Conflicts as catalytical elements in transdisciplinary knowledge production

Raphael Dietz, Sigrid Busch and Dan Teodorovici

Transdisciplinary research, in which partners from academia work together with practice partners to co-create knowledge, is regarded as a promising format for solving important societal issues. However, this format involves a higher degree of complexity than disciplinary and interdisciplinary research. Conflicts within the research team are a frequently observed symptom of this complexity and are perceived mainly as challenges. To reflect on the topic of conflicts, this article uses the transdisciplinary research project WECHSEL as a case study.
In the course of WECHSEL, experts from energy system analysis, urban planning and sociology, together with experts from the municipal government, investigated how energy transition can be used for a sustainable transformation of the Neckar Valley in Stuttgart. The project explored the possibilities of reconfiguring the existing energy infrastructure in favour of a high-quality urban and landscape development alongside the river bank.
The article describes the conflicts that arose during this transdisciplinary research and analyses the consequences to the research process resulting from them. Building on the experience of the WECHSEL project and existing literature, this article argues that conflicts should be understood not only as challenges, but also as catalytic elements that can even improve the research process. It concludes with practical recommendations on how researchers can improve the handling of conflicts in transdisciplinary projects and how policymakers and funding agencies can support this.

Konflikte als Katalysatoren transdisziplinärer Wissensproduktion

Transdisziplinäre Forschung, in welcher Partner aus Wissenschaft und Praxis zusammen neues Wissen erarbeiten, gilt als vielversprechendes Format, um wichtige gesellschaftliche Probleme zu lösen. Allerdings beinhaltet diese Art Forschung auch einen höheren Grad an Komplexität als disziplinäre oder interdisziplinäre Forschung. Konflikte innerhalb des Forschungsteams sind ein häufig beobachtetes Symptom dieser Komplexität und werden vor allem als Herausforderung betrachtet. Der Artikel zieht das transdisziplinäre Forschungsprojekt WECHSEL als Fallstudie heran, um dieses Thema zu reflektieren.
*Im Rahmen von WECHSEL gingen Expert*innen aus dem Bereich der Energiesystemanalyse, Stadtplanung und Soziologie zusammen mit Expert*innen der Stadtverwaltung der Frage nach, wie die Energiewende für eine nachhaltige Transformation des Stuttgarter Neckartals genutzt werden kann. Das Projekt untersuchte die Möglichkeiten, die bestehende Energieinfrastruktur zugunsten einer hochwertigen urbanen und landschaftlichen Entwicklung entlang des Flusses umgestalten zu können.*
Der Artikel beschreibt die Konflikte, die während der transdisziplinären Forschung auftauchten und analysiert, welche Folgen sich daraus für den Forschungsprozess ergaben. Aufbauend auf den Erfahrungen aus WECHSEL und vorhandener Literatur wird argumentiert, dass Konflikte nicht nur als Herausforderung, sondern auch als katalytische Elemente verstanden werden sollten, welche den Forschungsprozess sogar verbessern können. Der Artikel schließt mit praktischen Empfehlungen, wie Forschende besser mit Konflikten in transdisziplinären Projekten umgehen können und wie Fördermittelgeber dies unterstützen können.

Cities are seen as key to addressing the challenges of sustainable development (United Nations 2017; WBGU 2016). They are complex systems in which a large number of different actors negotiate an even greater number of interests. To cope with this complexity and to increase scientific impact on urban transformation, research formats focusing on co-production of knowledge are gaining increased attention (Polk 2015a) to stimulate 'a more holistic view of the problem and potential solutions' (Smit, Lawhon and Patel 2015: 61). While there is a broad range in the use of the term, this article relies on the following definition: 'Knowledge co-production refers to collaboratively-based processes where different actors and interest groups come together with researchers to share and create knowledge that can be used to address the sustainability challenges being faced today, and increase the research capacity to contribute to societal problem solving in the future' (Polk 2016: 35). Within the different discourses on the co-production of knowledge, we focus on transdisciplinary research (TDR), which is currently emerging more and more on the (German) scientific agenda (Defila and Di Giulio 2019; Jahn et al. 2012; WBGU 2011) and seeks to generate systems, targets and transformation knowledge (ProClim 1997: 15). Referring to TDR, the actor-based connotation of the term is used in the sense that 'besides scientists of multiple disciplines also actors from different practice fields are substantially involved in the research process' (Defila and Di Giulio 2018a: 33).[1]

In the WECHSEL[2] project, great benefits were drawn from the transdisciplinary (TD) approach: perspectives from many different citizens, stakeholders and disciplines were integrated into the development of a joint structural urban development plan for the Neckar Valley, requirements from energy supply and urban planning were brought together, and a collaboration between science and city administration was established. But the TD approach also comes along with various challenges (Lang et al. 2012), such as different logics of action (Gonser

1
Translation by the authors.

2
WECHSEL stands for 'Weiterentwicklung der bestehenden Stuttgarter Energieinfrastruktur und resultierende Chancen für die nachhaltige Stadtentwicklung', which can literally be translated as 'further development of the energy infrastructure of the City of Stuttgart and resulting opportunities for a sustainable urban development'.

et al. 2019), the clash of conflicting rationalities (Watson 2004), or the development of a common language (Trenks et al. 2018; Pohl and Hirsch Hadorn 2008b). Many challenges are related to conflicts (Hollaender et al. 2008; Schneider 2011; Vanasupa et al. 2012), for which reason, in this article, we reflect on the conflicts related to the TD approach that occurred in WECHSEL rather than to the benefits and research results.

