

**Abstract and paper for the IX Symposium of the European Group of the International Farming Systems Association, Volos, Greece, 3 - 7 April 2000.**

Workshop 5: Education and training for farming systems research and extension

Pernille Kaltoft,  
Assistant Professor, Ph. D.  
Department of Economics and Natural Resources,  
The Royal Veterinary and Agricultural University,  
Rolighedsvej 23,  
DK-1958 Frederiksberg C  
Denmark  
e-mail: [peka@kvl.dk](mailto:peka@kvl.dk)  
phone: +45 35282166

Title of paper: Professionalism in extension service - opening the "black box" of agro-scientific expert knowledge. Organic farming as a case.

**Abstract:**

Agricultural extension education and research focuses on the societal context in which extension work takes place, the situation of the farmer and on learning processes, both the farmer' learning processes and the mutual learning processes in the advisory situation. With this paper I add another focus, namely the expert knowledge (subject matter) of the extensionist (agronomist etc.). Insights from the social constructivistic sociology of science and technology can be used to open the "black box" of the expert knowledge showing how scientific facts as well as technology are products of social processes. The classical modern view of natural scientific knowledge considers this knowledge objective and value free. Also in relation to the field of agricultural extension education and research expert knowledge tends to be viewed as "factual", "objective", "hard". I use organic farming as an example of "opening the black box" drawing on my own previous empirical research. Expert knowledge related to organic farming can be divided into four different discourses, each related to certain values, views of nature and general aspects belonging to the philosophy of science. Based on a few empirical examples I show that the extensionist shall be aware of these different discourses/values inherent in his or her own knowledge (education) in order to be a real facilitator *and* also to ensure a diverse development of agriculture in terms of sustainability.

# Professionalism in extension service - opening the "black box" of agro-scientific expert knowledge. Organic farming as a case.

## Introduction

From reading the literature on agricultural extension education and research it is my impression that learning processes and the theories conceptualising these processes (reaching from theories about the transfer of knowledge to learning based on experience (experiential learning) to system approaches) constitute the core of the subject. This learning process approach is combined with a focus on the situation and the need of the farmer. The aim of this paper is to add a focus on the character of the expert knowledge of the extensionist. The scientific way of constructing knowledge does not differ that much from how farmers learn. Therefore one of the best ways to become a more professional extensionist is to be more conscious about the character of your own knowledge.

The concrete case of the paper is the upcoming of organic farming which has made different paradigms within the area of agro-scientific research visible. These paradigms are related to different views of nature inherent in the different paradigms. Farmers have different views of nature. Nobody is surprised to be told that organic and nonorganic farmers have different views of nature. Some are surprised if they are told that even the group of organic farmers represents a variety of views of nature, but very few realise that so-called expert knowledge can be classified with respect to view of nature. This becomes increasingly visible when analysing the Danish history of organic farming up to now.

It is my vision that extensionists become aware of their own view of nature (and other values) not just as private persons but as inherent in their expert knowledge systems as well. I consider such reflectiveness as a prerequisite for engaging in a real mutual dialog where you understand and acknowledge other kinds of views than your own.

## The expert knowledge as a "black box"<sup>1</sup> in agricultural extension education and research

The combination of the learning process perspective and a focus on the needs of the farmer has led the researchers within the field of agricultural extension service and education to understand the role of extension as facilitation of collective action among different stakeholders and involving social learning (Röling and Jong 1998, p. 152) and creating room for mutual learning (Nitsch 1994). This means a strong emphasis on the processes of advising and little emphasis on the expert knowledge of the extensionist. With "expert knowledge" I mean the subject matter or content areas of the extensionist about animal husbandry, plant nutrition and so on. Nobody seems to discuss whether the extensionist needs to be an agronomist or an agricultural economist (or whatever the relevant educations for agricultural extensionists are called in different countries). When the process perspective is so heavily stressed you could get the idea that another training would be more appropriate, for example a Master's degree in psychology or communication. I presume that this is

