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Defining concepts and the process of knowledge production in integrative research

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Abstract

Recent surveys of integrative landscape research projects and their funding bodies have revealed a lack of common understanding of integrative research concepts such as interdisciplinarity and transdisciplinarity. This lack of common understanding has had negative consequences for the success of integrative landscape research projects. This chapter presents a set of definitions for integrative and related research concepts. The production of new knowledge – also in the form of new theory and method development – is a characteristic of integrative research. Therefore, this paper also discusses the process of knowledge production in the context of integrative landscape research. In addition we discuss criteria for integration and different levels of stakeholder participation. We introduce a conceptual model, the knowledge cycle, as a

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way to illustrate the process of specific and generic knowledge production in integrative research. Finally, we comment on different aspects of reflection in integrative research.
Keywords: transdisciplinary; multidisciplinary; participatory; research collaboration; explicit knowledge; tacit knowledge

Introduction

In the research literature, we find many different terms used to describe integrative research concepts; these include terms such as interdisciplinarity and transdisciplinarity as well as other forms of disciplinary interactions. In landscape research, various experts have advocated the application of integrative approaches for solving the pressing problems of landscape change and development (Naveh and Lieberman 1994; Zonneveld 1995; Décamps 2000; Wu and Hobbs 2002). There have also been an increasing number of scientific meetings with a focus on integrative approaches in landscape research. Another major driving force for the adoption of integrative concepts in landscape research is research policy. When seeking project funds, applicants are increasingly asked to apply integrative approaches to solve current landscape problems. Thus, more and more landscape researchers are confronted with these concepts.

In the context of the INTELS project (http://www.intels.cc), which investigates integrative landscape studies in Europe, we analysed the understanding and use of integrative research concepts in landscape projects and in research literature. We gathered data that included interviews with researchers involved in integrative landscape research projects, interviews with representatives of funding bodies investing in integrative research, a review of research policy documents and an analysis of the research literature as one of the outputs of integrative projects.

Although there is an increasing interest in integrative research concepts, we identified a lack of common understanding in landscape research of what these concepts mean. The analysis of policy documents showed that integrative concepts are rarely defined and the expected outcomes of integration are rarely specified. Yet, the interviews with representatives of research policy agencies revealed that they have clear but diverse understandings of integrative research concepts. However, it is seldom possible for researchers to identify what is meant by integrative research in research policy documents. This is an important point because these documents are used by scientists to prepare research proposals. In most cases, the terminology in research policy documents is inconsistent and definitions are missing (Tress, Tress and Fry 2005). The interviews with researchers involved in integrative landscape projects also revealed many varying definitions of integrative research concepts. Often, researchers were confused about the meaning of concepts (Tress, Tress and Fry 2005). Many of these researchers had discussed the concepts of interdisciplinarity and transdisciplinarity in their projects but less than half of them could agree on a common understanding in the project (Tress, Tress and Fry in press). A review of journal papers published by landscape researchers who had stated explicitly that they used integrative concepts in their studies found that the concepts and methods applied in the studies were not explained sufficiently to understand the way authors used integrative research concepts. We found the use of terms such as integrated, integrative, cross-disciplinary, interdisciplinary, collaborative, multidisciplinary, participatory, transdisciplinary and others. They are used to express forms of research cooperation crossing disciplinary boundaries; however, we found few concrete

definitions of these terms. In many cases explanations were completely missing (Tress, Tress and Fry in press).

Why should we bother about a lack of a common understanding of integrative research concepts? One could argue that everybody is free to use and define the concepts in his or her own way. Of course, the plurality of definitions is legitimate; however, the studies of Jakobsen et al. (2004) and Tress et al. (in press) revealed that the lack of common understanding of integrative research concepts is a key barrier to integration in landscape projects and to communication between researchers. Project participants cannot exchange views on project experiences related to integrative research concepts when such concepts are used differently. If researchers cannot agree on a common understanding, projects might give up the intention to integrate. The consequences of a lack of clear definitions are also very serious for the evaluation of integrative landscape projects. If researchers are using the concepts differently, it is impossible to compare and evaluate the outcomes of different research approaches. Such a comparison is essential to justify the investment in integrative research approaches.

