

4th European Farming Systems Symposium

**Systems Research and Extension into the Next Millennium
Environmental, agricultural and socio-economic issues**

In
Volos, Greece, April 3 to 7, 2000

Workshop 2: Farming and rural systems methodologies

**Participatory Management of Large Interdisciplinary Research Teams -
First experiences from a rural research and development project in Germany¹**

By Thomas Aenis and Uwe Jens Nagel
Humboldt University Berlin
Division of Agricultural Extension and Communication Science

Abstract

The authors discuss their experiences within a German research and development project (GRANO) which experiments with a "participatory management" concept aiming at solving the specific problems of interdisciplinary research while at the same time ensuring co-operative decision making by relevant actors.

A major goal is to establish a systematic process of self-organisation in every sub-group with assistance by a number of process-advisors. By intervening in as well as analysing the research process they introduce, test, and evaluate practical management-tools. Instruments of intervention, having stood a "real life" test, are presented which have helped in managing an open process of project planning and implementation. In addition, a number of practical steps for solution of problems, characteristic of large interdisciplinary projects, are proposed.

A joint definition of problems and objectives as well as periodic evaluations are the basis for agreeing on common activities. Conflicts are thus reduced, especially between different disciplines of the natural and social sciences. Intervention of process-advisors using non-directive instruments in a flexible way may not show quick results but is sustainable. Evaluations of communication processes, if only done regularly, are a helpful tool to improve internal and external collaboration. It is especially important to close the cycle of problem resolution by jointly defining and deciding on consequences.

The approach has also shown that participatory planning of a research project in which both, researchers and regional actors are considered as equals is possible and may result in realistic project proposals. To do this, it was first necessary to come to a provisional internal understanding – with the help of a participatory management concept.

¹ We acknowledge financial support by the German Federal Ministry for Education and Research (BMBF)

Participatory Management of Large Interdisciplinary Research Teams - First experiences from a rural research and development project in Germany

By Thomas Aenis and Uwe Jens Nagel
Humboldt University Berlin
Division of Agricultural Extension and Communication Science

1 Introduction: Managing large R&D projects

Development problems which in industrialised agriculture are increasingly seen in an ecological context do not come in a disciplinary shape. With "interdisciplinarity" as an accepted paradigm in problem-focused research serious problems of managing interdisciplinary groups have emerged (KLEIN 1990, MITTELSTRASS 1995, HAWKINS 1997).

Reasons may lie in the individual researcher's lack of willingness to be a team player (KLEIN and PORTER 1990). In addition, interdisciplinary teamwork requires much time and engagement in "communicative activities" which are neither honoured financially nor in terms of improved academic status (HEBERLEIN 1988). Interdisciplinary work also requires a high degree of openness and innovativeness, including the acceptance of using less formalised methodological approaches.

The quality and efficiency of interdisciplinary co-operation is often limited because of a failure to integrate methods and concepts of various disciplines. The use of different paradigms, jargons, methodologies may prevent a mutual understanding of the problem and, therefore, lead to the definition of different and sometimes contradicting objectives. This holds especially true for the potential conflict between natural and social scientists (THIEDE and MASUCH 1995).

Within the realm of agricultural research, farming systems research (FSR) and land use planning are areas where interdisciplinarity is indispensable. However, as HAWKINS (1997) reports, only few FSR projects have reached interdisciplinary status involving both, technical and social sciences. Still, there is a growing scientific knowledge on ecologically and economically sound planning and management techniques for natural resources. If so, why is this knowledge not widely applied in practice? According to PRETTY (1995 p.203), additional factors play an important role:

- ◆ Local actors are not involved in research planning.
- ◆ Relevant local knowledge is not sufficiently considered.
- ◆ While "participation" features prominently in project documents it is not operationalised in a serious way.

Sustainability in social, economic, and ecological terms is the central goal of R&D projects in the field of natural resource management. Up until now, impacts seem to be marginal (PRETTY 1995 p.13). As a consequence, a change with regard to institutionalising and organising participation of all relevant actors is necessary (SMITH et al. 1997). But which efforts ensure participation? How to manage this process? Which structures support efficient outputs?

