Exploring fruitful links between real-world laboratory and disciplinary research

Introduction of the *DKN Future Earth* working group *LinkLab*

LinkLab is a newly established working group under the umbrella of German Committee Future Earth (DKN Future Earth). *It opens up a space to discuss relevant connections and interfaces between real-world lab research and various scientific disciplines, exploring fruitful connections and pathways for mutual learning for future sustainability-oriented research.*

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Towards bridging disconnects between real-world laboratory and disciplinary research

The effects of this year's extremely hot summer, which can be empirically attributed to human-made climate change (IPCC 2023), have once again highlighted that humanity is facing fundamental challenges threatening the integrity and even the future existence of human-environment or social-ecological systems (Rockström et al. 2023). At the same time, the recently published report of the German Council of Experts on Climate Change (Expertenrat für Klimafragen 2023) clearly states that policy measures in Germany to address this challenge are insufficient. In addition, there is a growing demand from various sectors of society for science to actively contribute to solving these challenges, rather than merely describing them.

Against this background, transdisciplinary and transformative research practices have been increasingly called for and established since the early 2000s. Based on the objective – originally formulated, for example, in Mode 2 research (Gibbons et al. 1994, Nowotny et al. 2001) and post-normal science (Funtowicz and Ravetz 1993) – to generate not only scientifically, but also socially robust knowledge, these research practices provide a key foundation for the development of a variety of formats and research settings with an experimental and action-oriented character. Besides sustainable and urban living labs (Liedtke et al. 2015, Voytenko et al. 2016), urban transition labs (Nevens et al. 2013), and transformation labs (Pereira et al. 2020), citizen science approaches have also been linked to transdisciplinary research and investigated for their transformative potential (von Gönner et al. 2023, Agnew et al. 2022). Members of the *NaWis* network have been actively engaged in developing, promoting, and refining such approaches, particularly in the context of real-world labs (RwLs) as settings for transdisciplinary and transformative research practices.

RwLs as research settings build on real-world experiments as core research method with the aim to initiate social learning processes for sustainable development and create a space for continuous learning for transformation (Caniglia et al. 2020, Mc Crory et al. 2022, Schäpke et al. 2018, Wanner et al. 2018). Over the last decade, much effort has been made to methodologically sharpen the RwL concept. This includes defining the core characteristics of RwLs (Schäpke et al. 2018, Wanner and Stelzer 2019, Parodi and Steglich 2021), develop-

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ing and testing appropriate methods for research and collaboration (Defila and Di Giulio 2019, Di Giulio and Defila 2018, Wanner et al. 2018), and defining success factors (Bergmann et al. 2021) as well as evaluating the impact of RwL research[1].

While there is general agreement that the basic idea of transdisciplinarity is to enable mutual learning processes among different knowledge domains, including different disciplines, and to generate new scientific insights in addition to contributions to solving or mitigating societal problems (Jahn 2008), RwL research often remains largely disconnected from more traditional, disciplinary research outside inter- and transdisciplinary sustainability research. In many of these disciplines, however, key challenges of RwL research have long been recognized and addressed: various disciplines have developed comprehensive methods, strategies, communication tools, and skills to deal with the

The *LinkLab* working group: Objectives and procedure

This is where the *LinkLab* working group comes in. Following repeated calls from international science networks – including *Future Earth* – for more transdisciplinary research formats to strengthen sustainability, an interdisciplinary *DKN (German Committee Future Earth)* working group comprising nine core members is being set up within the framework of *Future Earth* to work closely together on a defined topic.

The *LinkLab* working group brings together researchers from a variety of disciplines, including spatial and planning sciences, ethics and epistemology, legal studies, design research, digital participation and data science, anthropology and ethnology, and social-ecological systems research. Some of these disciplines have strong overlaps with RwL research, but may differ in the methods and approaches they use. For example, spatial and plan-

practiced by the working group will ultimately benefit everyone by enhancing the effectiveness of research projects in addressing sustainability issues. To be more specific: RwL research could benefit from many years of experience in ethnographic research with regard to collaboration between what used to be researchers and the researched (Lassiter 2005) and be sensitized to social and socio-material issues that may need to be considered in laboratory settings, such as the possible influence of social differences on participation or shared ownership. In turn, in systems increasingly formed by humans, pure ecological research may reach a limit in fully understanding the impacts and interactions in changing environments. Here, RwL approaches can provide a deeper understanding of the real-world implications and functionalities of specific transition pathways. Approaches from ethics and epistemology can contribute to a more re-

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demanding task of not only collecting data "objectively", but also interacting closely with practice partners and societal stakeholders during and as part of the research process. Others have specialized in issues related to legal, ethical, or normative implications of research processes, interventions, and knowledge transfer. At the same time, RwLs have great potential to enrich disciplinary research through their specific approaches and methods. Thus, there is a need for a comprehensive understanding of the perspectives and potentials that a greater integration of these approaches and methods offers for both real-world lab research and disciplinary research. Such a deeper understanding seems to be a suitable starting point to enable fruitful mutual learning processes.

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1 A special issue of *GAIA* on impacts of RwLs on sustainability transformations is planned for 2024.

ning sciences deal extensively with spatial situatedness, which is also a characteristic of most RwLs. Design research, as well as anthropology and ethnology, often use highly participatory and participating methods in their research, which RwLs may also draw upon.

Other disciplines may currently have less overlaps, but offer interesting perspectives for the further establishment of RwL research. As an example, innovations in data science and visualization open up new opportunities for participatory involvement, and a better understanding of the methods and procedures used in legal studies can offer valuable insights into how to approach regulatory issues in more experimental research approaches.

These disciplinary perspectives serve as a starting point to explore and define approaches to deliberately designing and using interdisciplinary connections. It is expected that the two-directional approach

fined understanding of the processes of knowledge production and their potential implications for real-world transformation processes, thus also advancing RwL research as an established research field.

Through discussion rounds in different constellations, based on literature work as well as a structured mapping and synthesis of approaches, the *LinkLab* working group aims to promote professional exchange among its members and beyond and to contribute to the scientific discourse on:

- relevant *connections and interfaces* between RwL (research) and various scientific disciplines, including good practices and success factors to make these connections fruitful;
- ways to overcome challenges and exploit untapped potential to *better capitalize on the methodological repertoire* of different research areas; and

■ *implications for research and policy* to enable impactful, rigorous, and inclusive RwL research.

Further steps and invitation to collaboration

The substantive work of *LinkLab* is guided by these core aspects of research. The aim is to produce a series of concrete outputs targeted at both the scientific community and policy makers, including a peer-reviewed research article and a policy paper. Draft versions of both documents will be discussed in-depth at the national level with the scientific community and political stakeholders within the group's network. Insights from the working group will also contribute to shaping the national and international landscape of transformative and transdisciplinary research and related activities, for example on the national level through the network of RwL research and the recently founded Socie-

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LinkLab aims to establish a permanent network for exchange on relevant research and policy implications to enable effective, rigorous, and inclusive real-world lab research.

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ty for Transdisciplinary and Participatory Research (GTPF), but also at the UN level (including United Nations Innovation Technology Accelerator for Cities [UNITAC] and United Nations Educational, Scientific and Cultural Organization [UNESCO]), in which some members of the working group are actively involved. In this way, these activities contribute to establishing a permanent network for exchange on the topic beyond the *LinkLab* project.

The working group warmly welcomes future collaboration on the topic and invites other researchers to contribute their experiences and (disciplinary) perspectives. To this end, we will – among other things – develop and publish a survey to advance our mapping of the research landscape over the coming months. Please contact the group through the corresponding author for more information or to express your interest in working with us.

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