The aim of this paper, therefore, is to discuss the need for a common understanding of integrative research concepts in landscape research and to present definitions of integrative and related research approaches such as multidisciplinary, interdisciplinary, participatory and transdisciplinary concepts. We propose a set of definitions, not as a fixed understanding of the integrative research concepts but as a means of communication that will help landscape researchers to share experiences and communicate on integrative research concepts and methods. Additionally, the paper considers the process of knowledge production in integrative research and the different levels of reflection that are necessary for integrative landscape research to be successful. Knowledge production is an important aim of integrative research and yet often neglected in practice.

Definitions of integrative research concepts

We propose the use of six different terms when discussing integrative and non-integrative research concepts according to Tress et al. (2003; 2005; in press) and Winder (2003): disciplinary, multidisciplinary, interdisciplinary, transdisciplinary, participatory and integrative. For a more detailed discussion of these concepts we refer to Balsiger (2004), Hansson (1999), Jantsch (1970) and Klein (1990).

We define *disciplinary* studies as projects that take place within the bounds of a single, currently recognized academic discipline. We fully appreciate the artificial nature of subject boundaries and that they are dynamic. The research activity is orientated towards one specific goal, looking for an answer to a specific research question.

We define *multidisciplinary* studies as projects that involve several different academic disciplines researching one theme or problem but with multiple disciplinary goals. Participants exchange knowledge, but do not aim to cross subject boundaries to create new knowledge and theory. The research process progresses as parallel disciplinary efforts without integration but usually with the aim to compare results.

We define *participatory* studies as projects that involve academic researchers and non-academic participants working together to solve a problem. Academic researchers and non-academic participants exchange knowledge, but the focus is not on the integration of the different knowledge cultures to create new knowledge. Both

disciplinary and multidisciplinary studies may include non-academic participants. Participatory studies are not necessarily research.