Some practical experiences have been made in training small teams for interdisciplinary research². KLEIN (1990 pp.189f) reports on co-ordination instruments for different phases of the research-process. What is missing are practice oriented approaches for managing large interdisciplinary research teams. The GRANO³ project we are presently involved in is experimenting - at a meta-level - with such approaches. This paper presents experiences of the first three phases (1997 - 1999).

2 A Participatory management concept within the GRANO-project

GRANO is a scientific co-operative project supported by the Bundesministerium für Bildung und Forschung (BMBF) as part of its national research programme "Research for the Environment". Programme goal is "...to find ways of transferring ecologically sound knowledge into practical action,

² See for example the experiences of ICRA (International Centre for development oriented Research in Agriculture) and CATAD (Centre for Advanced Training in Agricultural and Rural Development)

³ Approaches for a sustainable agricultural production: Application for Northeastern Germany

give recommendations in form of management-concepts to decision-makers and accompany the implementation of this concepts in a scientific way..."(BMBF 1996). The goal shall be reached, according to the ministry, with the help of "...a systematic approach by interdisciplinary research and by integrating regional actors, both decision-makers and land users".

How can this be translated into research practice? Definitions of interdisciplinarity vary from one author to another⁴. While "interdisciplinarity" according to JANTSCH (1972) often is used to describe interaction of two or more disciplines and "transdisciplinarity" deals with co-operation between different research-levels (basic, applied, even research policy), both characterise communication of people having a different background - but still within research. However, generation of knowledge is a necessary but not sufficient condition for changing reality (development). In order to achieve change, knowledge has to flow to some end user. This will require some kind of operationalisation which in turn involves knowledge users, research, as well as knowledge-disseminators (NAGEL 1979).

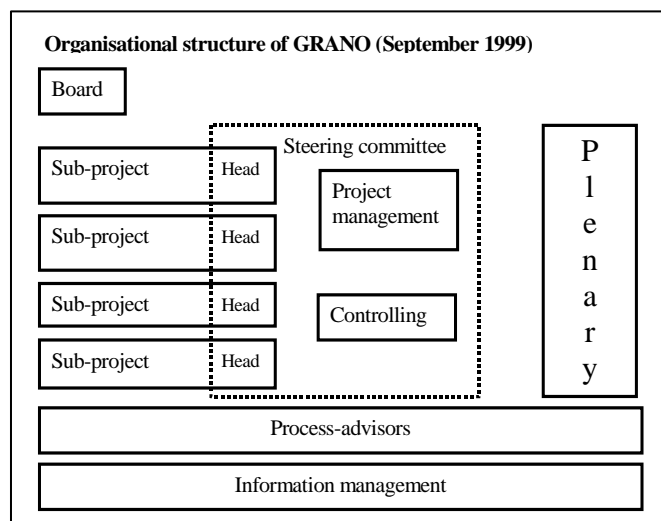
GRANO researchers felt from the very beginning that "interdisciplinarity" and "participation" are two sides of a coin. Project success could only be achieved if the project would be managed in a way that local and regional actors are involved in decision making during the full project cycle: from planning to implementation and in evaluation. Given the basic philosophy, the challenge was to find adequate ways not only to organise the interdisciplinary work process, but also to allow participation in different phases of the project and within its different organisational units. These forms of participation would change in time according to the respective phase of the project.

"Participatory management" was consequently defined as a process: solving the specific problems of interdisciplinary research, which is a more internal view, while at the same time ensuring co-operative decision making by all relevant actors, a more external view.

The organisational structure which includes different levels of decision-making has to be flexible, too. The present structure is shown below.

The project as a whole as well as all sub-projects had to find solutions for:

- ◆ Mutually defining problems to be tackled and objectives to be reached;
- ◆ Finding a common research methodology on the basis of the research philosophy and the negotiated objectives;
- ◆ Agreeing on activities;
- ◆ Developing a culture of communication, both internally as well as externally;
- ◆ Developing and institutionalising a system of feedback and evaluation.



3 Methods to introduce participatory management

In the beginning, the process of tackling the above problems was fairly centralised. With increasing complexity of the work process, enlargement of research staff, intensified contacts with local actors, and the change from planning to implementation it became, however, evident that only a decentralised approach would be feasible. Presently, a major goal is to establish a systematic process of self-organisation in every sub-group. These groups are expected to manage themselves in a co-operative way, specify objectives within the overall framework, define corresponding activities, and also reflect on their style of communication.