---

<sup>1</sup> I have borrowed the concept of "opening the black box" from the vocabulary of the so-called new sociology of technology (Bijker and Pinch, 1987, p. 21-22). It is also used in the critique of this tradition as the following title of a paper indicates: "Upon Opening the Black Box and finding it Empty: Social Constructivism and the Philosophy of Technology" (Winner 1990).

not discussed because it is considered important to have a background from some kind of agricultural university, which means that the subject matter (expert knowledge) of the extensionist still plays an important role as stated by Levander (1999, p. 25). However, this expert knowledge of the extensionist is treated as a "black box" in agricultural extension education and research.

The underlying philosophy of the education of agronomists (and engineers) is referring to a separation<sup>2</sup> of nature and culture<sup>3</sup>. Nature is described objectively and seen as value-free by the natural sciences. Values belong to the sphere of culture and can be understood in many ways. Social sciences and the humanities are characterised by plurality and relativity opposed to the objectiveness of the natural sciences. These claims seem naive seen from a sociological point of view (assessing that we are living in some kind of post or late modern society) but nevertheless they form the underlying philosophy of the education of agronomists/engineers: Technology is viewed as *applied* sciences and mathematics. The social constructivist tradition dealing with technology and attached to the sociology of science has thoroughly deconstructed the idea of technology as applied science (Bijker a.o. 1987). Bruno Latour who also belongs to the social constructivist tradition has gone further: Technology is not socially shaped in the old dualistic sense of social, which so to speak brackets nature off. Latour confronts the basic nature-culture dichotomy of western thought (Latour 1993). The actor network theories include non-human actors (Callon 1987, Latour 1983). Whereas nature is always conceptualised by humans, the concrete "appearance"/conception of the non-human actors will always be culturally interpreted. What is human and non-human is a product of practice. Latour talks about variable ontologies. In my terms it means that a view of nature is produced in every practice and that expert knowledge, like everything else, is immersed/embedded in values, assumptions about the role of science (epistemology), the "nature" of nature and culture (ontology), the concepts of objectivity and subjectivity. This means that every single piece of information, data or research result carries or represents at the same time a philosophy (or world view), just as any practice does. The philosopher MacIntyre, who has given the virtue ethics of Aristotle a renaissance (MacIntyre 1985), has written about the gap between philosophy and practice: "Unpractical philosophical theorizing confronts atheoretical social practice" (MacIntyre 1992, p. 11). In the context of this paper farming practice as well as agro-scientific work is a social practice.

This perspective of the constructivistic sociology (or philosophy) of science can be seen as a critique towards the "soft" and "hard" systems approach. According to constructivistic sociology of science (or technology) no "hard" systems exist. The so-called "hard system" only represents the winning interpretation (the social construction of technology tradition uses words such as "stabilisation" and "closure" to describe the process where a scientific "truth" (or a new technology) is established). Talking about hard and soft systems functions as an acceptance of the positivistic self-knowledge underlining most agro-scientific research. The same kind of acceptance towards the dominant understanding of expert knowledge can be observed when researchers concerned with extension consider expert knowledge as "information" for the farmer where this information is based on data generated by research (for instance Østergaard 1997, p. 6-7). Instead we should follow the way of thinking as presented by Cees van Woerkum in the following citation:

---

<sup>2</sup> The separation is viewed as either ontological and epistemological or as only epistemological. The difference does not matter for this discussion.