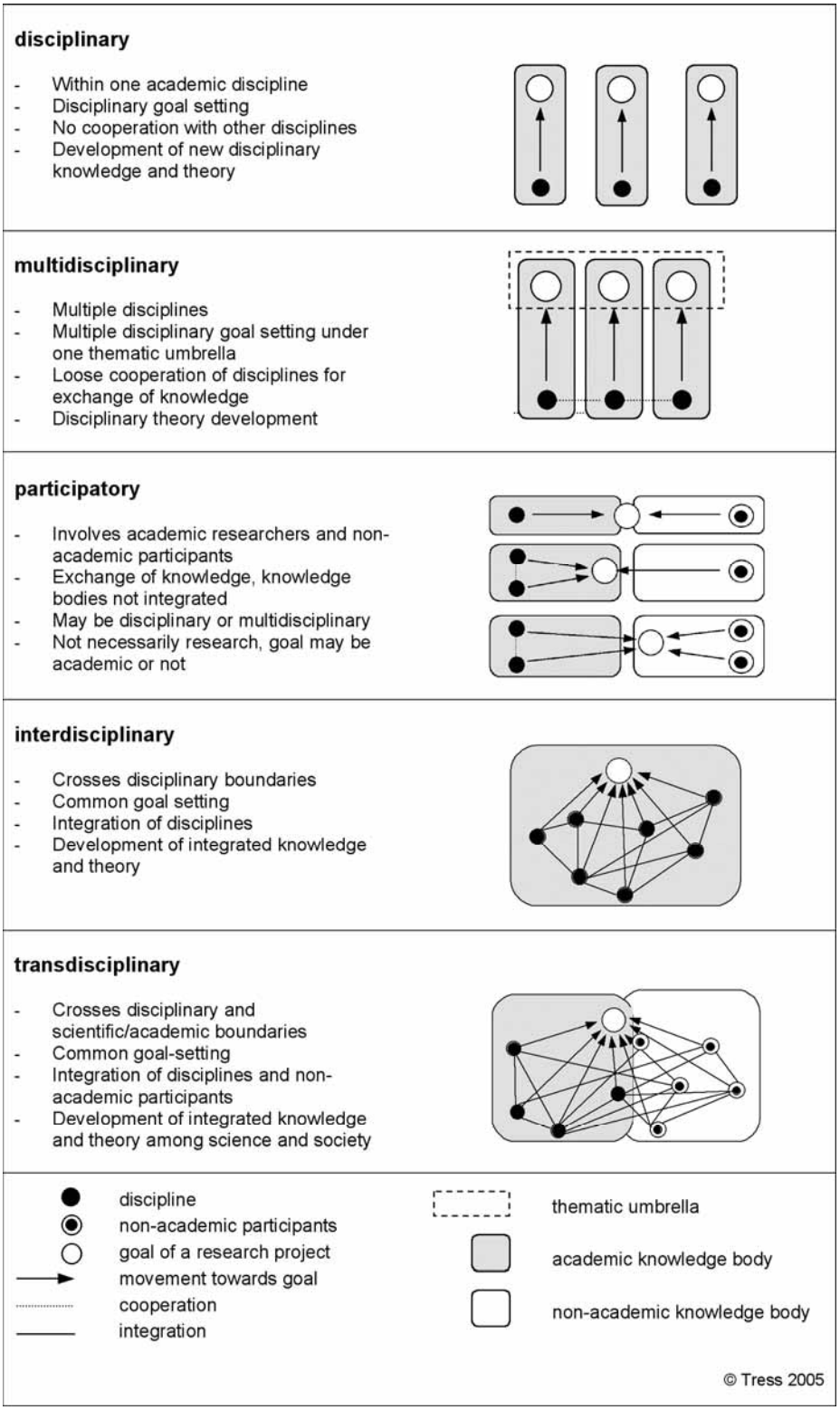

Figure 1. Overview of concepts: disciplinary, multidisciplinary, participatory, interdisciplinary and transdisciplinary

We define *interdisciplinary* studies as projects that involve several unrelated academic disciplines in a way that forces them to cross subject boundaries to create new knowledge and theory and solve a common research goal. By unrelated, we mean that they have contrasting research paradigms. We might consider the differences between qualitative and quantitative approaches or between analytical and interpretative approaches that bring together disciplines from the humanities and the natural sciences.

We define *transdisciplinary* studies as projects that both integrate academic researchers from different unrelated disciplines and non-academic participants, such as land managers and the public, to research a common goal and create new knowledge and theory. Transdisciplinarity combines interdisciplinarity with a participatory approach.

We define *integrative* studies as projects that are either interdisciplinary or transdisciplinary, in that new knowledge and theory emerges from the *integration* of disciplinary knowledge. With the expression *integrative research* we summarize interdisciplinary and transdisciplinary research efforts.

In Figure 1, the characteristics of the proposed definitions of research concepts are illustrated. The main differences between the proposed concepts are the intensity of cooperation and integration of disciplines and the involvement of non-academic fields as visualized in Figure 2.

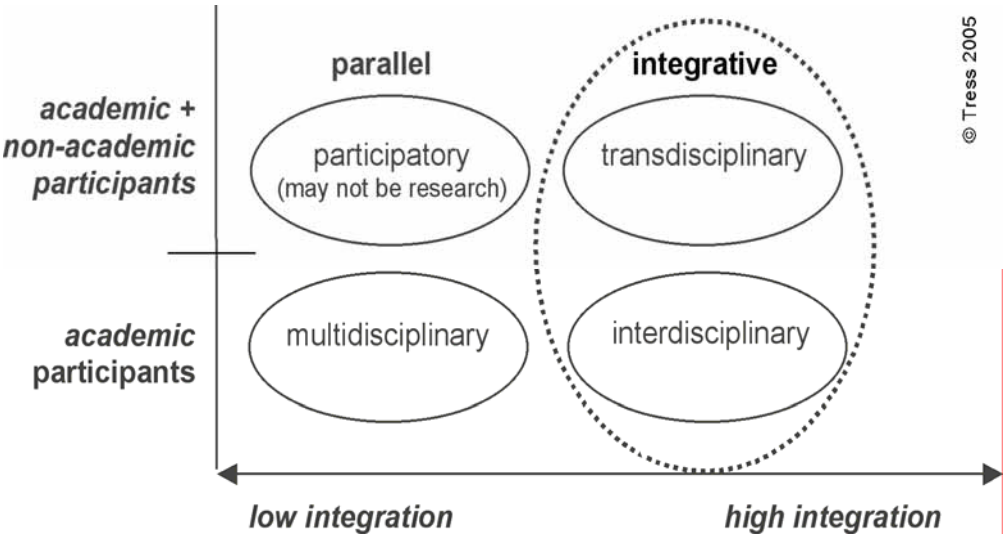

Figure 2. Degrees of integration and stakeholder involvement in integrative and non-integrative approaches

