A communication model for transdisciplinary consortium research

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Abstract: *This paper discusses transdisciplinary research from a communication perspective. Such research is oriented towards the resolution of societal problems. This requires a paradigm shift for the scientist, from the arena of theory and method to application instead. The emphasis is no longer on utility for the scientist or for science, but on the application, i.e., the utility to those applying the knowledge. Transdisciplinary research is often carried out within large consortia. Inner-consortium research communication can be understood as a system of process-, organisational- and team-communication (1) process communication includes the planning, monitoring and evaluation of networked projects at different levels – in the large group, in working groups, in meetings and workshops; (2) team communication deals with group dynamic processes within various small groups which arise during the course of the consortium's work – primarily intra-group communication –; and (3) organisational communication includes group dynamic processes within the large group „consortium" and the creation of project structures – both direct intra-group and indirect inter-group communication. The three fields of disciplinary, interdisciplinary and transdisciplinary communication are analysed. It is argued that within a "transdisciplinary" consortium, all three modes of communication co-exist.*

Keywords: *Transdisciplinarity, Interdisciplinarity, group communication, communication model, application-orientation*

Introduction

Application-orientation is increasingly demanded of scientists. To work on highly complex problems of relevance to the whole of society, large research consortiums are increasingly created and then faced with the need for interdisciplinary and transdisciplinary communication and co-operation. In practice, the challenges in carrying out this kind of research are multiple and in the majority of cases closely connected with group communication (Klein, 1996): conflicts of interest, paradigms and procedures; different views of problems; unclear objectives, status and hierarchies. These can lead to personal- and subject-based conflicts, lengthy group-dynamic processes, talking at cross purposes, etc. The result can be inefficiency, disintegration or even termination of the project. To manage such research, there is a lack of scientific-based problem-solving knowledge. In particular, criteria and methods for a timely (self-)evaluation within an ongoing project are lacking. Since management fundamentally is also a communication function, there is a need to develop a model of transdisciplinary research from the perspective of group communication.

This paper provides a theoretical analysis of the specific aspects of application-oriented research and advances the theory of group communication.

Thesis 1: Application-oriented research necessitates, first and foremost, a paradigm change for the scientist, primarily regarding the purpose of the research as opposed to theory and method. The emphasis thus shifts to the application of the research, i.e. the utility to those who will apply the knowledge, in contrast to its scientific utility. The entire problem-solving process must occur via dialogue involving the participation of the relevant actors. Participation in this sense also refers to the involvement of the scientist in problem solving, i.e. the implementation of the research results.

Thesis 2: Inner-consortium research communication can be understood as a system of intra-group communication, mainly face-to-face, and inter-group communication, involving the indirect transfer of messages by representatives. Three main communication objects can be identified: the research process, the organisation "consortium" and the working teams.

Thesis 3: Transdisciplinary consortium research can only be organised with a high degree of flexibility. Thus, disciplinary, interdisciplinary and transdisciplinary research groups can – and usually will – exist within the framework of a consortium. The specific modality of research co-operation and communication must be consciously negotiated by the actors involved.

Application-oriented, transdisciplinary problem-solving research

Transdisciplinary research, i.e. knowledge generation to solve societally-relevant problems, is definitionally oriented towards its application: the problem solution. For agro-environmental projects this is directly or indirectly similar to a change in land use (i.e. development). Application-oriented research thus is part of a broader problem-solving process: research and development (R&D). These two principal aspects cannot be separated, and even specialised research projects will have development activities, albeit marginal.

Sustainable solutions during the entire problem-solving process will only be obtained by mutual involvement of relevant actors in science and praxis during the fundamental decision-making phase of a project. For the research aspect, this begins at an early stage, with problem analysis and definition. The term “participation” is used for this kind of interaction. Participation describes the underlying decision-making processes rather than activities. It is determined by the behaviour and attitudes of the participating actors. Depending on its intensity, it may lead to different forms of co-operation, ranging from the consideration of interests to coaction. Participation in this sense requires communication and, in turn, only communication enables participation.