A number of process-advisors assist in these efforts, informally during an early phase of the project, later-on institutionalised as a working group. They play a double role: active intervention as facilita-

⁴ for an overview see KLEIN 1990

tors of group events as well as advisors, if called upon. A more passive role is assumed when analysing and documenting the research process as a whole. The approach may be characterised as action research on a meta-theme.

The objective of both, intervening in as well as analysing the research process, is to introduce, test, and evaluate practical tools which increase the potential for self-organisation within the different interdisciplinary groups. Inputs may come from all group members, the specific role of process advisors is to systematise the process. As a coherent theoretical model was not available and relevant practical experiences are rather scanty, GRANO decided to test a number of tools from various sources, adapt and improve these instruments step by step in an iterative way, and finalise a set of "good practices" towards the end of the project. Intermediate results are regularly documented, analysed, and systematically evaluated in view of their usefulness. They are then fed back to the groups to be refined.

Active intervention⁵ aimed at:

- ◆ Showing the advantages of a democratic leadership style not based on status differences;
- ◆ Generalising problem and objectives oriented planning procedures (a modified logframe approach, SCHUBERT et al. 1991);
- ◆ Encouraging the flexible use of different non-directive instruments of co-operative decision-making (brainstorming, open discussions, visualisation, consensus building);
- ◆ Institutionalising a system of monitoring and evaluation (feedback from controllers, SWOT analysis, informal "flashlight" evaluations).

Indirect intervention takes place in many different and often informal ways:

- ◆ By facilitating plenary and group workshops it is possible to demonstrate key elements of co-operative group action;
- ◆ By applying FISHER's concept of "lateral leadership" when acting as an ordinary group member (FISHER and SHARP 1998);
- ◆ By feeding back the information gained as a participant observer to key persons and group leadership;
- ◆ By systematically collecting process data with the help of questionnaires, observation, informal interviews, analysing results and preparing a manual on interdisciplinary group work.

Although the project is at this time (September 1999) only in the beginning of its implementation stage and therefore the internal view dominates it is possible to identify instruments which have stood a "real life" test. In the following, a number of such instruments are presented which, in our view, are useful for managing a large interdisciplinary project and, at the same time, allow participatory planning. In addition, a number of "typical" problems are discussed, problems which have been identified both by GRANO researchers (e.g., as a result of problem-brainstorming in a plenary session) as well as by controllers and which are documented within different project papers. We assume these problems to be characteristic of large interdisciplinary projects in general and a number of practical steps for problem solution are presented.

4 The internal view: Managing interdisciplinary project planning

On the basis of a first project outline, the original GRANO team was invited - together with 6 other research groups - to prepare a detailed project proposal during a 10 months "definition phase". The work in this phase was still dominated by researchers. A decision was taken, however, that whatever the results of this phase would be they would have to be adapted once local actors would play a stronger role.

The most important planning instrument during GRANO's definition phase was the **plenary workshop**, a two-day event which was held five times. At these workshops, all major topics (definition of problems, objectives, structure, methodology) were discussed by the whole group. Workshops were open to all interested researchers as well as external actors. The number of participants varied from 25

⁵ SKINNER (1994) shows several practical techniques.

to 32. External actors represented state and county level. Workshops were prepared well in advance by a planning team and the workshop concept (objectives, topics, procedures) was disseminated via email to all participants in advance for comments.

Workshops were always facilitated by one or two persons. None of the facilitation techniques used were particularly new, but many participants were at first quite unaccustomed to this working style. First of all, a half-circular seating arrangement without tables changes patterns of communication. Contacts between participants and with the facilitator are more direct and informal. Pin-boards were used to visualise both process and results. Brainstorming in a written form allowed the participation of everybody. Workshop evaluations became a regular feature. They included the assessment of results as well as of the communication process. Workshop minutes were distributed shortly after the event.

The core outcome of this series of plenary workshops was an agreement on major problem areas, on objectives to be reached, and a common understanding with regard to a "project philosophy" (GRANO 1997). A basic assumption was that the project plan was provisional in the sense that it largely presented a research point of view. It was therefore decided not to elaborate detailed activities at the local level but rather to design a procedure which would allow a step-by-step implementation in which concrete terms would be negotiated with local actors. In addition, two model regions were selected which would allow a test of transferability during project implementation. Different forms of participation were to be institutionalised during the defined phases.