Although TDR isn't a completely new phenomenon (Defila and Di Giulio 2018a; Healy 2019), it appears that such research formats are currently increasingly demanded and funded by research donors. As a result of this quick transition into the mainstream, it seems that many scientists are approaching this task with their classical set of methods and views rooted in disciplinary traditions (Freyer, Bingen and Helgenberger 2010), without being specifically experienced in the methods of TDR (König et al. 2013). Thus, the question arises how researchers can be better prepared for conflicts occurring in TDR projects.

The authors use their experiences made in the research project WECHSEL, combined with a literature review, to investigate this question. First, WECHSEL is briefly described and contextualised, and then the different formats of co-production are described to generate a general understanding of the setting and modus operandi of WECHSEL. After this descriptive part, specific conflicts are identified and their consequences analysed, and finally recommendations are made for the perception of conflicts in TDR.

Seeing the transformation of large-scale energy infrastructure as a chance for a sustainable urban development – the WECHSEL project

The vision of turning Stuttgart into a city that acknowledges its river, in combination with the challenges that arise from climate change and the mitigation strategies that follow (e.g., the transformation of the energy system), are goals that call for thoughtful and transformative planning. The WECHSEL research project (2017 – 2019), funded by the German Federal Ministry of Education and Research, responded to this vision and examined the transition of energy systems in connection to the spatial dimension in the Neckar Valley.

Stuttgart and its river – a brief contextualisation

The Neckar Valley in Stuttgart is characterised by a bustling business sector of international rank and is also home to cultural events that attract millions of visitors each year. On the downside, it reflects a fragmented townscape that has been shaped by a clash of different components. The urban fabric is a composition of old villages, industrial areas, energy and transportation infrastructures, and landscapes. Currently, access to the river is very limited – physically and mentally [Fig. 1 and 2]. Unlike other cities that have recently undergone massive redevelopments along their riversides (e.g., Madrid, Hamburg, Lyon, Frankfurt [Deaño 2011; Hölzer 2008; Knoll et al. 2017]), Stuttgart is defined by a disperse distribution of land property along the Neckar that hinders access to large and continuous sites for development (brownfields) [Fig. 3].

Nevertheless, in 2017 the City of Stuttgart launched the *Masterplan Erlebnisraum Neckar*[3] (Landeshauptstadt Stuttgart 2017), which seeks to develop a system of public green spaces along the river. So far, a counterpart focusing on the urban structure is still missing. However, the energy transition gives opportunities for addressing this issue, especially as extensive infrastructural sites along the Neckar are occupied by energy and water supply infrastructure (power plants [Fig. 4], a gas storage facility [Fig. 5], a shutdown waterworks) owned by a single enterprise. With the complex situation calling for an integrated inter- and transdisciplinary approach, WECHSEL was launched.

As a transdisciplinary think tank, WECHSEL brought together researchers of the University of Stuttgart – from the fields of energy economy (IER[4]), urban planning (SI[5]) and sociology (ZIRIUS[6]) – and the City of Stuttgart (ASW[7] and AfU[8]). Using various methods, the perspectives of different stakeholders such as citizens, civic associations, economic, corporate, governmental institutions and politicians, as well as the views of external experts, were incorporated into the research process to co-design a proposal for a 'Structural Urban Development Plan of the Neckar Valley in Stuttgart'.

3
Landscape Architecture Masterplan Neckar Valley

4
Institut für Energiewirtschaft und rationelle Energieanwendung / Institute of Energy Economics and Rational Energy Use

5
Städtebau Institut – Internationaler Städtebau / Institute of Urban Planning and Design – International Urbanism

6
Zentrum für interdisziplinäre Risiko- und Innovationsforschung der Universität Stuttgart / Centre for Interdisciplinary Risk and Innovation Research at the University of Stuttgart

7
Amt für Stadtplanung und Wohnen – Abteilung Stadtentwicklung / Department of Housing and Planning – Division of Urban Development