Methodologically, application-oriented research is not a new approach, and its main elements, interdisciplinary and transdisciplinary co-operation, participation, and mutual learning are wide-spread in agricultural research and particularly in farming systems research. Relatively new is the demand for the resolution of complex societal problems together with at least a partial implementation of the research results. The success of such projects is strictly dependent on both the problem-solving and participatory approaches. No single individual practitioner would otherwise participate in a research team. Impact at the end-user level therefore is an explicit goal. What distinguishes application-oriented research from development activities is that research activities dominate and therefore short-term impacts may be marginal. For specific undertakings this may result in a wide spectrum, from research to development-dominated R&D projects.

Gibbons et al. (1994) postulate the need for a new mode of application-oriented research. The main difference between Mode 1 and Mode 2 research, as they express it, is that the Mode 1 benefit will be primarily internal (cognition in the case of public research or profit in the case of private), whereas for Mode 2 research it lies externally with the user. Research related to external applications demands a change in the researchers’ personal attitudes towards their profession, i.e. a paradigmatic and mental change. The core interests are practical and measurable contributions to problem solving rather than cognition per se. Research serves an external purpose. The primary benefit lies with the user. This might be seen as constraining research freedom. Furthermore, researchers might have to abandon their former neutrality, positioning themselves, eventually, in favour of one possible solution.

Consequences for the practical conduct of research

Consequences for the organisational and practical conduct of the research are multiple (Gibbons et al., 1994). The most important from the author's perspective concern problem orientation and co-operation.

Problem orientation

Due to their complexity, many, if not nearly all, anthropogenic problems cannot be solved in a unidisciplinary way. Often they are also ill-defined, i.e. neither the problem nor its causes can be defined accurately and „*... it is hard to be very specific about the optimal outcome, or the steps necessary to (their) achievement*" (Taylor, 1986:142). Sustainable solutions demand integration, namely involvement and knowledge of various scientific disciplines and practitioners in problem-solving groups as well as a concerted methodology (Taylor, 1986; van Woerkum, 1999; Tress et al., 2003). This refers to all working steps, from a joint problem analysis, definition of objectives, and division of labour, as well as to a synthesic joint development of solutions. Agro-environmental problems usually are complex and ill-defined.

The definition of relevant research questions is seen as a crucial point. Whilst in classical research gifted scientists are often the ones who define questions as well as approaches, here a different procedure is needed: "*... the problem-field **first** needs to be scanned in order to identify the issues and to specify them in a highly differentiated way*" (Taylor, 1986:145). Research must be application-oriented from the beginning, which means that already in this early stage all relevant actors in science and praxis must be involved (Klein et al., 2001:9). A precondition is the rejection of the traditional „*transfer of technology*" self-concept, a clear role assignment in which science generates knowledge which is merely consumed by the users.

From the primacy of problem orientation two other aspects can be deduced; firstly, the methods used within the research process arise from a praxis context which obligates a flexibility in methodological approaches. Secondly, problem resolution usually will be local, situational and context-specific. Generalising typically will be difficult to impossible and often correspond only to methodologies.

Co-operation

Application-oriented research is often characterised by contract research. The principal could be the knowledge users themselves; within private research it is the company which sells the product, whereas for public research it is often a public/governmental authority. Knowledge production in itself is a kind of interplay between the principal who requests and finances a certain kind of research, the researchers with their own interests and priorities, and the users of knowledge.

If the purpose of research is the resolution of complex problems not defined by the researcher himself, there is need for an exchange of knowledge. According to Nagel (1979) a knowledge flow must exist: knowledge of the problem to be solved must flow towards the scientists and knowledge of solutions must flow towards the end users; all this will require knowledge transfer. In this process, the basic functions of a knowledge system must be fulfilled in order to ensure a sustainable knowledge flow: needs identification and knowledge generation, dissemination and use (Nagel, 1979:136ff). The linkages between the actors in a knowledge system are of a complex nature. Specific knowledge of problems must be generalised for researchers; knowledge of solutions, often highly abstract, must be operationalised, i.e. contextualised and adapted to a specific situation. A meaningful knowledge system is legitimised only by the use of knowledge. This demands an evaluation of the problem resolution by the user. This coincides with more recent considerations from environmental research: in addition to system knowledge, goal and transformation knowledge must be generated regularly, i.e. knowledge of how the desired ultimate result can be reached or the system knowledge exchanged (CASS, 1997, cited in Mogalle, 2001:12f). Know-how is lacking in particular for the functions of operationalisation and knowledge exchange.