Plenary workshops are too large for intensive subject matter discussion. Four **topical working groups** soon constituted themselves which either prepared inputs to the plenary workshops or pursued activities resulting from workshop decisions. The themes for each of these groups emerged from the preliminary problem census and included environmental issues, the farm, the region, and the political framework. In order to ensure interdisciplinarity and inter-group communication, most researchers worked in at least two of these working groups.

Even these working groups proved to be too large or not flexible enough for some of the tasks. Consequently, a third tier was introduced in the form of **ad-hoc working groups**. These were active in-between workshops, but also during workshops to solve pressing problems or conflicts. Members were often senior researchers delegated by the plenary or the topical working groups.

In addition to these fora, the project organisation includes three units with service functions to all: information management, controlling, internal and external co-operation.

Information management was seen as important for transparency and efficient collaborative work. It includes general transmission of information as well as supporting decentralised information management within workgroups. Data storage is centralised but it is assured that researchers at different locations working on the same topics have access to all data while security and data protection is ensured. The unit has also installed a platform for decentralised communication between participants allowing exchange of documents of various formats and co-ordination of dates. Internet-based communication tools have proved quite efficient for the research group. Other participants, especially farmers do not necessarily have access to the internet. Therefore, traditional communication techniques are also still in use.

The unit has specifically been given the task to create practical and user-friendly instruments. All instruments are developed, tested and adapted in dialogue with users. Within each sub-group, a person has been designated the "data contact person". In addition, system administrators attend subject-matter working groups and an intensive co-operation between process-advisors and information management has been institutionalised (AENIS and WIELAND 1999).

Controlling as a distinct project activity was seen as indispensable for several reasons. It is an instrument of project management to ensure that, once project activities become increasingly decentralised they are still focused on overall project objectives. This is practically done by supporting decentralised planning, helping to define and monitor milestones, and institutionalising feedback to project management. In addition to this internal aspect of evaluation, the project controller will elaborate and install a system of participatory monitoring and evaluation. Thus, actors in the project regions will not only be involved in assessing final impact of the project but can also influence project implementation.

Some of the tasks of the unit responsible for **internal and external co-operation** have been mentioned above ("process advisors"). "External co-operation" refers to organising, supporting, and analysing the different forms of participation at different levels (local, county, state) and at various phases of the project. Experiences from the first three phases are presented below.

5 The external view: Organising participation

Experiences with participatory research and development projects are widely documented and have established a new paradigm of agricultural and environmental research (CHAMBERS et al. 1989, SCOONES and THOMPSON 1994). A closer look reveals that many - if not most - of these experiences have been gained in developing countries and at rather limited local scale. For Germany, there is very little documented evidence for people's participation in research & development projects. GRANO had to develop its own approach to practice-research co-operation.

The approach⁶ may be visualised as a "ladder of participation". Starting with the process of **selecting project regions** within the State of Brandenburg, state and regional representatives were invited to participate in the decision making process at plenary workshops. Once the two project regions were determined, their sheer size presented formidable obstacles to obtaining representative views from relevant actors. They include three counties with some 454.000 inhabitants and an area of 6.440 km².

GRANO researchers conducted an in-depth **situational analysis** of the first region (Uckermark-Barnim) over a period of 6 months with four objectives in mind:

- To identify problems as seen by actors in the region;
- To identify existing initiatives for problem solution;
- To acquaint local actors with the GRANO project and win potential co-operators;
- To complement existing knowledge within the research team.

Results of the situational analysis were synthesised and served as an input into a three-day **regional planning workshop**. Care was taken to make the document as user-friendly as possible. Its content focused on the "subjective" problem definition rather than presenting the research point of view. Selecting relevant participants proved to be difficult. What was needed was a sample of actors who were to some degree representative of major interest groups as well as of micro-regions. At the same time, they had to be willing and able to participate in a three-day event. To safeguard the workshop character, it was decided to limit the number of participants to 25 (including 7 researchers of various disciplines). In theory, the following steps were to be followed for selection:

- (1) Determine relevant interest groups;
- (2) Check list with local resource persons;
- (3) Determine the number of persons to invite from each group;
- (4) Get proposals for names (and substitutes) from local resource persons and from groups;
- (5) Sound out willingness of potential invitees and get agreement to attend;
- (6) Finalise list of participants.