8
Amt für Umweltschutz / Department of Environmental Protection


①


②

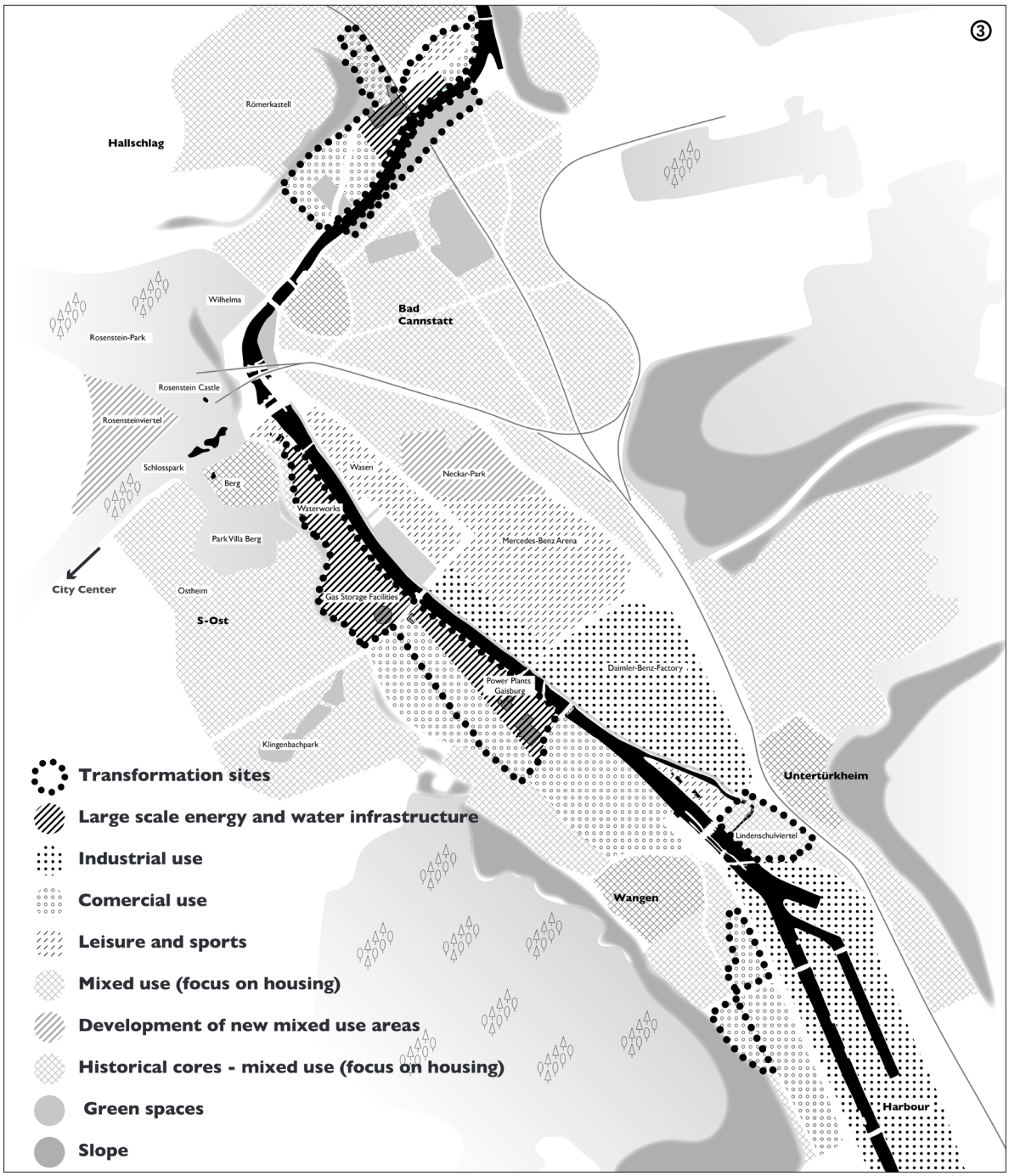


Figure 1: Industrial infrastructure blocks the access to the Neckar River. Source: IUSD / IRD 2017

Figure 2: Installation to raise awareness of the lack of accessibility to the river, realised by students as part of the research project. Source: IUSD / IRD 2017

Figure 3: The Neckar Valley in Stuttgart is a patchwork of different functions and urban fabrics, with limited access to the river. Source: WECHSEL

Figure 4: Gaisburg power plant. Source: WECHSEL

Figure 5: Gas storage and federal highway alongside the Neckar. Source: WECHSEL

9
'The term information (i.e., in the sense of informing) is used to refer to one-way forms of communication between different actor groups; actors are informed about the synthesis project through articles, books, policy briefs, presentations, and/or documentaries (videos), but are afforded only limited power to influence the process and/or the outcome (Brandt et al. 2013; Krütli et al. 2010).' (Hoffmann et al. 2017: 681)

10
Consultation comprises two-way forms of communication; actors are asked to comment on the synthesis proposal/project, and to bring in their knowledge (e.g., through questionnaires and/or interviews) individually, in small groups, in larger meetings, or via digital platforms. The actor group initiating the consultation (e.g., the core team) decides whether to include these contributions in the synthesis project or not (Hoffmann et al. 2017: 681).

Transdisciplinary methods of co-design and co-production applied during the research process

The project made use of different formats that can be categorised according to Hoffmann, Pohl and Hering (2017) to their degree of actors' involvement in the information,[9] consultation[10] and collaboration.[11] Fig. 6 gives an overview of the actors' involvement during the project. It shows that the first two categories were organised in temporary events like presentations at public events or stakeholder workshops, while the third – collaboration – was organised in a more frequent and flexible way and contained the highest degree of co-production. Here, conflicts related to TD occurred and were dealt with. Collaborative formats mainly contained: a) quarterly meetings open to all members of the research team, which were merely informative and didn't leave space for reflection; b) a disciplinary exchange workshop, where one discipline introduced their way of working to the other disciplines – an approach that has not been adopted by the other disciplines; and c) different TD working groups to work on specific research questions or to organise events.