In summary, the entire problem-solving process must take place via dialogue and with the participation of the relevant actors. Participation in this sense also refers to the involvement of the scientist in problem solving, i.e. the implementation of the research results.

The communication system of transdisciplinary consortium research

Pertinent questions include: what does communication mean within a research consortium, how do the participants interact and which factors play a role, and what are the peculiarities?

Communication can be analyzed from two perspectives. From the technical point of view, the process of message transfer is central, i.e. sending and receiving messages via different channels and coding and decoding messages and feedback. Communication psychology is mainly concerned with the cognitive aspects of these processes, i.e. the individual senders and receivers, as well as the coding, decoding and feedback processes. Both aspects are relevant to group communication.

Communication in consortiums is always communication within and between groups. This is also the case if only two persons interact because at least one group is affected by this bilateral communication. Aside from intra-group communication which aims at the exchange of a message within a specific group, inter-group communication, whereby a message from one group is transferred into another by at least one representative, is of particular importance. Both types of communication differ significantly:

Intra-group communication is direct, face-to-face communication, in which several individuals are always involved. With increasing numbers of participants, the number of transfer channels multiplies and subsequently also the number of sources for disturbance. Communication between two members, for example, can be perceived as "noise" by a third party. The content of one and the same message may be interpreted differently by each member. The more heterogeneous a group is, the higher the risk of incongruence. On the other hand, with a plurality of channels, possibilities for feedback also increase. This can compensate for the negative effects of miscommunication and contribute to a higher level of transparency within a group.

In contrast, **inter**-group communication is indirect. A message from participants of group **A** is transmitted to those of group **B** by one of its members, the representative. This kind of communication is always more complex than that within a group. The message is filtered by the representative and the opportunity to approve the content is limited. The representative will only transmit that content that he has heard, which will be interpreted in turn by the receivers. Feedback also requires at least two steps, via the representative. Due to limited transfer channels, it is also limited. The communication ability of the representative and his credibility (McCroskey et al., 1971: 84) both play a key role in this type of communication. His credibility is influenced by his competence, character, motivation and personality, which is demonstrated by his leadership style. Moreover, his dynamism during the communication process plays a role: „*we tend to consider the dynamic individual more credible than his counterpart*" (ibid. 82).

Group psychology usually differentiates groups by size into large groups and small groups (cf. Hug, 1999b:342f). Attributes of small groups are common goals (a primary task), norms, strong emotional links and a sense of cohesiveness which is articulated by using the term "we". Communication is timely, regular and face-to-face. A small group consists of only a few members; therefore every change of membership changes the performance of the group significantly.

Large groups or "organisations" usually have a strong institutional setting, distinctive role differentiation in the areas of power and influence (hierarchies) and division of labor. Organisations usually split into small groups which develop their own dynamics but are always strongly influenced by the overall organisation regarding their objectives, structure and problems. In the case of consortium research this means that the consortium usually is a large group; within this framework, working groups emerge which have the attributes of small groups. Inter-group communication plays a role primarily regarding topics concerning the organisation as a whole.

A consortium can be seen as a system whose elements are the participants as well as the formal and informal groups of different sizes. A consortium is in general an open system with varying degrees of interdependency with its environment. Consortiums are being funded by public authorities who often set unforeseeable demands during the ongoing project (Sülzer and Zimmermann, 1996:81ff).

Within the framework of this system, application-oriented research is conducted, usually in the form of projects. Because it is an integrative process, sub-projects interact and fit into a larger whole, the overall project. A research consortium therefore always is a project network. A synergy effect is the aim, i.e. the overall project achieves more than just the sum of its parts, the sub-projects. Insofar as there is a need for specific integration activities, namely a synthesis project, this can be an activity of either the large group consortium or a specific sub-project of a subgroup.

