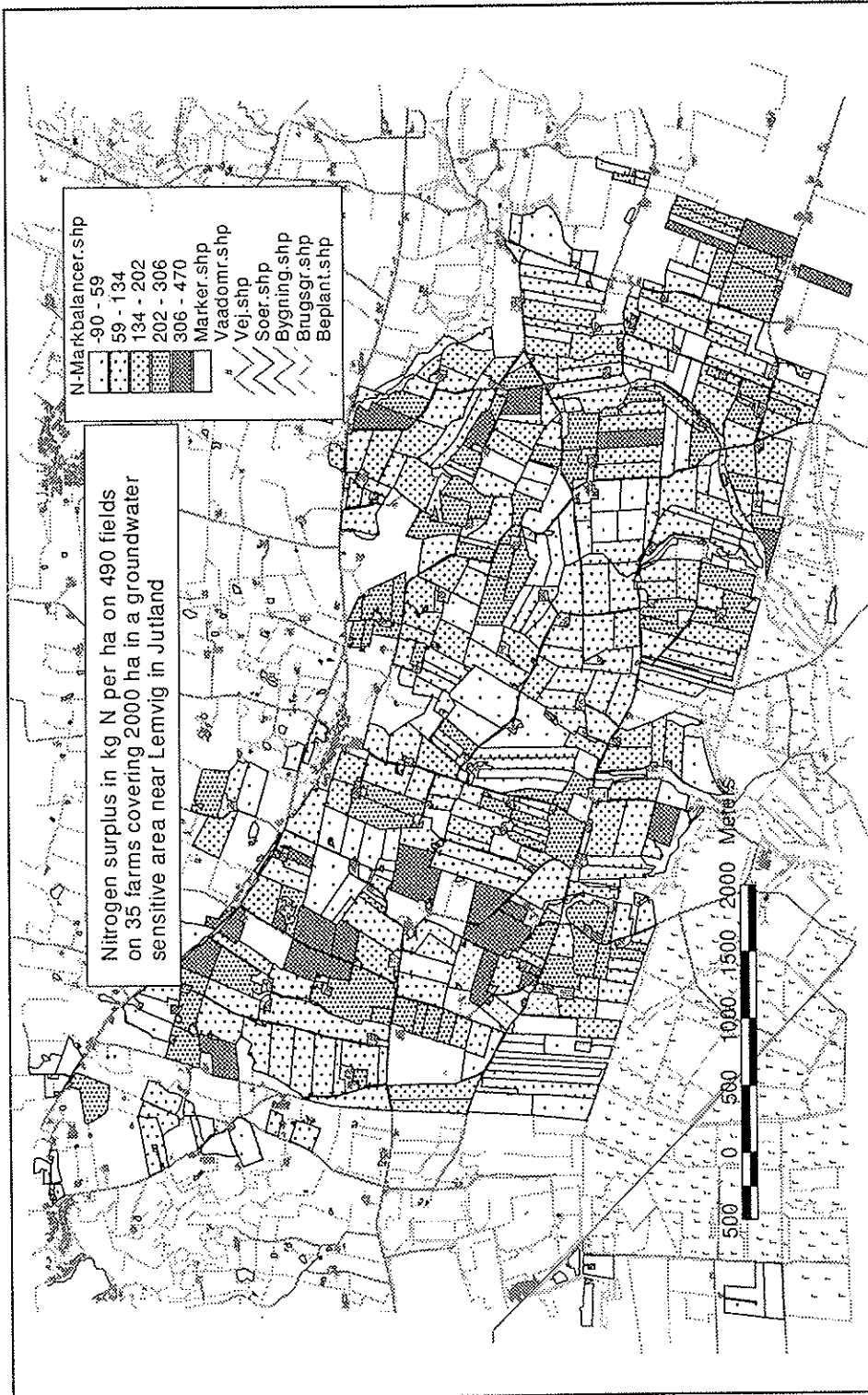


Figure 8.2 Presentation of the 1998 nitrogen surplus at field level for different crops



The idea is that these two processes represented by the two kinds of tools will support each other in a mutual process of discursive problem identification and contextual problem solving. Former experience and research show that MODS tools cannot stand alone, and that discursive problem identification plays an important role in such a developing process.

So far, there have been no local environmental revolutions, but through our contact with the farmers we recognise that the farmers are reflecting on the inputs. The success of such projects depends on the degree to which the relevant local actors are involved in the process. Furthermore, it is also important that the local advisors act as central actors in the local discourse and as facilitators of the process and that the other interested parties are involved. As researchers, we can stimulate such a process with knowledge and tools, but we cannot control the processes. In the role of facilitators, we have to be sensitive to the local social processes. Network analysis turns out to be a good point of departure for such reflections.

## 6 CONCLUSION

Indicators that quantify environmental and ethical aspects of farming have proved to be a good point of departure for a discussion with farmers on the environmental impacts of farming. Many farmers appreciate the whole-farm orientation of such a discussion that combines the environmental aspect with technical and economic aspects of farming.

Empirical studies suggest that only 25 per cent of organic farmers can be expected to voluntarily include an ethical tool that includes different environmental indicators. Attitudes towards such a tool are correlated with the way in which the farm is managed and not with the environmental concerns of the farmer. Studies of conventional farmers show that one of the major barriers for voluntary improvement of the environmental impact of farming is the farmer's perception of the environmental impact of the farm.

Researchers can possibly stimulate and facilitate local voluntary processes by means of knowledge and tools (top down) but they cannot control these processes. In the role of catalysts, we need to be sensitive to the local social situation and processes. A social-technical network analysis has proved to be a good tool for such sensitivity.

## NOTE

1. Oblimin: 'a general criterion for obtaining an oblique rotation which tries to simplify the pattern matrix by way of reference axes' (Kim and Mueller 1994, p. 72). This method allows the extracted factors to be correlated but makes the interpretation of these easier.

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