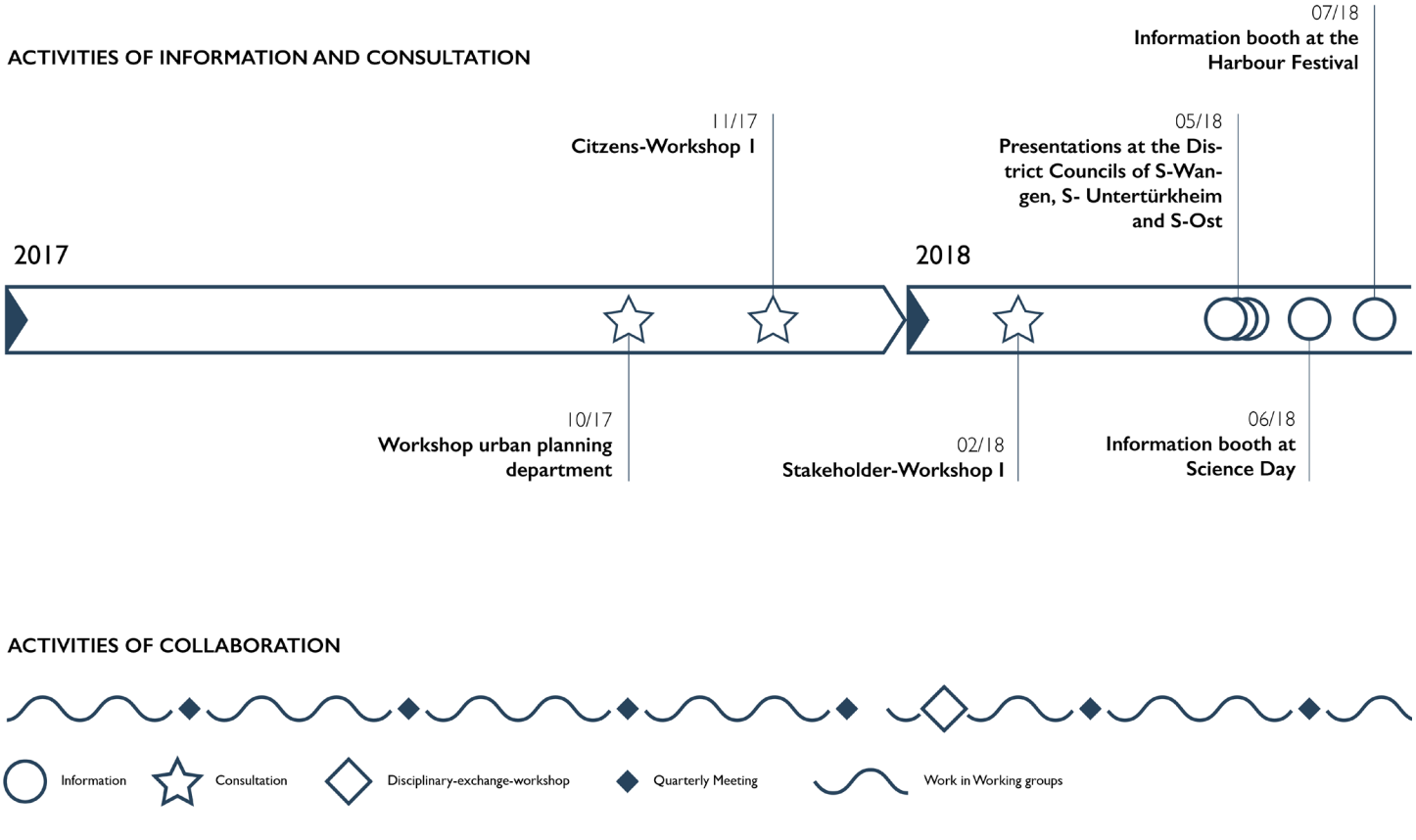
Addressing conflicts within the transdisciplinary research project

Given the fact that TD aims at integrating perspectives of a variety of individuals, institutions and disciplines to generate solution-oriented and socially robust knowledge (Lang et al. 2012), it is hardly surprising that conflicts are a major challenge to TD projects (Hollaender et al. 2008; Löhr et al. 2017; Vanasupa et al. 2012). In TD research, conflicts may result from the use of different methods and tools (Smit, Lawhon and Patel 2015: 62), diverging risk cultures (Gonser et al. 2019), unbalanced problem ownership (Healy 2019), role conflicts (Köglberger et al. 2019), or simply from the fact that the project itself is situated in a conflictual setting (Eckart et al. 2019; Hindenlang et al. 2008). Within WECHSEL, two major conflicts could be identified: conflicting objectives (Beecroft et al. 2018; Parodi et al. 2016) and conflicts regarding the prioritisation of interests related to these objectives (Healy 2019) during the process of solution-oriented knowledge production. Both led to substantial challenges in relation to the timing of knowledge integration, the synchronisation of interim research findings, and synthesis generation (Löhr et al. 2017).

Conflicts within the WECHSEL project

A major conflict resulted from different opinions on how the future use of the energy infrastructure sites should look like. While stakeholders and researchers focusing on the transformation of energy infrastructure into accessible urban space argued that infrastructure areas should be reduced as much as possible, stakeholders and researchers focusing on energy-system considerations advocated in favour of maintaining these areas in the long term for potential energy-supply technologies. In addition to the spatial dimension, a significant conflict of objectives regarding economic aspects became apparent. The conversion of energy infrastructure facilities and associated pipeline systems involves cost-intensive measures, presumably only partially compensable by the development gain of the areas. The measurable costs of the transformation of energy infrastructures were thus confronted with the intangible added value in terms of quality of life that might be achieved through the transformation.

These conflicting objectives led to the second conflict, regarding the prioritisation of research interests, manifested in time-consuming and eventually fruitless discussions on whether a screening for alternative sites could



be conducted within the scope of this project or whether this would only make sense in an additional research project with a supra-regional spatial focus and an extensive circle of additional experts and stakeholders.

Both conflicts were not transparent from the start, but only gradually became apparent during the discussion of intermediate results. The arenas in which these conflicts became visible were the quarterly meetings and the stakeholder workshops. Both formats were apt to make such conflicts visible, but due to the scarcity of time and their enormous complexity, were not really suitable to explore their systemic context or to mitigate or even solve them. This led partially to some time- and manpower-consuming efforts to find methodological ways to adjust the synthesis of the project. The proposal to engage an external mediation was rejected on the argument that: a) resources for such an additional task were missing in the project budget, and b) this could imply negative perception of the project from externals, possibly leading to negative impacts on future project applications.

Due to the unresolved conflicting objectives and interests, knowledge integration was severely delayed. The systemic issues to these conflicts first had to be carefully disclosed during various working group meetings before a negotiation and consideration process could be carried out. The goal of this process was to determine which subareas could be made available for what kind of transformation at what time intervals. The staggered time intervals and the division into subareas responded to the fact that ad hoc solutions to conflicts related to long-term transformation paths – which are also subject to a high degree of vagueness regarding the framework of energy policy – may not be available. They were conceived as part of a strategy for managing the unknown (Bammer 2019) and coping with the complex socio-ecological problem that energy transition provides (Schneidewind, Singer-Brodowski and Augenstein 2016). In addition, they formed the basis for the development of a scenario-based mission statement in which, finally, a certain part of the research results could be synthesised. This mission statement describes and visualises two possible transformation states of the energy infrastructure areas, which extend over several decades and could be based on one another time wise.