To reiterate, application-oriented research manifests itself in the form of networked projects which are implemented and reported upon within the large group consortium or smaller research teams. Communication has two aspects: project implementation as the factual aspect and team communication on a meta level. Regarding management and taking into consideration the principal differences between large group and small group communication, three fundamental categories of communication can be distinguished (Aenis, 2005):

- **Process communication** includes the planning, monitoring and evaluation of networked projects at different levels – in the large group, in working groups and in meetings and workshops. The research process usually is not a linear one, due to the difficulties in anticipating complex solutions. Research must be open to the unexpected. The result will be developed in a stepwise fashion, just as the problem definition, objectives, and methodology also develop in a stepwise manner depending on available information. Iteration, the "*... process of redoing all or part of a study*" is seen as a "*... vital factor in achieving integration*" (Rossini et al., 1979:140).

- **Team communication** deals with group dynamic processes within various small groups which arise during the course of consortium work; team communication is multi-factorial. Important factors can be separated into two categories: 1) those such as cohesion, team formation, role differentiation and role perception, decision making, and conflicts which describe participant interaction or group dynamics and 2) others such as group size, persistence, status, and social competency which correspond to individual participant characteristics and are linked to the group allocation modality. The latter factors are, in practice, strongly determined by group-external decisions, for example, procedures during the application phase. The group itself has only limited influence on them, e.g. if members leave the group, and therefore they can be seen as virtually fix. Team communication is mainly intra-group communication.

- **Organisational communication** includes group dynamic processes within the large group „consortium" and the creation of project structures. The large group acts on the one hand like a small group and therefore the same factors are relevant. However, direct interaction always is limited and even at the plenary level, no one person could communicate directly with all members. This has particular implications for clarifying roles, which usually are more formalised than in small groups. Communication will be often indirect via the media or a third party. Both are hindered by physical separation. Within the organisation the framework conditions for the working groups are set and communicated, and group interaction is governed. Organisational communication is both direct intra-group and indirect intra-group communication.

All three areas of communication interact and complement each other within the communication system "consortium" (Fig. 1). Each field of communication must be managed via specific instruments in order to achieve integrated solutions efficiently. Management in only one field will not be successful.

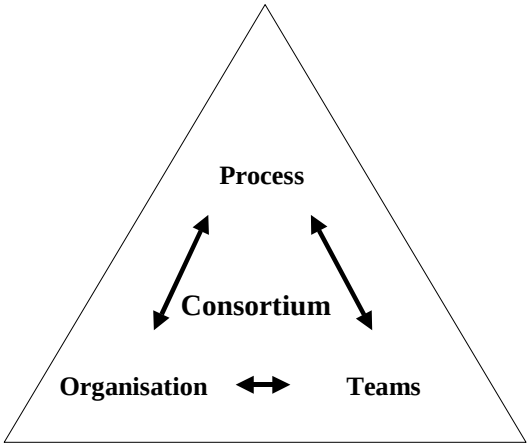

Figure 1. The communication system „consortium“

Disciplinary, interdisciplinary, or transdisciplinary communication?

Typically, researchers from several fields of science and the humanities cooperate. Often different types of research are also involved and applied scientists work with basic scientists as do university-based collaborators with private institute-based researchers. Non-scientists increasingly also participate in the core research process particularly as the educational level increases. The question arises whether disciplinarity, interdisciplinarity, and transdisciplinarity are complementary or if they are mutually exclusive. Consequently these three fields of communication will be further analyzed.

Disciplinarity

In order to characterise disciplinary communication, it appears necessary to determine what forms a discipline. But neither epistemology nor research praxis has a unified understanding:

- Many authors distinguish solely between (natural) science and technology on the one hand and social science and the humanities on the other (see Rólen, 1996; Daschkeit and Schröder, 1998). But this is just a rough distinction which explains communication problems and conflict between the two “cultures”, although not within these groups.