Levels of participation

Two main groups of participants can be distinguished in integrative research: academic and non-academic participants. Academic participants are researchers; non-academic participants are societal actors such as policy makers, representatives of administration or interest groups, locals or the broader public. The expression 'non-academic participants' does not mean that these societal actors may not have an academic education but their role in the project does not serve academic purposes in the way the role of the researchers does. In integrative research these two types of actors – researchers and non-academic participants – can cooperate in different ways: First, researchers from one discipline cooperate with researchers from other disciplines, which can be multidisciplinary or interdisciplinary, depending on whether

integration is aimed at or not. Second, researchers from one discipline can cooperate with societal actors, which can be participatory. Also here, integration is not the aim but exchange. Third, researchers from several disciplines can cooperate with societal actors, which can be either participatory or transdisciplinary, again depending on whether the project aims at integration of knowledge or exchange.

Stakeholder participation can be realized at different levels. Stakeholders can have different roles in the research process, which may span from being informed by researchers to steering the research process. Figure 3 illustrates the different levels of participation. At the lowest level, stakeholders get informed about a study; at the second level, stakeholders are consulted and provide data and input for a study; at the third level, stakeholders are involved in a study and have influence on its course; at the highest level, stakeholders steer a study and determine the course of a project.

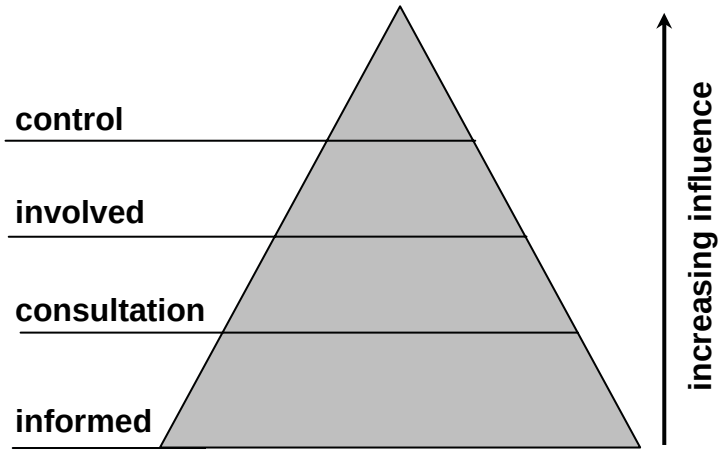

Figure 3. Levels of stakeholder participation

It is important for a project to define the role of stakeholders. Researchers and/or stakeholders or funding bodies need to define whether stakeholders provide data, interpret data, change the research plan, implement changes in the research process or manage the entire research process. The expectations towards a project might not be fulfilled if the role of stakeholders is not clearly defined. Stakeholders, for instance, might assume that they are directly involved in the decision-making of the project, whereas researchers might only wish to get the opinion of stakeholders to achieve research aims. A detailed discussion of participatory approaches is found in Buchecker et al. (2003), Campbell and Vainio-Mattila (2003), Rowe and Frewer (2004), Selman (2004), Van Asselt and Rijkens-Klomp (2002) and Warburton (1998).

What is integration?

By integration we mean that different knowledge cultures are bridged and their knowledge fused together when answering a research question. As different knowledge cultures we might consider the natural sciences, social sciences and humanities, disciplines using quantitative versus qualitative approaches or disciplines that have different concepts of data and validation. For integrative research projects, this means that the research question is defined jointly and the answer to the research question derives from an integration of disciplinary knowledge. In our view, integration needs to lead to the development of new common methods and theory and finally to new knowledge. This does not mean, however, that methods deriving from

one discipline cannot be applied any longer. Instead, the knowledge that is derived from, for instance, applying a qualitative method should be confronted and merged with knowledge derived from quantitative methods. In a next step, new knowledge evolves when these different knowledge layers are brought together to answer a common research question. This process is difficult to achieve if left to the end of a project and must be started from the beginning. Eventually, new theory can be developed through the integration process and new methods may become available to different knowledge cultures.