The role of conflicts in transdisciplinary research projects – conclusion and recommendations

'Conflicts are fundamental to TD research' (Hoffmann-Riem et al. 2008: 16), and they certainly were fundamental to the WECHSEL project. WECHSEL revealed conflicting objectives that are rooted in some parts of the city's society but that had not been clearly expressed before. This corresponds to the aim of TDR to identify societal problems (Pohl and Hirsch Hadorn 2008a: 6f). These conflicts initially acted as a barrier to the TD cooperation, but finally led to the adaption of the research agenda during the phase of knowledge integration. This way, the conflicts turned out to also be some kind of an inspirational or catalytic force. The conflicts the WECHSEL research team had to face fostered a form of knowledge production that, according to Renn (2019), corresponds to the catalytic concept: conflicts were identified, the underlying assumptions and interests were disclosed, and common solutions were developed in the form of the scenario-based mission statement.

From these reflections on conflicts within the WECHSEL project, two recommendations on TDR, addressing both

11
Collaboration encompasses multi-way forms of communication (e.g., debates, workshops) that are often moderated by one actor group (e.g., the core team); experts from science and practice are empowered to develop the synthesis project in collaboration with the core team, and thus to 'codetermine both process and the outcome on an equal footing (Krütli et al. 2010).' (Hoffmann et al. 2017: 681)

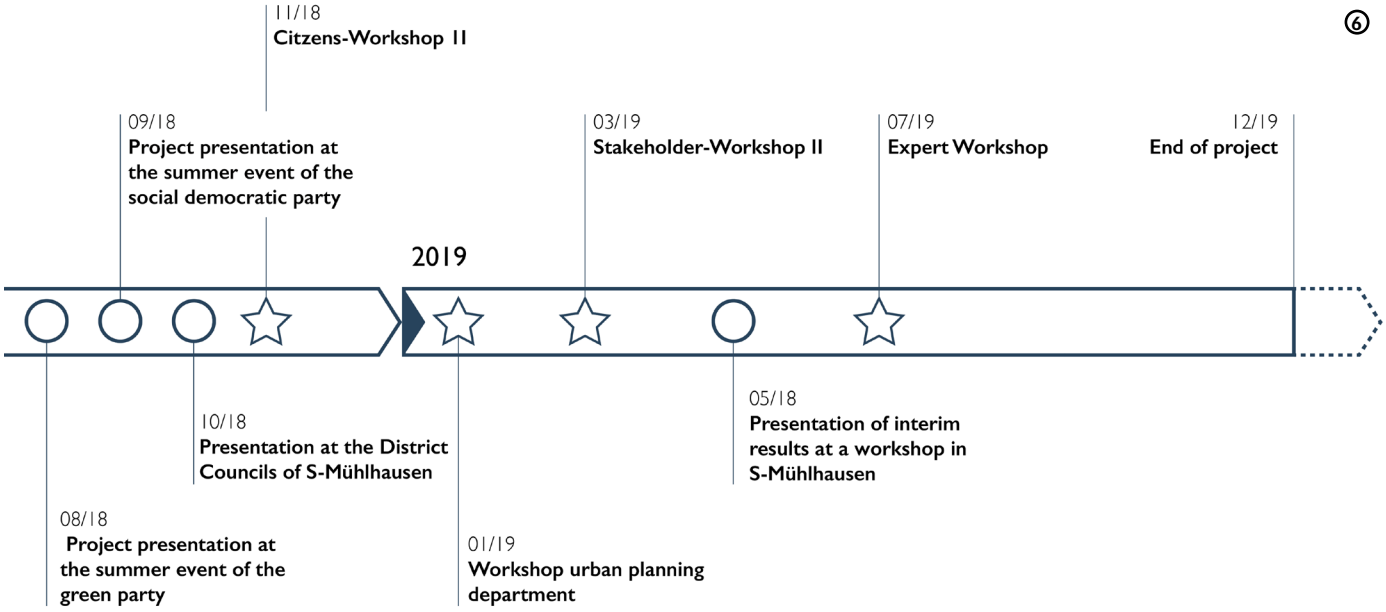


Figure 6: Actors' involvement in WECHSEL. Source: WECHSEL

policymakers and funding agencies as well as researchers from academia and practice, can be drawn:

1. A change of the perspective on conflicts in transdisciplinary research is reasonable

A recently-discussed approach to conflicts in TDR is the implementation of self-managed conflict-management programmes with the aim to 'prevent, manage or resolve disputes' (Löhr et al. 2017: 1190). Such programmes seem to be feasible for projects with sufficient additional resources and capacities. For smaller projects that are tight on budget, like WECHSEL, the implementation of such a programme could also lead to a further increase in complexity that might overburden the involved researchers. From the experience of WECHSEL, we would therefore like to advocate a complementary approach: a change of perspective on conflicts. Rather than viewing conflicts as 'eyesores' of the project, researchers and funding agencies should understand conflicts as inherent parts of TDR and as symptoms of its complexity (Hoffmann-Riem et al. 2008). Sometimes, as in the WECHSEL project, conflicts may be existing societal conflicts that are only made visible for the first time – which is a significant research finding.

Funding agencies can support this attitude towards conflicts by clearly communicating that they understand the significance of conflicts in TDR and that their occurrence is not seen as failure. As an alternative to self-managed conflict management programmes, they could offer and promote flexible opportunities of external support like mediation (see: Recommendation 2C).