- Others give equal status as disciplines to the thousands of “subjects” which have evolved in the last century. Equating disciplines with subjects, however, does not explain the use of the same methodologies across a wide range of subjects nor the successful communication within closely-related subjects (see Balsiger et al., 1996).

- A third option is to regard disciplines as they manifest themselves within a specific organisational framework such as faculties within universities.

- Similar theoretical assumptions and concepts, often including methodologies as well, when subsumed under the term paradigm, form a disciplinary “identity”. The main elements of a disciplinary system are, per Thomas Kuhn (1976), common symbols (formulas), trust in fundamental explanative models, values and broadly-accepted exemplary solutions. Bärmark and Wallén (1979:181) conclude, based on practical experience, that paradigms are not articulated and therefore constitute a „tacit dimension“ which can be neither measured nor probed.

- Per Thomas Kuhn (1976:188f), disciplines manifest themselves in scientific communities which exist in parallel to each other. Such communities do not necessarily communicate and therefore do not form a real group. Scientific communities have the following characteristics: they consist of experts in a specialised scientific area with the same training and professional

experience, who have read the same standard literature and often have learnt the same lessons from it. A specific research topic or subject exists which is characterised by the bounds of the standard literature, a degree of competition within the community, common goals including the training of successors, relatively intensive communication and a tendency toward similar opinions.

All-in-all, the term "discipline" can be only vaguely defined. It lies somewhere between a "subject" and the two "cultures" and is characterised by a common research topic, paradigms and methods and a similar institutional background.

Within a concrete consortium, "disciplinarity" describes either a single researcher or an interaction between researchers within the same community. However, only the researchers themselves can determine whether they belong to the same community and identify the pertinent level ("social science", "agricultural science", "farming systems research" etc.) in a given communication situation. For example, a rural sociologist and a micro-economist might discover that they correspond with respect to their world view and methodological principles because both are social scientists. At the same time, they may disagree on specific methodologic questions because lower-level communities have developed and applied different methods. The lower the level is on which the researchers coincide, the easier the communication amongst them. This leads to the conclusion that disciplinarity and interdisciplinarity in interactions between researchers from communities of different levels always will exist simultaneously. In the above-mentioned example the partners will, depending on the context, perceive a given situation as disciplinary or interdisciplinary. Meta research might be difficult to categorise exactly and it thus might be better to speak of "homogeneous" or "heterogeneous" groups.

Interdisciplinarity and multidisciplinarity

Already in 1972, Guy Berger has characterised interdisciplinarity as an "archipelago". Only from afar does it appear interconnected. Interdisciplinarity comprises a large range of characteristics which cannot be described as a whole. This result is inherent in the fuzziness of the disciplines. From the perspective of communication, the following aspects are of relevance:

- Interdisciplinarity is often seen as co-operation (Blaschke and Lukatis, 1976:147ff; Balsiger, 1996). As communication is seen increasingly as important, the term has widened to include co-operation and communication. Others see the communication aspect rather than the action aspect as constitutive (Rolén, 1996). This paper includes both but recognises that communication determines action on a meta level (Watzlawick et al., 1990).
- Balsiger (1996:76) finds that interdisciplinarity always is more than the existence of various disciplines. A duality exists between organisational principle and ongoing process, which must be shaped permanently.
- It is always a type of team research: „*... a small number of specialists from different disciplines work in close collaboration on the resolution of a specific and clearly defined problem. This cooperation and corporate responsibility extends from the definition of the problem through the development of a research design to the final writing of a report*" (Matthiasson, 1968:65). Interdisciplinarity therefore must be associated with a defined group.

In the frame of an application-oriented R&D consortium, interdisciplinarity is regarded as communication and co-operation between scientists with different disciplinary backgrounds, within a defined group. Interdisciplinarity predominantly aims at integrative generation of knowledge for the resolution of societally-relevant problems. Integration in this context demands concrete efforts (planning, action, evaluation) to achieve joint research results, i.e. the development of ready-to-implement suggestions for problem-solving.