Research-policy makers often see integration as providing a better solution to a research problem than a disciplinary or multidisciplinary approach. However, we only have poorly developed criteria for measuring what a 'better solution' means. We might consider greater acceptance, better assimilation of research, greater public involvement or a reduction of conflicts between different interests as goals for an integrative approach.

Knowledge production in integrative research

Integrative research is more than the pure interaction of different research and/or societal partners, but it remains a research activity. We have defined the process of creating new knowledge as a characteristic for integrative research. In the following section, we will focus on how this knowledge creation process might happen in integrative landscape research. In certain circumstances, integrative research activities can cross the boundary of research and become the application of existing knowledge. The consequences of crossing these boundaries are also discussed here.

The circle of knowledge creation

At an abstract level, each integrative or participatory research project contains processes of knowledge creation, application and reflection, as well as feedback to science. These processes go hand in hand and mutually influence each other. In order to describe these processes we have developed a model to represent the circle of knowledge creation (see Figures 4 and 5).

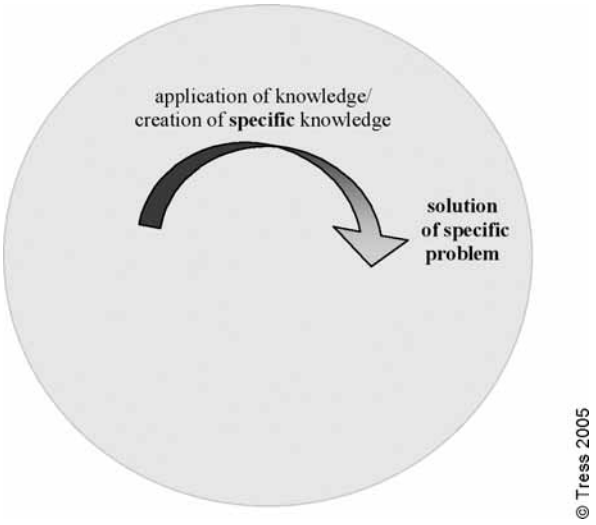

Figure 4. The circle of knowledge creation – development of specific knowledge

All projects have a goal – the solution of a specific problem – determined by the client or by client and researchers together. We describe the circle of knowledge creation in two steps:

1) Existing knowledge is used to develop a solution to a specific problem. This knowledge is available through the expertise of the project team (academics as well as non-academics) or from the results of earlier projects – part of the body of scientific knowledge. In order to be considered as research, *new* knowledge has to be generated by the project team in order to solve the given problem. If the problem can be solved with already existing knowledge, it would not normally be considered a research project but a development project, professional practice or consultancy. Available knowledge as well as newly generated context-specific knowledge is applied in order to solve a specific problem. This is illustrated in Figure 4. We use the term *specific* here to underline that the solution of a contextual problem does not automatically allow the results to be used to solve other problems of a similar kind. This is the difference between the first and second part of the circle of knowledge creation, where the focus is on the generation of *generic* knowledge.
2) Generic knowledge is knowledge that is generally applicable to answer similar kinds of problems. As science is interested in the nature and behaviour of observable phenomena (Feynman 1998) it seeks knowledge that has relevance and validity beyond a specific context. Through reflective processes, single researchers and research teams can use the specific knowledge developed in the project for the further development of existing methods and theory. The researcher will draw conclusions of general relevance and in this sense develop generic knowledge. This generic knowledge is fed back to science – usually in the form of a scientific paper or book publication – and is the main process through which progress in science takes place. This is illustrated in the lower half of the circle of knowledge in Figure 5. In this way knowledge is also shared within the scientific community and available for future projects. Generic knowledge increases the body of knowledge in scientific communities and the knowledge applicable to societal problems.