Researchers, for their part, should appreciate conflicts as catalytic forces while being open to resulting adaptations to the research agenda. They should transparently name and discuss conflicts on the project level and in their feedback to the funding agencies. They should also proactively ask for the before-mentioned supportive measures from the funding agencies, without being afraid that this could be interpreted as failure.

2. The need to enhance reflexivity in transdisciplinary projects

Secondly, we argue that there is a need to enhance reflexivity within the TD process.

Against the background of the experience within WECHSEL, where research team members were primarily concerned with the collection of data as well as the design of innovative transformative spatial and energetic scenarios in complex co-design settings, resources to reflect on the TDR process itself on a meta-level were missing. However, this reflection is very conducive to making underlying issues explicit (Fazey 2018), to facilitating a synthesis finding (Polk 2015b), and to steering the research process in the right direction (Hoffmann et al. 2017).

Therefore, funding agencies and policymakers should demand a process-related meta-reflection of the TD research, and grant financial and methodological support especially for this endeavour. The project participants, on the other hand, should actively request this reflection if this is not ensured by a suitably experienced TD project manager and implemented within the research proposal and research design. In our view, the following elements are fundamental to support reflexivity:

A. Introductory workshops that prepare the researchers for the specificities of transdisciplinary research

These workshops should be geared to communicating TDR methodologies. The aim of the workshops would be for researchers to build on the experiences and reflections of other TDR projects right from the beginning of the project. This would reduce the risk of 'reinventing the wheel' in any TDR project – a circumstance that is likely to be observed, given the relatively new research format (Hoffmann et al., 2017). In addition, these workshops could raise awareness that TDR benefits from a close exchange of knowledge, a disclosure of inherent issues, and a transparent exchange of interim results – in the sense of an iterative approach to a common vision of research. Furthermore, they could react to the need to prepare researchers for conflicts and challenges that inevitably come along with TDR settings (Siebenhüner 2018).

B. Interim reports and interim workshops aimed at supporting reflexivity

In the case of the WECHSEL project, programme requirements to the interim report focused on communicating the status of the most important scientific and technical interim results of the project. Additionally, the opportunity should be seized to evaluate the TD process to date and to disclose the progress of knowledge integration as well as to reflect on methods for generating syntheses. The interim reports should also be used deliberately to give room to the inevitable conflicts within TD research, to encourage their naming, and to examine what contribution they could make to the acquisition of systemic and transformative knowledge.

C. Means to involve external consultancy

Methodological support from external TD experts can facilitate the researchers' ability to take a step outside their daily research tasks to critically reflect on the process (Beecroft et al. 2018: 93; Defila and Di Giulio 2020). In the case of the WECHSEL project, an external consultancy might have been able to contribute, at an earlier stage, to the disclosure and moderation of conflicting interests and objectives. The means to include external consultancy could either be integrated into an accompanying research project (Defila and Di Giulio 2018b) or designed as independent elements that can be flexibly included in the process if required.

Although conflicts are an integral part of TDR processes, TD literature seems to perceive them mainly as a challenge. With our experience from the WECHSEL project and the recommendations derived from it, we would like to help researchers to understand and manage conflicts more effectively and encourage them to also understand conflicts as catalytic elements for knowledge production.

References

Bammer, G. (2019) 'What makes a researcher transdisciplinary? A framework to identify expertise.' In: GAIA – Ecological Perspectives for Science and Society 28/3, p. 253-253.

Beecroft, R.; Trenks, H.; Rhodius, R.; Benighaus, C. and Parodi, O. (2018) 'Reallabore als Rahmen transformativer und transdisziplinärer Forschung: Ziele und Designprinzipien.' In: Di Giulio, A. and Defila, R. (eds.) Transdisziplinär und transformativ forschen: Eine Methodensammlung, p. 75-100. Wiesbaden: Springer.

Brandt, P.; Ernst, A.; Gralla, F.; Luederitz, C.; Lang, D. J.; Newig, J.; Reinert, F.; Abson, D. J. and von Wehrden, H. (2013) 'A review of transdisciplinary research in sustainability science.' In: Ecological Economics 92, p. 1-15. doi:https://doi.org/10.1016/j.ecolecon.2013.04.008

Deaño, N. M. (ed.) (2011) Madrid Rio: A Project of Urban Transformation. Madrid: Turner.

Defila, R. and Di Giulio, A. (2018a) 'Transdisziplinarität und Reallabore.' In: Reallabor für nachhaltige Mobilitätskultur – Universität Stuttgart (ed.) Stuttgart in Bewegung. Berichte von unterwegs, p. 31-37. Berlin: Jovis.

Defila, R. and Di Giulio, A. (2018b) 'What Is It Good For? Reflecting and Systematizing Accompanying Research to Research Programs.' In: GAIA – Ecological Perspectives for Science and Society, 27/1, p. 97-104. doi:10.14512/gaia.27.S1.17

Defila, R. and Di Giulio, A. (2019) 'Wie Reallabore für Herausforderungen und Expertise in der Gestaltung transdisziplinären und transformativen Forschens sensibilisieren – eine Einführung.' In: Defila, R. and Di Giulio, A. (eds.) Transdisziplinär und transformativ forschen, Band 2: Eine Methodensammlung, p. 1-30. Wiesbaden: Springer.

Defila, R. and Di Giulio, A. (2020) 'Science policy recommendations for funding real-world laboratories and comparable formats.' In: GAIA – Ecological Perspectives for Science and Society, 29/1, p. 63-65. doi:10.14512/gaia.29.1.14

Eckart, J.; Häußler, E.; Erl, T.; Gonser, M. and Riel, J. (2019) 'Kommunale Akteure verstehen: Vorgeschichte der Arbeit in Kommunen beachten.' In: Defila, R. and Di Giulio, A. (eds.) Transdisziplinär und transformativ forschen, Band 2: Eine Methodensammlung, p. 33-38. Wiesbaden: Springer.