<sup>3</sup> Bruno Latour considers the specific construction of nature and culture to be the crucial aspect of modernity (Latour 1993, p. 34)

"Behind scientific results, also in the field of 'hard sciences', we can trace the assumptions or presuppositions that account for what is important or not and what consequently has to be dealt with. There is a lot of implicit knowledge that influences the interaction between scientists; not only the interaction via scientific articles, but - more important - the interaction in laboratories or in the informal setting of congresses and workshops ..."  
(Woerkum 1999, p. 40)

Many of the characterisations of farmers' learning (or similar professions) that have come up as results of detailed studies (Levander 1998 and 1999, Østergaard 1998) resemble the findings from the constructivistic sociology of science (and technology): Knowledge is contextual, scientific "facts" are contextual. The farmer/the scientist is placed in various social networks and the farmer/the scientist "communicate" with nature (nonhuman actors in the actor network theory). For both groups contextuality and being a part of networks also mean that knowledge and ways of learning are historical, parts of "local" tradition (which might be a global "local" tradition in the case of the scientist). Tacit knowledge, knowing-in-action and embodied knowledge play an important role for both groups (for example described for engineering scientists by Schön (1983)). Farmers' learning and experts' learning - and thereby the construction of practice whether it is a farming practice (producing food) or a scientific practice (producing "data", "knowledge") - basically have to be conceptualised in the same way.

Extensionists are in some places beginning to recognise that the complex situation of the farmer and the farm family as a whole must be the point of departure for the advice given. In Denmark a big project was running for three years (from 1990 to 1993) within The Danish Agricultural Advisory Centre in order to implement a model of strategic whole farm planning (Jensen et al. 1993). The model had strong emphasis on the visions of the farm families. Based on experiences from my work with organic farmers I believe that an increased awareness of the construction of your own expert knowledge is a necessity for extensionists in order to be able really to engage in mutual learning or to become real professional facilitators. In the case of the organic farmers it has often been quite obvious to see the links between on the one hand the visions and objectives of the farmers and on the other hand different trails ("paradigms") of expert knowledge.

### **The vision of the organic farming movement seen in a post or late modern context**

Organic farming has emerged as a social movement. The organisations of organic farming movement ask for liveable rural communities, for reducing the distance between consumer and producer and for the recycling of nutrients through integration of cities, agro-ecosystems and natural ecosystems<sup>4</sup>. These three demands are contrary to the actual direction of the world food system where food production becomes increasingly detached from production on a global scale, making direct contact between consumers and producers as well as recycling of organic matter/nutrients illusory. The demands from the organic vision of another society therefore go far beyond asking the consumers to buy organic products. Basically, the organic farming movements work for a changed man-nature relation where humans (again) understand and respect our relations to and dependence of the soil. The central ideas of the organic farming movements about soil fertility and sustaining living nature express these views<sup>5</sup>. A first glance this is a pre-modern point

---

<sup>4</sup> I refer to eight goals of the organic farming formulated in a Nordic IFOAM subgroup in 1989 (Kølster 1989). The three aspects mentioned are the three last goals. The goals of The Danish Association of Organic Agriculture include the same visions. IFOAM stands for International Federation of Organic Agriculture Movements.

<sup>5</sup> The goal number 3 and 5 in Kølster (1989).

of view, recalling, for example, elements of the organic worldview of the middle ages (Merchant 1980). Organic farming includes farmers that really are pre-modern in their own lifestyles, as for example the old-fashioned farmer Jens from my case study (Kaltoft 1997, p. 161-175, Kaltoft 1999, p. 43-44): Jens is a rare example of a practitioner with a worldview that is not affected by scientific discourse<sup>6</sup>. The lifestyle of Jens is not possible to choose, because it is so inseparable from tradition, making virtue ethics in the old sense (MacIntyre 1985) a relevant conceptualisation. In this sense Jens can be characterised as pre-modern. The attitudes of Jens cannot be conceptualised by any principles, laws or general rules. The criterion seems to be some kind of complex functionality of the farm, but at the same time leaving the knowledge of this functionality obscured for theoretical conceptualisation in tacit knowledge.