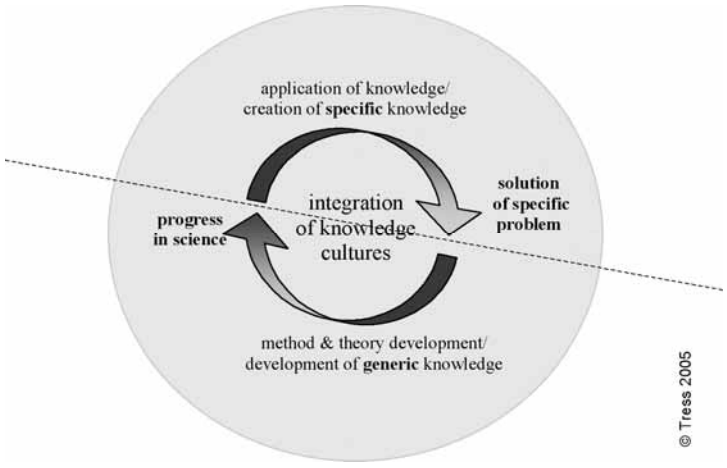

Figure 5. The circle of knowledge creation – development of generic knowledge

Based on the results from the INTELS project, we acknowledge that there might be a problem for integrative projects to include all aspects of the circle of knowledge creation. It would appear that many applied integrative projects only focus on the goal of gaining the specific knowledge needed for solving the problems of their client or

stakeholders. Once this has been achieved, the project may be deemed completed so that there is neither time nor money for a more fundamental reflection on the knowledge that was created or how it can be fed back to the wider scientific community. Many valuable experiences get lost in this way, hampering progress in research. It can also be discussed whether projects that do not feed back to science are research projects or whether they are better characterized as consultancy. This is because their focus is more on the application/creation of specific knowledge than on the creation of generic knowledge that contributes to progress in science. A characteristic of consultancy is that it relies on the application of existing knowledge for the solution of a problem – even if the solution is contextual and unique.

What is research?

When debating different types of research, we are also forced into the discussion of what is and what is not research. The gathering of data, recording observations, collecting experiences, developing plans, discussing with stakeholders and finally solving a real-world problem is not necessarily research. Admitted all these are valuable activities, but knowledge creation first becomes research when the data and information we have gathered are systematized, analysed and fed back into academic communities (Winder 2003). This is what distinguishes scientific knowledge from non-scientific knowledge (Audi 2003). The discussion of what is and what is not research is of high relevance for landscape research and planning, which at the same time is a field of applied and fundamental science (Nadin 1997; Benson 1998; Selman 1998; Milburn and Brown 2003).

According to the UK Research Assessment Exercise 2001 (RAE 2001), research is to be understood as original investigation undertaken specifically to gain knowledge and understanding. It includes work of direct relevance to the needs of commerce and industry as well as to the public. Research pushes forward the boundaries of knowledge within a particular specialism and/or challenges existing subject boundaries, whereas consultancy is work commissioned by a client for an agreed payment. It has the primary aim to fulfil a commission, not to push back the boundaries of knowledge, but it is not less important. We have developed a footprint for integrative research that illustrates the differences of research and consultancy and is shown in Figure 6.

