Ecosystem Services and Transdisciplinarity

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Introduction

Based on the idea to make science more relevant to the solution of real-world problems, transdisciplinarity (TD) was established as a reflexive, integrative, method driven scientific principle aiming at the solution or transition of societal problems and concurrently of related scientific problems by differentiating and integrating knowledge from various scientific and societal bodies of knowledge (Lang et al., 2012). A key motivation for TD is to address the complexity inherent in many of these problems: as we cannot fully grasp all relevant complexity, we have to reduce complexity and to make choices; these choices are only to a (often very) limited extent purely technical of scientific, thus involvement of societal reflections and actors and arguments is legitimate (Keune et al., 2015). Similar to related approaches such as post-normal science citizens science, participatory approaches (for definitions please see the OpenNESS glossary[2]), TD goes beyond multi- and interdisciplinary research by co-creating knowledge with and for societal actors. Therefore the language, the concepts and the methodology used in TD are not solely scientific phenomena but jointly produced in the interaction between science, practice and policy.

Influenced by Anglo-American scientific debates in the 1960s and 1970s Jantsch (1972) was one of the first to use the term 'Transdisciplinarity' (TD). During the 1980s the term was introduced in the European scientific community by Mittelstraß (1992) as a type of research which crosses disciplinary borders and which is based on and meant to solve real world problems. A widely accepted conceptualisation of the transdisciplinary research approach is provided by Lang et al. (2012). This involves three collaborative phases between scientific and non-scientific actors to:

1) collaboratively frame the problem and build a collaborative research team (Phase A);

2) co-produce solution-oriented and transferable knowledge through collaborative research (Phase B); and

3) (re-)integrate and apply the produced knowledge in both scientific and societal practice (Phase C).

TD reshapes some basic epistemological principles by extending the realms of knowledge and transforming the roles of academic and non-academic actors within the research process (Walter et al., 2007). Operating across theses traditional boundaries at the interface between science-policy-practice interface (Turnhout et al., 2009) developing a common understanding, targeted communication and relationship building are essential parts of this process (Carmen et al., 2015b). This kind of boundary work can be eased by boundary facilitators, i.e. individuals with certain skill sets to facilitate the flow of information and communication processes or boundary organizations. Boundary objects (Star and Griesemer, 1989; Clark et al., 2011) or boundary concepts (Mollinga, 2010) can be beneficial for TD processes as well (for more detailed definitions of boundary terms please see the OpenNESS glossary[1]). The ecosystem service concept (Potschin and Haines-Young, 2016) can be considered a boundary concept, to the extent that it enables researchers from other disciplines, policy makers and other stakeholders to develop a common language (Hauck et al., 2013) and each can select knowledge relevant to their particular field (Jordan and Russel, 2014). The concept more and more brings together experts, policy representatives and other stakeholders

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[2] http://www.openness-project.eu/glossary

in so-called Ecosystem Services Communities of Practice (CoP). An ES-CoP is a network made up of individuals and organizations that share an interest and practice regarding ecosystem services and wants to further each other's understanding and activities in in this area. EU-examples are MAES and the Belgian Ecosystem Services CoP (BEES; Keune et al., 2015).

The development of initiatives such as Future Earth or the Intergovernmental Platform of Biodiversity and Ecosystem Services (IPBES) show that the need to bring knowledge generation, decision making and action closer together is now widely recognised in both scientific and policy based communities (Carmen et al., 2015a; Díaz et al., 2015). In this context interactive 'knowledge exchange' and 'knowledge co-production/co-construction/co-creation' processes with multi-stakeholder groups are initiated. The former relates to processes which 'generate, share and/or use knowledge through various methods appropriate to the context, purpose and participants involved' (Fazey et al., 2013). The later includes knowledge exchange within knowledge development processes aiming to produce knowledge that is acceptable for all participants (Hegger et al., 2012; van Enst et al., 2014) driven by non-scientists stakeholders' needs (Martín-López and Montes, 2015).