This kind of farmers does exist, probably also among the industrialised farmers, but it is not in that sense of pre-modern that organic farming in general can be characterised as including pre-modern aspects. Following the ideas of Latour, the consequences of giving up belief in external objective nature as opposed to the human subject, will not only be one ontology of nature (or nature-culture), but loads of different ontologies. Or more correctly, as stated by the actor-network theorists: we already have these different ontologies, we just do not want to see and acknowledge them. In my analysis of the different views of nature of organic farmers and of the views of nature inherent in the different scientific discourses related to organic farming, different ontologies are expressed (Kaltoft 1997, 1999). To get beyond modernity means to a certain extent to become pre-modern again, but now realising that we live in hundreds of 'middle ages' at the same time. Each local nature-culture - that might be organic farming opposed to industrial farming or subgroups within the organic farming movement - constructs networks and thereby mobilises nonhuman actors in different ways.

### **The modernisation of organic farming**

In Denmark organic farming is institutionalised as described by several researchers (Christensen 1998, Kristensen 1997, Kristensen & Nielsen 1997, Kaltoft 1999). The phenomena of institutionalisation is observed in other countries too: Ireland (Tovey 1997), Australia and New Zealand (Kristen Lyons and Geoffrey Lawrence 1999, Campbell and Liepins 1999). When institutionalised organic farming stops being a social movement. The institutionalisation is an adaption to classical modernity - organic farming practices are integrated in the dominant institutions and the dominant way of defining knowledge, expert knowledge, sustainability and so on.

For organic farming the institutionalisation includes a change in the producer-consumer relation, a change in the attitudes towards and relations to the scientific institutions and a change in views of nature. The producer-consumer relation becomes non-personal and market mediated as the organic products are sold increasingly through ordinary channels (supermarket i.e.). Today the organic products are distributed globally. Consumption of organic products in itself only secures less use of pesticides and mineral fertilisers and maybe better welfare for the animals involved. Organic farming becomes a food processing system and is drawn into the ordinary lay-expert relation where we believe that rational, objective scientific knowledge serves the development of a rational and economical food production system. The original radical view of nature, including a view of nature as subjective or minded leaving the farmer with a moral responsibility for the soil, is abandoned in

---

<sup>6</sup> It is rare in Denmark - and in other North European countries I presume - not to be affected by scientific discourse as most farmers have fairly much education.

favour of a modern view: organic farming as a technical means to solve environmental problems, using the insights of ecology, for example the idea of closed circuits, as a more efficient way of controlling nature.

The struggle about how to define organic farming can also be seen as a struggle about how to define sustainability. Different discourses of sustainability are related to different ideas about environmental ethics, ranging from techno-managerialism to social and deep ecology (Koutsouris 1999, p. 101). The organic farming movement relates primarily to social and deep ecology, whereas the process of institutionalisation (modernisation) of organic farming associates organic farming with a technical and management concept of sustainability.

### **Scientific discourses of organic farming**

The organic farming movement has never been non-scientific. A lot of scientific arguments have been used to explain the ideas of organic farming, and scientific work has been carried out in order to help the development of organic farming (but by no means as much as has been carried out to support and develop the industrial farming system). The organic farming movement represents elements of criticism towards ordinary science, but often also a deep belief in "true" objective knowledge about nature - they are asking for another knowledge than the one produced by the established scientific institutions. In my study of six farmers' views of nature and practices (Kaltoft 1999, 1997) five of these had ideas about explaining scientifically what they were doing, for example in relation to manure. They were referring to the science of ecology (3 farmers/farm families) or knowledge produced in the scientific community of anthroposophy (1 farm family) (a phenomenologically based natural science founded on the ideas and work of Goethe, developed by Rudolf Steiner and others) or new theories about plant communication (1 farmer) or the expert knowledge of the advisors from the extension service (2 farmers). Aspects of farmers' narratives are part of the broader narratives including the sciences and professional practices. Knowledge is shared by *some* farmers, *some* agronomists in extension and advisory services, and *some* agro-scientific researchers.