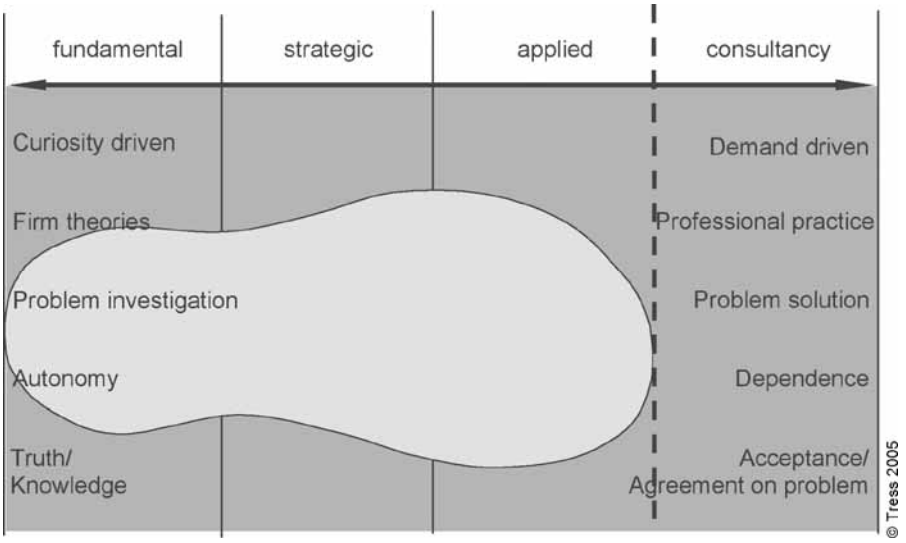

Figure 6. Footprint of integrative research

Tacit and explicit knowledge in integrative research

Integrative research requires that new knowledge is created, but also that this knowledge has to be fixed and put into a broader framework. In order to become research, knowledge has to be transformed from being tacit into being explicit. Nonaka and Takeuchi (Nonaka and Takeuchi 1995) use the terms *tacit knowledge* as subjective knowledge and *explicit knowledge* as objective knowledge; however, we use the terms in a more specific sense, adapted to the needs of a research context. To us, tacit knowledge is implicit and personal. This means that the knowledge is not directly accessible to others and that it is impossible to assess its significance in relation to existing knowledge. In contrast, explicit knowledge is accessible to others. Explicit knowledge is mostly tangible; it is fixed on some kind of medium such as a book, scientific journal, CD, video or a web site. As a consequence, it is brought into the wider context of the public domain. This process allows us to judge results in relation to existing beliefs and commonly held attitudes (see Table 1). Exposure to peer review is one of the main pillars of scientific progress.

Table 1. Characteristics of tacit and explicit knowledge

Tacit knowledge	**Explicit knowledge**
implicit	expressed in language
personally bound	not bound to an individual
not accessible for others	accessible to others, tangible, available on a medium
not put in context of other knowledge	seen in the context of existing knowledge

Levels of reflection in integrative and participatory projects

In order to feed back integrative knowledge into the scientific community, and to contribute to progress in science, integrative knowledge, theories and methods need to be transformed from tacit into explicit knowledge. This takes place by means of reflection. In the context of research projects, reflection can go on at four different levels (see Figure 7).

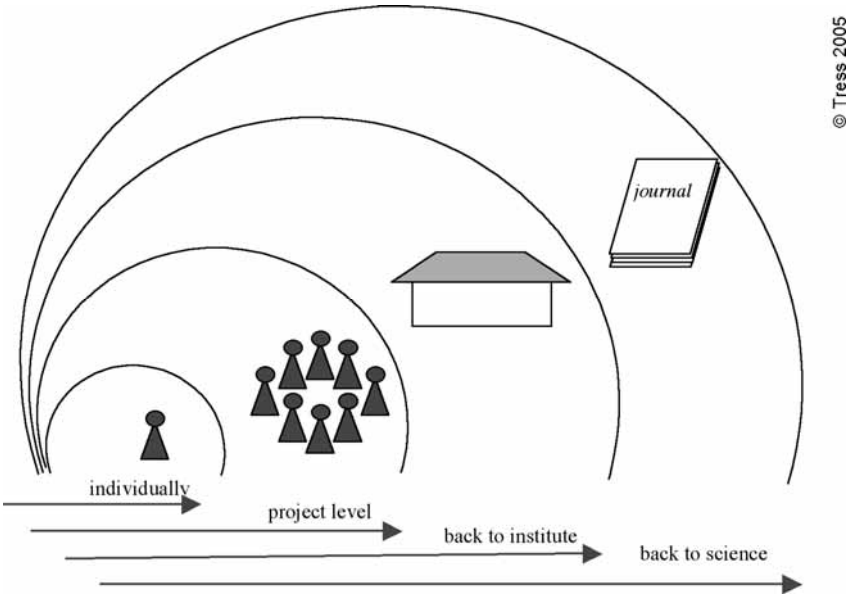

Figure 7. Four levels of reflection in integrative research projects

Reflection can take place at the *personal level*; it is one person's individual reflection. A participant can reflect on what she/he actually has done and learned in the project and what have been the benefits for her/his career, about the experiences and how these experiences relate to earlier experiences. This includes reflection on the contents of a project as well as on the process. By *contents* we mean the subject of a project and what an individual participant has learned in this subject, which may enable her/him individually to increase the personal knowledge base. By *process* we mean how the project was organized and how it proceeded including the roles of and interactions between participants. It also includes the positive or negative experiences with the specific project setting, and what went well and what did not work. These reflections may influence a person's future choice of projects, and working cultures.