Steps 1-4 presented no complications, practical problems in finalising steps 5 and 6 were formidable and too numerous to mention. The workshop did, however, take place as planned with 21 persons attending.

Getting together relevant actors is no end in itself. What, then, is specifically "participatory" in this type of planning workshop and how does it influence the course of the research project? Final objective of the workshop was to determine practical fields of intervention in the project region. In order to achieve this, a logical sequence of activities was followed: on the basis of present problems develop a vision on the future of the region and determine the potential role of the GRANO project. In practice, this meant:

⁶ For details see SIEBERT et al. 1999

- Problem analysis: Results of the situational analysis were cross-checked, corrected or supplemented
- Future vision: Results of a brainstorming on "Our region in 2010" were clustered and transformed into medium term objectives for a five-year period
- Role of GRANO: objectives were prioritised taking into account resources and expertise available within GRANO. A number of concrete project proposals were identified together with suggestions for local partners.

As a consequence of this workshop, four projects have been defined which are presently being implemented in the region⁷. In each of these projects, specific forms of local participation will be used. One project in particular will concentrate on co-operative efforts to tackle environmental issues.

Experiences gained in the first project region were used to conduct both a situational analysis as well as a similar planning workshop in the second project region Elbe-Elster.

6 Internal management problems and tentative solutions

It was soon realised that the advantage of having a large interdisciplinary group in terms of expertise, experience, and personality is threatened by differences in, e.g., leadership styles, objectives, time resources. The GRANO team itself is rather heterogeneous (table 1).

Difficulties of **integrating new members**

into the culture of an on-going process were underestimated at first. The original team felt that the group of 10 young researchers, mostly PhD students, could be co-opted through a process of "learning by participating". They attended team workshops and participated in working group activities, e.g., by being involved in the situational analysis.

Not familiar with the open-ended planning approach and with working in a rather complex set-up, they felt increasingly alienated which, in turn, led to growing dissatisfaction and a number of misunderstandings. One example were continued misinterpretations of the function and objectives of the regional planning workshop even after the programme had been repeatedly presented. While project management interpreted this in the beginning as an information problem, it was, in fact, a problem of group communication.

The roots of the problem emerged from a workshop which concentrated on process evaluation. As a consequence, plenary workshops have seen some change with regard to their functions: While they are still the main planning tool, their role for information exchange and process evaluation has been strengthened. In addition, project management has established a systematic approach to problem solving which can be characterised as follows:

1. Problem articulation by individual researchers, by working groups, by project management, or as result of observations by process-advisors and controlling;
2. Direct feedback/reaction by process-advisors or, if the problem seems to be of general interest, inclusion as workshop topic;
3. In exceptional (crisis) situations: planning a specific workshop;

Table 1: Background of GRANO team members

GRANO-members		1997	1999
Discipline	Natural scientists	15	19
	Economists, social scientists	17	24
Status	Professors, Heads of Institutes	8	8
	Senior researchers	17	18
	Research assistants (PhD students)	7	17
Institution	University	9	9
	Advanced technical college	3	6
	Research Institutes	20	28
Total		32	43

⁷ Decentralisation and flexibilisation of agro-environmental policies; Agro-environmental extension; Regional marketing; Agriculture and tourism; Management of the regional potential of agricultural landscapes.

4. Process of problem resolution: identification (brainstorming), analysis (clustering), articulation of possible solutions, explicit decision on consequences;
5. Monitoring of implementation by working group leadership, controller, process-advisors, project management, respectively.

Three such plenary problem-evaluations have taken place. Two problem areas were given priority: "**project transparency**" and "**information flow**", whereby it was obvious that the two are closely inter-related. As a reaction, the project concentrated on improving information dissemination at workshops, via advisors, and by further refining internet-based communication tools. However, evaluations did not only cover communication issues but also subject matter. Adjusting the methodology of the situational analysis after evaluating experiences from the first region and then applying it to the second region may serve as an example.

Information transfer is still an issue. It was agreed upon that team members have to actively seek information from others, in other words, the responsibility is with the receiver rather than the sender. Still, even this decentralised system has to be managed in the sense that members have to be encouraged to give information and the tools have to be made available. The communication tools mentioned earlier (email, various databases, groupware) are now well-established and are not only widely used but also continuously improved. The combination of electronic with interpersonal communication tools and organisational arrangements (such as double membership and co-operation between information management and process-advisors) has shown good results.