Recently a very interesting dialogue has been going on internally in the organic research group at the Danish agricultural university<sup>7</sup>: Due to the growing organic farming sector in Denmark research institutions are giving more financial support for natural scientific research in organic farming. As a result new researchers appear within the subject area, and a conflict between the old researchers and the newcomers occurs. The 'old' researchers are those who are dedicated to organic farming, they are part of the movement and they often have close relations to organic farming practice, whereas some of the new researchers know nothing - besides the rules - about organic farming but they are experts in for example nitrogen fixation. The encounter forces the 'old' researchers to clarify their values in relation to their scientific methods, not only as external goals or demands made on their research. Unfortunately, the newcomers do not need to explain what they are doing, they are just making science! But anyway it might mean the beginning of a changing consciousness among natural scientific researchers.

---

<sup>7</sup> I know about these local, informal discussions because I have been invited to give my point of view on their discussions. And I supervise a student (who is writing her thesis) doing an investigating of the relations between view of nature and scientific practice among the researchers in organic farming. We have presented our ideas and wishes for the group of researchers and so to speak been allowed to do research on their research - very much like the idea of Latours ethnographic study of the researchers in the laboratory.

## Four "paradigms" in organic farming knowledge - an example of opening the black box of agro-scientific expert knowledge

In previous work I have described four paradigms of knowledge in organic farming, the methodology behind the construction of these "paradigms", that they are not Kuhnian and so on (Kaltoft 1999, p. 49-51, Kaltoft 1997, p. 231-277). I will now use this work as an example of how extensionist could be more aware about different values inherent in their own knowledge and consequently be better advisors for the farmers.

The four paradigms of knowledge related to organic farming are: the paradigm of nutrients (the conventional point of view), the paradigm of soil fertility (the traditional, ecological point of view), the biodynamic point of view seen as a paradigm, and the paradigm of communication (an intermediary point of view). Each paradigm is described regarding contents, analysed with respect to philosophy of science, and consequences for the knowledge in action are described, for instance manuring strategies (Kaltoft 1997). The results of the analysis is summarised in Figure 1.

	<b>the paradigm of nutrients</b>	<b>the paradigm of soil fertility</b>	<b>the biodynamic paradigm</b>	<b>the paradigm of communication</b>
<b>central issue</b>	plants need nutrients to grow	the important role of humus in relation to soil fertility	enriching matter with mind (life forces)	matter "carries" information
<b>knowledge of nature</b>	Liebig + empirical results	soil ecology (edaphology)	soil ecology (edaphology) + phenomenological knowledge about nature	semiotic knowledge of nature
<b>view of nature</b>	nature as matter  Cartesian-Newtonian	non-dualistic, teleology in nature is connected to ecosystems  <i>or</i> nature as matter, non-reductionism	mind-matter dualism  spheres of mind	non-dualistic, teleology on all levels of nature  <i>or</i> nature as matter, "teleology" a result of complexity of systems
<b>role of man</b>	manipulator in control	cautious co-operation	developer, to create farm individualities	to interpret communication
<b>manure</b>	mineral fertilisers (conventional) liquid manure + ploughing in stable manure (organic)	to work for fertile soil, increasing humus in soil	compost using the biodynamic preparations	high level of nitrogen gives low quality of crops and vice versa

Figure 1

The paradigm of nutrients basically belongs to the thinking of conventional farming, but it also exists in organic farming and it is gaining influence. Extension and advisory services stick to this paradigm for instance on the question of manure. The consequence being that it is regarded as the most central issue to save nutrients in organic farming in order to increase output. The paradigm of nutrients is heavily supported by the education of agronomists. And as organic farming gets more dominated by professionals, i.e. agronomists and others, this influence will grow. Today, for example, extensionists assist organic farmers' planning of crop rotation and distribution of manure, using computer programs that are based on the paradigm of nutrients. Both for the extensionist and the farmer it is difficult to discuss and be critical towards a computer tool. The computer program appears to be very "hard", but it is not. The challenge is to make the extensionist (agronomist) aware of this.