Interdisciplinary group communication differs from multi-disciplinary in that the latter is, to a greater or lesser degree, the parallel treatment of a problem by individual researchers or small groups using their specific disciplinary tools. A problem is divided in such a way that similar or different aspects are addressed using different disciplinary methods. There will be limited efforts to combine results and no joint analysis. There is neither an intent to integrate nor a need for intensive communication. This kind of research tends to produce single or disjointed reports (Matthiasson, 1968:265).

In this context one can question whether multidisciplinary and interdisciplinary approaches contradict each other. A project as a whole cannot be integrative and additive at the same time. However, it is possible to work on a problem with either disciplinary or interdisciplinary instruments. In that respect, it might make sense to use at least partly disciplinary methods if they better facilitate resolutions. In this case, one subgroup would work disciplinarily and the results would be integrated later at a higher level. It might be also possible for the whole consortium to work multidisciplinarily over a certain period, with the results integrated at a later phase of the project. Results of meta research clearly show that interdisciplinary approaches require many more resources for communication (Mogalle, 2001). The dictum should be “as much interdisciplinarity as needed and as little interdisciplinarity as possible”.

Transdisciplinarity

The term transdisciplinarity, when compared with interdisciplinarity, comprises an even wider spectrum. Recent definitions typically interpret the prefix “trans” as a *crossing of the boundaries* (Klein, 1996) between scientifically-trained individuals and non-scientists. Usually this still refers to the research process (Tress et al., 2003; Klein et al., 2001). The broadest definition assumes that knowledge generation is only one aspect of the co-operation and communication between scientists and practitioners. Finally it is the application itself which justifies this intensive form of communication. However, practitioners can only be expected to be engaged if the problem in reality is being solved or, at least, practical steps towards problem solving take place.

Analogous to interdisciplinarity, transdisciplinarity is seen as communication and co-operation between scientists and practitioners within a defined group with the aim of a joint, integrative resolution of societally-relevant problems.

This means that research in this context is no longer strictly a domain of scientists. More and more individuals are trained but do not work in the scientific realm. Furthermore, a wide range of innovations, particularly in the agricultural sector, are being developed on the farm. Local or indigenous knowledge is important for the development of situation-adapted land use (Warren, 1991). Nevertheless one can assume that within research consortiums, “research” is the domain of interdisciplinary and “development” the domain of transdisciplinary communication, with much overlap.

For transdisciplinary **research** this has the following consequence: a research group is characterised as transdisciplinary only if practicing partners are involved. Furthermore, transdisciplinary research is connected to implementation of its results and therefore often „... *transdisciplinary research is a form of action research*“ (Klein et al., 2001:9).

Some conclusions

With growing knowledge of the complexity of man-made problems, the need for holistic solutions is increasingly accepted (Di Giulio, 1996:32). On the contrary, even holistic approaches often provide incomplete solutions or resolve only partial aspects (Becker, 1996:149). Meanwhile, with increasing knowledge comes also increasing complexity of the problems and their respective factors. Thus the discussion about holistic or reductionist approaches tends to become circular. It will neither be possible to isolate all factors nor generate a truly holistic solution within a given time frame and under limited resources. Too many actors would have to cooperate, resulting in unsolvable

communication challenges. Even interdisciplinary research will not provide complete solutions and will only cover certain aspects. This has consequences for the question, if and/or when disciplinary, interdisciplinary or transdisciplinary approaches should be used. There will be always a need to reduce the complex problem into processable components which then are solved as holistically as possible (Bechmann and Frederichs, 1998:12). The real challenge is to identify these components, i.e. planning. It is to be assumed that, the more precisely the component is delineated, the more disciplinary the research could be.

Multidisciplinarity, interdisciplinarity or transdisciplinarity therefore are not values per se but the result of rational considerations. The mode of research – Mode 1, Mode 2, disciplinary, interdisciplinary or transdisciplinary – is to a lesser degree predefined by the problem but rather by a conscious decision of the pertinent actors. Their interests and preferences are the main forces driving the choice and definition of the problems as well as the methodology for problem solving. The chosen strategies depend principally on the intended problem-solving scope: disciplinary research will tend to produce concrete solutions in limited areas, interdisciplinary research will be more integrative and, finally, transdisciplinary research will always involve implementation activities.

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