Fazey, I. (2018) 'Ten essentials for contributing more directly to transformational change.' In: GAIA – Ecological Perspectives for Science and Society 28/1, p. 8.

Freyer, B.; Bingen, J. and Helgenberger, S. (2010) 'How transdisciplinarity becomes a member of the club of science.' In: Proceedings of the Twentieth European Meeting on Cybernetics and Systems Research, p. 366-371.

Gonser, M.; Eckart, J.; Eller, C.; Köglberger, K.; Häußler, E. and Piontek, F. M. (2019) 'Unterschiedliche Handlungslogiken in transdisziplinären und transformativen Forschungsprojekten – Welche Risikokulturen entwickeln sich daraus und wie lassen sie sich konstruktiv einbinden?' In: Defila, R. and Di Giulio, A. (eds.) Transdisziplinär und transformativ forschen, Band 2: Eine Methodensammlung, p. 39-83. Wiesbaden: Springer.

Healy, H. (2019) 'A political ecology of transdisciplinary research.' In: Journal of Political Ecology, 26, p. 500-528. doi:10.2458/v26i1.23245

Hindenlang, K. E.; Heeb, J. and Roux, M. (2008) 'Sustainable Coexistence of Ungulates and Trees: A Stakeholder Platform for Resource Use Negotiations.' In: Hirsch-Hadorn, G.; Hoffmann-Riem, H.; Biber-Klemm, S.; Grossenbacher-Mansuy, W.; Joye, D.; Pohl, C.; Wiesmann, U. and Zemp, E. (eds.) Handbook of Transdisciplinary Research, p. 315-326. Dordrecht: Springer Netherlands.

Hoffmann, S.; Pohl, C. and Hering, J. G. (2017) 'Exploring transdisciplinary integration within a large research program: Empirical lessons from four thematic synthesis processes.' In: Research Policy 46/3, p. 678-692. doi:http://dx.doi.org/10.1016/j.respol.2017.01.004

Hoffmann-Riem, H.; Biber-Klemm, S.; Grossenbacher-Mansuy, W.; Hirsch-Hadorn, G.; Joye, D.; Pohl, C.; Wiesmann, U. and Zemp, E. (2008) 'Idea of the Handbook.' In: Hirsch-Hadorn, G.; Hoffmann-Riem, H.; Biber-Klemm, S.; Grossenbacher-Mansuy, W.; Joye, D.; Pohl, C.; Wiesmann, U. and Zemp, E. (eds.) Handbook of Transdisciplinary Research, p 3-17. Dordrecht: Springer Netherlands.

Hollaender, K.; Loibl, M. C. and Wilts, A. (2008) 'Management.' In: Hirsch-Hadorn, G.; Hoffmann-Riem, H.; Biber-Klemm, S.; Grossenbacher-Mansuy, W.; Joye, D.; Pohl, C.; Wiesmann, U. and Zemp, E. (eds.) Handbook of Transdisciplinary Research, p. 385-397. Dordrecht: Springer Netherlands.

Hölzer, C. (2008) Riverscapes: Designing Urban Embankments. Basel, Boston-Mass., Berlin: Birkhäuser.

Jahn, T.; Bergmann, M. and Keil, F. (2012) 'Transdisciplinarity: Between mainstreaming and marginalisation.' In: Ecological Economics 79, p. 1-10. doi:https://doi.org/10.1016/j.ecolecon.2012.04.017

Knoll, M.; Lubken, U. and Schott, D. (eds.) (2017) Rivers Lost, Rivers Regained. Rethinking City-River Relations. Pittsburgh: University of Pittsburgh Press.

Köglberger, K.; Dietz, R.; Eller, C.; Piontek, F. M.; Albiez, M. and Potthast, T. (2019) 'Schutz in der Exposition, Schutz für die Exposition – Wie man in transdisziplinären und transformativen Forschungsformaten mit Ungewohntem und erhöhter Aufmerksamkeit umgeht.' In: Defila, R. and Di Giulio, A. (eds.) Transdisziplinär und transformativ forschen, Band 2: Eine Methodensammlung, p. 93-138. Wiesbaden: Springer.

König, B.; Diehl, K.; Tscherning, K. and Helming, K. (2013) 'A framework for structuring interdisciplinary research management.' In: Research Policy 42/1, p. 261-272. doi:https://doi.org/10.1016/j.respol.2012.05.006

Krütli, P.; Stauffacher, M.; Flüeler, T. and Scholz, R. W. (2010) 'Functional-dynamic public participation in technological

Dipl.-Ing. Raphael Dietz

Research associate at the Institute of urban planning, University of Stuttgart and architect and urban planner at 'asp' Architekten GmbH Stuttgart. His scientific work focuses on sustainable urban transformation, following a transdisciplinary approach.
Contact: <raphael.dietz@si.uni-stuttgart.de>

Dr.-Ing. Sigrid Busch

Senior researcher, lecturer and architect at the Institute of Urban Planning, Department of International Urbanism, University of Stuttgart, Germany. The focus of her work is on governance and sustainable urban development as well as on digital tools for simulation and visualization in urban planning to support stakeholder involvement.
Contact: <sigrid.busch@si.uni-stuttgart.de>

Dr.-Ing. Dan Teodorovici

Senior researcher and lecturer at the Institute of Urban Planning, Department of International Urbanism, University of Stuttgart, Germany. He is also working as an independent architectural and planning historian, author and exhibition curator. His research interests include international urbanism, classicism, palladianism, planning history, conservation and infrastructural urbanism, along with interactions between traditions and modernism.
Contact: <dan.teodorovici@si.uni-stuttgart.de>

decision-making: site selection processes of nuclear waste repositories.' In: Journal of Risk Research 13/7, p. 861-875. doi:10.1080/13669871003703252

Landeshauptstadt Stuttgart (2017) Erlebnisraum Neckar. Ein Masterplan für Stuttgart als Stadt am Fluss. Stuttgart: Landeshauptstadt Stuttgart.