As another example I will mention one of the farmers from my case studies (Kaltoft 1999, p. 45-46, Kaltoft 1997, p. 200-209) who was advised by the extensionist (an agronomist) to build a certain kind of new stable. This stable was actually built and will determine the manure practice on the farm for many years as a nutrient focussed practice instead of as a soil fertility focussed practice. This happened even though during the interview the farmer revealed a sceptical attitude towards what he experienced as the experts focus on nutrients. The blindness of the extensionist towards these different "paradigms" regarding manure made him persuade the farmer to choose a solution that might not fit the farmer. Seen in a larger context organic farming practices are gradually narrowed into practices that match a classical modernistic definition of sustainability (increased control of physical nature). Awareness in itself does not necessarily change this direction of development but it is a prerequisite for a future development of a diversity of strategies for sustainability in agriculture. The paradigm of nutrients is more "main stream", easier to connect with technical education, easier to inform conventional farmers about, easier to put into quantitative rules whereas the three other ways of thinking presuppose awareness of different views of nature and different value assumptions.

## **Conclusion**

I have argued, using organic farming as a case, that professionalism in extension work demands more awareness among the extensionists about the character of their own expert knowledge. This falls back as a missing dimension in the education in agricultural universities, a theme I have not dealt with at all in this paper. Drawing on recent constructivistic sociological studies of science and technology, I claim that the learning processes and knowledge construction in science and farming practice are equal in principle. Today agricultural extension education and research treats the expert knowledge (subject matter) of the extensionist as a "black box". I suggest that we start to open the box to become aware of the assumptions and presuppositions inherent in that knowledge. The case of organic farming shows how different scientific discourses support the development of different organic farming practices. If the extensionist wants to help the farmer developing his (or their) visions of an organic farm he (or she) must be aware of these different discourses, their relation to different views of nature, definitions of sustainability and different concepts of environmental ethics.

## **References**



- Bijker, Wiebe og Trevor Pinch (1987): *The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other*, in Bijker et al. (ed.): *The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology*, MIT Press, Cambridge, Massachusetts, London, England.
- Callon, Michel (1987): *Society in the Making: The Study of Technology as a Tool for Sociological Analysis*, in Bijker et al. (ed.): *The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology*, MIT Press, Cambridge, Massachusetts, London, England.
- Campbell, Hugh and Ruth Liepins (1999): *The Development of Organic Standards in New Zealand: Evaluating the Evolution of Organic Certification during Export-led development*, paper presented for the XVIII Congress of the European Society for Rural Sociology, Lund, Sweden, 24-28 August.
- Christensen, Jens (1998): *Alternativer - natur - landbrug*, Dr. Thesis, Akademisk Forlag, København.
- Jensen, Christian; John Mogensen; Gunnar Sigaard and Jens Ole Thøgersen (1993): *Action Research in Strategic Whole Farm Planning*, in *Proceedings of the 11.th European Seminar on Extension Education*, August 30 - September 4, 1993, edited by Jens Ole Thøgersen, Christian Jensen, Gunnar Sigaard and John Mogensen.
- Kaltoft, Pernille (1999): *Values about Nature in Organic Farming Practice and Knowledge*, in *Sociologia Ruralis*, Vol. 39, No. 1.
- Kaltoft, Pernille (1997): *Naturetik som praksisbegreb. En undersøgelse af naturforståelse, praksis og viden i økologisk jordbrug*, Ph.D. thesis, Department of Technology and Social Sciences, The Technical University of Denmark.
- Koutsouris, Alex (1999): *The Sustainability Discourse: Challenges to Agricultural Education*, in *The Role of Extension Education in a Global World*, Proceedings of the 14.th European Seminar on Extension Education, vol. 1, Cracow.
- Kristensen, Niels Heine (1997): *Økologisk bæredygtige produktionssystemer i fødevarersektoren - en vurdering af tre case studier*, Ph.D. thesis, Department of Technology and Social Sciences, The Technical University of Denmark.
- Kristensen, Niels Heine and Thorkild Nielsen (1997): *From Alternative Agriculture to the Food Industry: The Need for Changes in Food Policy*, in *The IPTS Report*, Special Issue 20, (<http://www.jrc.es/iptsreport/vol20/english/FOO3E206.htm>).
- Kølster, Per (1989): *Økologisk Jordbrug - Fælles nordisk beskrivelse*, in Bo Pedersen (ed.): *Ecological agriculture in the Nordic countries*, Report from the 1989 meeting of Nordic researchers and advisors in ecological agriculture and Nordic IFOAM, p. 122-126.
- Latour, Bruno (1993): *We Have Never Been Modern*, Harvester Wheatsheaf, New York, London.
- Latour, Bruno (1983): *Give Me a Laboratory and I will Raise the World*, in *Science Observed. Perspectives on the Social Studies of Science*, ed. by Karin Knorr-Cetina og Michael Mulkay, SAGE, London.
- Levander, Lena (1999): *Green Fingers, green eyes and itchy feet - challenges for extension?*, in *The Journal of Agricultural Education and Extension*, vol. 6, no. 1.