Another level at which reflection can take place is the *project level*, dealing with reflection among the participants of a project. At the project level, participants can reflect on common learning and knowledge exchange, their level of ambition to integrate the different knowledge cultures and whether this ambition was achieved. An important point is to reflect on when and under which circumstances common learning takes place and what can be done to stimulate such moments. Equally important is reflection on how knowledge was shared among the participants and how it was made available to everyone.

Reflection in terms of *feedback to the research institute/university* is a third level. It is the level of organizational learning. Theories of organizational learning state the importance of feedback of individual and project knowledge to the organization, as this is the way in which an institute learns and thus can improve its products over time (Argyris and Schön 1996; Argote 1999). Reflection contributes to the excellence and reputation of an institute. The accumulation of new findings and knowledge and making these available to other researchers within the same institute is a key factor in the professional development of the individual staff and the institute as a whole. If knowledge remains implicit and is not integrated and shared at the institute level, it can easily get lost. This loss can happen simply in that knowledge gets forgotten over time or when individuals leave the organization. In this way, organizational learning is turned into organizational forgetting (Argote 1999). When an organization loses relevant knowledge, it may lose the ability to provide certain services or investigations. Therefore, it is important to feed back new knowledge into the research institute, and to store it in a way that will make it widely available at present and into the future. Mechanisms for formally and informally achieving this accumulated experience through information exchange are vital to the professional well-being of institutes in the age of intellectual capital.

Another level of reflection is *feedback into science and academia*. Only when reflection at this level is achieved, we can speak of a research activity, since it is through this reflection and feedback that generic knowledge is created. In research it is important to reflect on how the problem was defined and the methodological approach selected. Scientific reflection considers the assumptions/hypotheses and whether they were confirmed or rejected. The selection of methods, their advantages and shortcomings and consequently what needs to be developed further in the future all require reflective analysis. One of the most important topics for reflection relates to the results of the project and particularly how these relate to previous findings. Do the results support existing theories or challenge them so that new theory development becomes necessary? Under the current research system, the most common way of feeding such reflections back into science is by means of publication. Where peer-review is applied, this works also as a quality-control filter, deciding whether or not

the results presented add relevant and original contributions to the body of knowledge of a scientific community (Milburn et al. 2003). Publication not only forms the framework of reference for new studies but also acts as a mechanism to safeguard research teams from unknowingly duplicating research efforts over and over again. Publication allows us to acknowledge each others' results and build upon existing knowledge.

The four levels have a hierarchical holistic structure, in which one level is related to the other levels. The relationship works in both directions, so that the lower levels relate to the upper levels and vice versa. It is important to regard them all together as means of reflection in integrative landscape research.

Conclusion

This paper suggests the explicit use of integrative research concepts in landscape research and planning. The lack of a common understanding of integrative research concepts was identified as a barrier to integration in the daily work of research projects and in the evaluation of the results of these projects. We propose definitions for disciplinary, multidisciplinary, participatory, interdisciplinary and transdisciplinary concepts that will enable researchers to communicate effectively about their experiences with these approaches. We encourage authors to state explicitly in the Methods sections of their research papers how integration was understood and applied in the project reported in the paper. Integration is presented as a fusion process of different knowledge cultures from which new theory, methods and knowledge are derived. The process of knowledge creation in integrative research is not fundamentally different from that in non-integrative projects. The cycle of knowledge illustrates two steps in this process: the creation of specific knowledge by applying existing expertise for the solution of certain real-world problems, and the reflection level where specific knowledge is transferred to generic knowledge. By creating generic knowledge integrative research contributes to progress in science. Reflection includes transforming tacit knowledge, which is bound to certain persons, to explicit knowledge, which is accessible to others and can be seen in the context of the existing knowledge body. Reflection in integrative landscape research is necessary to share new knowledge with others; however, to build up integrative knowledge a common understanding of what integrative research concepts include is needed first.

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