Working, communication, and leadership styles at the level of working groups differed largely in the beginning. Some groups tried to follow the working-style of plenary workshops, others practised more conventional approaches. In most cases and particularly in the early phase, planning activities presented the greatest problems, above all detailed operational planning. Here, an active intervention by controlling was deemed necessary and a number of group and individual work plans were jointly elaborated. However, a short training effort would have been more efficient, had the problem been identified at an earlier point.

Some of the practical consequences of bad planning were: lengthy and abstract group discussions, lack of coherence within the group (individualism), unclear decision making, lack of discipline with regard to implementation.

To change and improve group communication several instruments were used: Informally but systematically, feedback was given by process-advisors and in some cases facilitation services were offered. This tended to be less effective at the early stages, as knowledge on practical communication tools was lacking. Project management then offered training in team management and facilitation which marked a turning point. A slow but sustainable change in the efficiency of group communication can be observed (which would, probably, have been even more distinct had senior members participated as well). This is a prerequisite for the decentralised functioning of the overall project during the field implementation phase. While by now distinct planning activities can be observed in most groups, regular internal evaluations still have to be institutionalised at this level. If the group has enough time and is facilitated externally, sessions are closed with a "flashlight" evaluation – periodic evaluations are not common.

Safeguarding **co-operation between working groups** is a central management task. Here, a steering committee has been formed which meets monthly. It soon became clear, however, that at this level only major issues can be discussed and resolved. Specific problems are treated by ad-hoc groups. One example was an ad-hoc workshop to resolve a conflict on the criteria for farmers' participation. Rather than developing a detailed prescription for inter-group co-operation, our suggestion is to improve monitoring, define issues, and then organise a suitable forum for problem resolution.

7 Conclusions

Notwithstanding the difficulties mentioned above, the GRANO experience has shown that it is possible even for a large interdisciplinary research team of 30 – 40 participants to establish a participatory management system where decisions are made in a co-operative way and conflicts can be dealt with

productively. Innovative research in a good climate is definitely not limited by participatory management. But a large interdisciplinary group needs time and purposive efforts to constitute itself as a team.

Getting to a common understanding of methodology and concepts is a dynamic process with many iterations. A joint definition of problems and objectives as well as periodic evaluations are the basis for agreeing on common activities. Conflicts are thus reduced, especially between different disciplines of the natural and social sciences. The emerging group culture allows to cope with existing differences provided that participants identify with the basic philosophy. Facilitation of the process is indispensable. Project management should involve professional moderation/facilitation (which is costly) at least for initial training of participants.

Co-operative team management and communication do not develop automatically, even though they are considered as extremely productive by all participants. Senior researchers are not necessarily good process managers and both, the project as whole and its sub-units, need professional support, e.g., by process-advisors. A co-operative style can not be enforced which implies that process-advisors have to use non-directive instruments in a flexible way. This type of intervention may not show quick results but it is sustainable. From our experience, acceptance of methodological inputs is increased if process-advisors also play a subject-matter role within the project.

Evaluations of communication processes, if only done regularly, are a helpful tool to improve internal and external collaboration. Instruments like problem-brainstorming or SWOT analyses help to make problems transparent to the group and find common solutions. Project management and group leadership have to insist that evaluations take place and sufficient time is allotted. It is especially important to "close" the problem solving cycle by jointly defining and deciding on consequences to be taken and corresponding responsibilities.

The GRANO approach has also shown that participatory planning of a research project in which both, researchers and regional actors are considered as equals is possible and may result in realistic project proposals. To do this, it was first necessary to come to a provisional internal understanding – with the help of a participatory management concept. Widening the circle of participating actors and integrating their views into the detailed field projects was above all "costly" in terms of time. Compared to traditionally managed research projects, GRANO has achieved field implementation only after a long period of conceptualisation and preparatory activities. This may be an extremely critical point when it comes to obtaining funds for this type of research. Only measurable and competitive impacts once the project comes to a close will be a convincing argument for future donors.