- Levander, Lena (1998): *From Green Fingers to Green Eyes. Exploring the conception of knowledge and knowledge construction of horticultural entrepreneurs*, Ph.D. thesis, University of Helsinki, Department of Economics and Management, Publication no. 19, Extension Education, Helsinki.
- Lyons, Kristen and Geoffrey Lawrence (1999): *Institutionalisation and Resistance: Organic Agriculture in Australia and New Zealand*, paper presented for the XVIII Congress of the European Society for Rural Sociology, Lund, Sweden, 24-28 August.
- MacIntyre, Alasdair (1992): *Moral Philosophy and Contemporary Social Practice: What holds them apart?*, Working paper from Center for Kulturforskning, nr. 113, Århus, Denmark.
- MacIntyre, Alasdair (1985/90): *After Virtue*, Duckworth.
- Merchant, Carolyn (1980): *The Death of Nature: Women, Ecology and the Scientific Revolution*, Harper & Row, New York.
- Nitsch, Ulrich (1994): *From Diffusion of Innovations to Mutual Learning. The Changing Role of the Agricultural Advisory Service*, paper, Department of Extension Education, Swedish University of Agricultural Sciences, Uppsala.
- Röling, N. and F. de Jong (1998): *Learning: Shifting Paradigms in Education and Extension Studies*, in *The Journal of Agricultural Education and Extension*, vol. 5, no. 3.
- Schön, Donald A. (1983): *The Reflective Practitioner. How Professionals Think in Action*, Basic Books, Inc., Publishers, New York.
- Tovey, Hilary (1997): *Food, Environmentalism and Rural Sociology: On the Organic Farming Movement in Ireland*, in *Sociologia Ruralis*, Vol. 37, No. 1.
- Winner, Langdon (1990): *Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology*, working paper no. 44, Senter for teknologi og menneskelige verdier, Forskningsparken, Universitetet i Oslo.
- Woerkum, Cees van (1999): *Integrated Designing*, in *The Role of Extension Education in a Global World*, Proceedings of the 14.th European Seminar on Extension Education, vol. 1, Cracow.
- Østergaard, Edvin (1998): *To skritt frem og ett tilbake. En fænomenologisk undersøgelse af økologiske bønder i omstilling*, Ph. D. thesis, Institut for Plantefag, Norges Landbrugsuniversitet.
- Østergaard, Edvin (1997): *The Role of Learning in Farmers' Conversion to Ecological Agriculture*, in *Learning in Farmers' Decision Making*, edited by Bo Ôhlmér and Daniel Lunneryd, proceedings from a Workshop in Uppsala, January 20-21, 1997, Department of Economics, Swedish University of Agricultural Sciences, report 116.