Lang, D. J.; Wiek, A.; Bergmann, M.; Stauffacher, M.; Martens, P.; Moll, P.; Swilling, M. and Thomas, C. J. (2012). 'Transdisciplinary research in sustainability science: practice, principles, and challenges.' In: Sustainability Science 7 (Supplement 1), p. 25-43. doi:10.1007/s11625-011-0149-x

Löhr, K.; Hochmuth, C.; Graef, F.; Wambura, J. and Sieber, S. (2017) 'Conflict management programs in trans-disciplinary research projects: the case of a food security project in Tanzania.' In: Food Security 9/6, p. 1189-1201. doi:10.1007/s12571-016-0643-1

Parodi, O.; Beecroft, R.; Albiez, M.; Quint, A.; Seebacher, A.; Tamm, K. and Waitz, C. (2016) 'Von "Aktionsforschung" bis "Zielkonflikte". Schlüsselbegriffe der Reallaborforschung.' In: Technikfolgenabschätzung – Theorie und Praxis 25/3, p. 9-18.

Pohl, C. and Hirsch Hadorn, G. (2008a) 'Gestaltung transdisziplinärer Forschung.' In: Sozialwissenschaften und Berufspraxis 33/1, p. 5-22.

Pohl, C. and Hirsch Hadorn, G. (2008b) 'Methodological challenges of transdisciplinary research.' In: Natures Sciences Sociétés 16/2, p. 111-121.

Polk, M. (ed.) (2015a) Co-producing knowledge for sustainable cities: Joining forces for change. London, New York: Routledge, Taylor and Francis Group.

Polk, M. (2015b) 'Transdisciplinary co-production: Designing and testing a transdisciplinary research framework for societal problem solving.' In: Futures 65, p. 110-122. Doi: 10.1016/j.futures.2014.11.001.

Polk, M. (2016) 'How to manage complexity: Co-producing knowledge for urban change.' In: Co-production in action: Towards realising just cities, p. 32-45. Gothenburg: Mistra Urban Futures.

ProClim – Forum für Klima und Global Change (ProClim) / Konferenz der Schweizerischen Wissenschaftlichen Akademien (CASS) (1997) Forschung zu Nachhaltigkeit und Globalem Wandel – Wissenschaftspolitische Visionen der Schweizer Forschenden. Bern: ProClim/CASS.

Renn, O. (2019) 'Die Rolle(n) transdisziplinärer Wissenschaft bei konfliktgeladenen Transformationsprozessen.' In: GAIA – Ecological Perspectives for Science and Society 28/1, p. 44 –51.

Schneider, F. (2011) 'Approaching water stress in the Alps: Transdisciplinary co-production of systems, target and transformation knowledge.' In: Borsdorf, A.; Stötter, J. and Veulliet, E. (eds.) Managing Alpine Future II – Inspire and Drive Sustainable Mountain Regions. Proceedings of the Innsbruck Conference November 21-23, p. 107-117. Wien: Verlag der Österreichischen Akademie der Wissenschaften.

Schneidewind, U.; Singer-Brodowski, M. and Augenstein, K. (2016) 'Transformative Science for Sustainability Transitions.' In: Brauch, H. G.; Oswald Spring, Ú.; Grin, J. and Scheffran, J. (eds.) Handbook on Sustainability Transition and Sustainable Peace, p. 123-136. Springer International Publishing. Doi: 10.1007/978-3-319-43884-9_5.

Siebenhüner, B. (2018) 'Conflicts in Transdisciplinary Research: Reviewing Literature and Analysing a Case of Climate Adaptation in Northwestern Germany.' In: Ecological Economics 154, p. 117-127.

Smit, W.; Lawhon, M. and Patel, Z. (2015) 'Co-producing Knowledge for Whom, and to What End? Reflections from the African Centre for Cities in Cape Town.' In: Polk, M. (ed.) Co-producing knowledge for sustainable cities: joining forces for change, p. 47-69. London, New York: Routledge.

Trenks, H.; Waitz, C.; Meyer-Soylu, S. and Parodi, O. (2018) 'Mit einer Realexperimentreihe Impulse für soziale Innovationen setzen – Realexperimente initiieren, begleiten und beforschen.' In: Di Giulio, A. and Defila, R. (eds.) Transdisziplinär und transformativ forschen: Eine Methodensammlung, p. 233-268. Wiesbaden: Springer.

United Nations (2017) New Urban Agenda. Quito: United Nations.

Vanasupa, L.; McCormick, K. E.; Stefanco, C. J.; Herter, R. J. and McDonald, M. (2012). 'Challenges in Transdisciplinary, Integrated Projects: Reflections on the Case of Faculty Members' Failure to Collaborate.' In: Innovative Higher Education 37/3, p. 171-184. doi:10.1007/s10755-011-9199-3

Watson, V. (2004) 'Conflicting rationalities: Implications for planning theory and ethics.' In: Planning Theory and Practice 4, p. 395-407. doi:10.1080/1464935032000146318

WBGU – German Advisory Council on Global Change (2011) World in Transition. A social contract for sustainability. Berlin: WBGU.

WBGU – German Advisory Council on Global Change (2016) Humanity on the move: Unlocking the transformative power of cities. Berlin: WBGU.