Bibliography

- Aenis, Thomas and Ralf Wieland (1999): Management interdisziplinärer Zusammenarbeit in Umweltprojekten - Erfahrungen aus 2 Jahren Kommunikationsforschung und Informationssystementwicklung in GRANO. In: FLAKE, Michael, Ralf Seppelt and Dagmar Söndgerath (eds.): Umweltsystemanalyse. Tagungsband Geoökon '99. TU-Braunschweig pp. 255-260.
- BmBF (1996): Ökologische Konzeptionen für Agrarlandschaften – Rahmenkonzept. Bundesministerium für Bildung und Forschung. In: Bundesanzeiger 06.02.1996. Bonn.
- CATAD (Centre for Advanced Training in Agricultural and Rural Development): www.iae.tu-berlin.de/~slecatad/.
- Chambers, Robert, Arnold Pacey and Lori Ann Thrup (1989): Farmer First - Farmer Innovation and Agricultural Research. Intermediate Technology Publication, London.
- Fisher, Roger and Alan Sharp (1998): Lateral Leadership: Getting Things Done When You're Not the Boss. Harper Collins.
- GRANO (1997): „Ansätze für eine dauerhaft umweltgerechte landwirtschaftliche Produktion, Modellgebiet Nordost Deutschland“. Projektantrag. Müncheberg (ZALF).
- GRANO: www.zalf.de/grano.
- Hawkins, R. (1997): Training in interdisciplinary team research for agricultural development: the experience of ICRA. In: european journal of agricultural education and extension vol. 4 no. 1 pp. 49-66.

- Heberlein, Thomas A. (1988): Improving Interdisciplinary Research: Integrating the Social and Natural Sciences. In: *Society & natural resources* 1, pp. 5-16.
- ICRA (International Centre for development oriented Research in Agriculture): www.icra.agropolis.fr/english/.
- Jantsch, Erich (1972): Towards Interdisciplinarity and Transdisciplinarity in Education and Innovation. In: Apostel, Léo et al. (eds.): *Interdisciplinarity - Problems of Teaching and Research in Universities*. Seminar at the Centre for Educational Research and Innovation (CERI) pp. 97-120. Paris (OECD Publications).
- Klein, Julie Thompson (1990): *Interdisciplinarity - History, Theory, and Practice*. Detroit (Wayne State University Press).
- Klein, Julie Thompson and Alan L. Porter (1990): Preconditions for Interdisciplinary Research. In: Birnbaum-More, Philip H., Frederick A. Rossini & Donald R. Baldwin (eds.): *International Research Management. Studies in Interdisciplinary Methods from Business, Government, and Academia* pp. 11-19. Oxford/ New York (Oxford University Press).
- Mittelstraß, Jürgen (1995): Transdisciplinarity. In: *Panorama* 5 p.45-53.
- Nagel, Uwe Jens (1979): Knowledge Flows in Agriculture: Linking Research, Extension and the Farmer. In: *Quarterly journal of international agriculture* vol. 18 (2), pp. 135-150.
- Pretty, Jules N. (1995): *Regenerating Agriculture – Policies and Practice for Sustainability and Self-Reliance*. Washington D.C. (Joseph Henry Press).
- Schubert, Bernd, Uwe Jens Nagel, Glenn C. Denning & Prabhu C. Pingali (1991): *A Logical Framework for Planning Agricultural Research Programs*. Manila (IRRI).
- Scoones, Ian and John Thompson (eds.) (1994): *Beyond Farmer First – Rural people's knowledge, agricultural research and extension practice*. London: Intermediate Technology Publications.
- Siebert, Rosemarie, Tina Boeckmann, Kirsten von der Heiden and Klaus Müller (1999): Stakeholder participation as a deciding factor in the implementation of sustainable land use concepts - a "GRANO" participation approach. Paper presented at the 64th Seminar of European Association of Agricultural Economists (EAAE), October 27-29, 1999 in Berlin (in print).
- Skinner, Steve (1994): *Change and how to Make it Happen. A Practical Guide to Facilitation Methods for Organisational Change*. Halifax (CETU).
- Smith, Susan E.; Dennis G. Willms and Nancy A. Johnson (1997): *Nurtured by Knowledge - Learning to Do Participatory Action Research*. Ottawa.
- Thiede, Carsten Peter & Georg Masuch (eds.) (1995): *Wissenschaftstheorie und Wissenschaftspraxis. Reichweiten und Zukunftsperspektiven interdisziplinärer Forschung*. Paderborn (Bonifatius).