Evaluating TD processes

While a lot of benefits are associated with TD knowledge production (see Hauck et al., 2016), and a number of methods, concepts and frameworks have been developed to facilitate the processes, including the ES concept as boundary concept, a great challenge for TD remains. We still lack approved quality standards that equally guide transdisciplinary researchers, program managers and donors (Jahn et al., 2012). We are currently in a development phase where "doing it in a transdisciplinary way" seems to be the "politically correct expectation". TD can be facilitated or hindered by a number of structural or behavioural factors, such as legislative requirements for stakeholder involvement or deeply held beliefs associated with disciplines and organisations that frame ways of seeing problems and ways of acting to solve problems that may not match the integrated approach which is central to the concept of ecosystem services. Furthermore, the extra resources need for TD may raise the question: "Does TD research bring 'better' solutions compared to more traditional research approaches to the problem?"

One possible way forward to address this question and assess TD, proposed by Lang et al. (2012), is to jointly define success criteria in terms of both the desired effects, as well as in terms of scientific innovations. Criteria for both aspects are used to evaluate the project throughout the research process, by an extended peer group (comprising experts from science and practice). Two dimensions for evaluation are important here (see also Carmen et al., 2015a). First, many evaluation criteria focus on the TD process, such as competence of the project partners, adequacy of the problem formulation, flexibility of the project management (Bergmann et al., 2005), legitimacy (Cash et al., 2003) or fairness. Second, Walter et al. (2007) propose to assess the societal impacts of TD as well. These include impacts related to the TD process (network building, trust in others, understanding of others, community identification) and to created products (system knowledge, goal knowledge, transformation knowledge). The final impact of a TD process lies between these two categories and describes the interaction between process and products: distribution of knowledge. In addition Walter et al. (2007) suggest evaluating changes/improvements of the decision making capacity of the participants as knowledge is applied but also learning and new ideas are integrated more widely within traditional scientific and non-scientific communities. Taking these into consideration, evaluation of TD research in OpenNESS should play an important role.

Significance to OpenNESS and specific Work Packages[3]

TD is one of the major approaches within OpenNESS, related to the question of how TD can help to or is even necessary for the operationalisation of ES and NC. TD is facilitated by WP6 and 7, relates to all WPs and is particularly relevant for a number of methods, such as integrated valuation, which requires TD as a precondition to obtain a credible valuation (Carmen et al., 2015b). WP2 has also examined the knowledge needs from the perspective of stakeholders involved in OpenNESS to help us learn more about knowledge process needs for ecosystem services research (Carmen et al., 2015b). The DoW for OpenNESS suggests a TD research approach particularly for the place-based case studies in WP5. In principle a TD approach would mean that stakeholders have been included in defining research objectives and strategies for the case studies and most importantly their knowledge has been incorporated. In addition, shared learning between researchers and stakeholders and the impact and usefulness of science in decision-making on biodiversity and ES across different governance levels would have been promoted. An extensive cross cutting evaluation in WP5 will evaluate the case studies based on these and other criteria to contribute to address questions such as "To what extend TD can help to or is even necessary for the operationalisation of ES and NC" or "Does TD research bring 'better' solutions compared to more traditional research approaches to the problem?"

Relationship to four challenges

Transdisciplinary relates to all four challenges in terms of processes of how to deal with the challenges with different actors (research, policy, media, stakeholders), hence it is difficult to see how the approach would differ in the individual challenges.

Recommendations for the OpenNESS consortium

In order to address the questions of usefulness of TD, we recommend a regular evaluation of the TD research processes carried out not by the scientists or donors, but by participating stakeholders, particularly in WP5 and currently an evaluation process is developed in the context of D5.4 in this context. A number of evaluation frameworks are available; for example Bergmann et al. (2005); Walter et al. (2007), Fazey et al. (2014), the SPIRAL handbook (http://www.spiral-project.eu/) (or the WP5 joint research activity on 'Operationalisation through transdisciplinarity' led by Saarela et al.). Three categories can be considered for evaluation, for which we each list a small number of EXEMPLARY questions:

1. Possible questions to evaluate an on-going process:
   - Are, and how where the goals and reasons for involving stakeholders beyond scientists in this case study (CS) made sufficiently transparent and are their particular interests addressed via adequate problem definitions?
   - How where the roles, responsibilities and rights of all participants of the CS distributed and communicated?
   - Are the resources and competences of people engaged in the CS sufficient to achieve the aims, solve the problems? If not, what is missing?
   - Which settings, methods, and ways of communicating to facilitate joint knowledge production are appropriate?
   - Which effort was made to enable reflections, openness and flexibility for improvements in the CS?
2. Possible questions to evaluate a completed process:
   - How where the aims and objectives of the CS jointly framed and adapted during the process?
   - How were the aims of the CS been achieved and did the project contribute to developing solutions to stakeholder problems?

[3] For a brief description of the OpenNESS Work Packages see: http://openness-project.eu/about/work-packages

- How were the results/knowledge co-produced in the CS communicated, products distributed, even beyond the project?

3. Possible questions to evaluate societal impacts:
   - Social networking: How many new connections have been made due to your involvement in the CS?
   - Trust: Did willingness to cooperate and share knowledge with other stakeholders and scientists increase through the CS?
   - Understanding of others: Did participating in the CS increase understanding of the desires and concerns of other stakeholders?
   - Use of results: How were direct outputs, new ideas, tools and methods actually used, e.g. in decision making, for realizing opportunities of action or change political agendas?

Methods that can be used for evaluation are manifold. Evaluation workshops or round tables or face-to-face feedback rounds in less formal, individual conversations but also using independent facilitators. Common is also the use of questionnaires, or interviews. An essential part of evaluation processes is to feed information back into knowledge generation process to facilitate learning, adapt and improve.

Three 'Must Read Papers':

Fazey, I., Bunse, L., Msika, J., Pinke, M., Preedy, K., Evely, A.C., Lambert, E., Hastings, E., Morris, S., Reed, M.S. (2014): Evaluating knowledge exchange in interdisciplinary and multi-stakeholder research. *Global Environmental Change* 25: 204-220.

Lang, D. et al. (2012): Transdisciplinary research in sustainability science – practice, principles, and challenges. *Sustainability Science* 7: 25-43.

Walter, A.I. et al. (2007): Measuring societal effects of transdisciplinary research projects: design and application of an evaluation method. *Eval Program Plann* 30: 325–338

Further Literature or cited References

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Carmen, E. et al. (2015b): Knowledge need for the operationalization of the concept of ecosystem services (ES) and natural capital (NS). OpenNESS project report for the European Commission, EC FP7 Grant Agreement no. 308428.

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Jahn, T. et al. (2012): Transdisciplinarity: Between mainstreaming and marginalization. *Ecological Economics* 79: 1-10.

Jantsch, E. (1972): Towards interdisciplinarity and transdisciplinarity in education and innovation. In: *Problems of Teaching and Research in Universities, Organ. for Economic Cooperation and Development*, Paris, pp. 97–121.

Jordan, A. and D. Russel (2014): Embedding the concept of ecosystem services? The utilisation of ecological knowledge in different policy venues. *Environment and Planning C* 32(2): 192 – 207.

Keune, H. et al. (2015): Emerging ecosystem services governance issues in the Belgium ecosystem services community of practice. *Ecosystem Service,* doi:10.1016/j.ecoser.2015.06.001 (in Press)

Martín-López, B. and C. Montes (2015): Restoring the human capacity for conserving biodiversity: a social-ecological approach. *Sustainability Science* 10(4): 699-706.

Mittelstraß, J. (1992): Auf dem Wege zur Transdisziplinarität. *GAIA* 1 (5): 250.

Mollinga, P. (2010): Boundary work and the complexity of natural resources management. *Crop Science* 50(1): 1-9.

Potschin, M. and R. Haines-Young (2016): Conceptual Frameworks and the Cascade Model. In: Potschin, M. and K. Jax (eds): *OpenNESS Ecosystem Services Reference Book*. EC FP7 Grant Agreement no. 308428 http://www.openness-project.eu/library/reference-book

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