

Building pathways between transdisciplinarity and transformation

Lessons from practice

The notion of “transformation” has moved from academic discussion and is now part of the discourse of public and private organizations. Here, we offer a systematic examination of how combining transformation and transdisciplinary approaches can support the transformation to sustainability.

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Abstract

In recent years, the notion of “transformation” has moved from academia to the strategic agendas of public and private organizations. Within this discourse, both transdisciplinarity and co-production are often mentioned as means to enable transformation, particularly in debates about risks and opportunities in transformative science and problem-solving. However, there has been little systematic examination of the potential in combining these approaches to contribute more effectively in the transformation to sustainability. Building on an autoethnographic analysis of two projects in transformation and transdisciplinarity, we identify pathways to strengthen collaboration between these approaches: 1. moving from transdisciplinarity “for” transformation to transdisciplinarity “as” transformation and 2. identifying concrete spaces for conceptual and methodological cross-fertilization between these approaches. We discuss the challenges and elaborate recommendations for these pathways and conclude by offering a few insights on how communities can together foster effective sustainability solutions to societal challenges.

Keywords

autoethnography, case studies, pathways to sustainability, problem-solving, transdisciplinary research, transformation

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Growing concerns about the complexity of societal challenges such as climate change have increased awareness of the need to “transform” the systems that run the world. Scientific research plays a key role in providing novel ideas and solutions for these complex problems. In this context, notions of “transformation” and “transdisciplinarity” are now commonly discussed in academic, public, and private circles (Patterson et al. 2017). Transdisciplinarity, understood as a collaborative and integrative praxis grounded in different ways of knowing, acting, and being (Pohl et al. 2021), is often mentioned as a means for transformation (Wheling 2022, ISC 2021, Lam et al. 2021, Otero et al. 2021, Renn 2021). Transformation, on the other hand, addresses research activities that seek to contribute to large-scale and long-term changes in systems. Despite their commonalities, there has been little systematic examination of the potential of combining both approaches to contribute to sustainability (Torralba et al. 2022).

In this paper, we discuss how transdisciplinarity and transformation can enrich each other, finding new ways to address sustainability problems. We analyze two projects as examples of transdisciplinarity/transformation addressing 1. development of a geothermal energy project in Switzerland and 2. a consortium working towards strengthening the role of innovation policy in sustainability. Building on autoethnographic accounts, we identify two pathways to strengthen their collaboration:

- moving from transdisciplinarity “for” transformation to transdisciplinarity “as” transformation;
- identifying concrete spaces for conceptual and methodological cross-fertilization.

The paper is structured as follows: first, we explore the conceptual and practical aspects of transdisciplinarity and transformation from the literature, their connections and implications. Second, we detail the ethnographic approach used in this paper, followed by a description of the two case studies. Then, we present the findings per case. Last, we discuss opportunities and recommendations for transdisciplinarity and transformation communities to foster effective collaboration for sustainability.

Transdisciplinarity and transformation as intertwined notions

There are multiple understandings of transdisciplinarity, some focusing on its epistemological dimensions and others relating to its implications for the organization and diffusion of knowledge, particularly its “problem-solving” aim (Klein 2014). These different understandings underlie concerns about the science-society interface and methods to address societal challenges (Lawrence et al. 2022).

Like transdisciplinarity, transformation is a central notion in discussions about science and society relationships for which there is no single definition (Patterson et al. 2017). It encompasses a broad set of disciplines that question the status quo of the current global situation and actively seek to contribute to creating a more sustainable world (Hölscher et al. 2021). The term evokes deep, long-lasting, and often open-ended changes in the way societies are organized, in contrast to transition, which defines a steered change process in subsectors of society (Stirling 2015). In multiple research strands, the terms “transition” and “transformation” are considered together, and transition studies consider (system) transformation to be one way to realize a transition (Hölscher et al. 2018).

Scoones et al. (2020) distinguish different approaches within the transformation literature that vary in the degree to which they focus on intervening in society. While some studies focus mainly on describing past transformations, others intend to inform or even support ongoing transformation processes. This relates to transdisciplinarity’s problem-solving stance that distinguishes between system knowledge (about what is), target knowledge (about what ought to be), and transformation knowledge (about how to transform a system into what ought to be) (Pohl and Hirsch Hadorn 2007).

It is therefore not surprising that transdisciplinarity and transformation are increasingly discussed together in academic literature (Schneidewind et al. 2016, Renn 2021). Transdisciplinarity often addresses transformation (ISC 2021, Otero et al. 2020) to inform the decisions of societal actors with the capacity to steer projects for systems transformation. In fact, transformation scholars underline the necessity to use a diversity of methods to reach transformative goals (Hölscher et al. 2021) and call to “embrace the concept of transdisciplinarity” (ISC 2021, p. 3) as it offers a way to co-produce knowledge in settings of epistemic plurality. Furthermore, transdisciplinarity promotes epistemic justice in knowledge production through equally valuing different bodies of knowledges (Lieu et al. 2023, in this issue). Transdisciplinary scholars have underlined how its endeavor to integrate disciplines and diverse societal actors makes it a suitable tool to promote transformation (Lam et al. 2021, Renn 2021).

This proximity has led to debates about transdisciplinary research that actively seeks to enable and support transformation processes (Wehling 2022). It is within this context that we explore this relationship through the examination of two empirical cases where transdisciplinarity and transformation were used.

Methods

The methodological approach consisted of an autoethnographic process based on our collaborative practices as transdisciplinary researchers and practitioners. We take as case studies two research projects in which at least one of the authors was involved (Hughes and Pennington 2017).

For data collection, we revisited field notes, publications, and other outputs from the two projects to identify how transdisciplinarity and transformation were addressed. We then conducted a qualitative content analysis of the material (Charmaz 2006).

For the autoethnographic process, authors involved in the projects produced self-reflexive accounts of their experiences to problematize these experiences and analyze how both approaches were addressed in practice (Hughes and Pennington 2017). The method entails a form of ethnographic research in which the researcher connects personal experiences to wider cultural, political, and social meanings (Hughes and Pennington 2017). Hence, our analysis resulted from individual and collective learning processes based on systematic self-reflection on contextualized experiences of the cases and scholarly discussion of the concepts of transformation and transdisciplinarity. We held regular meetings to characterize, analyze, and compare the cases and to elaborate on pathways between discourses. This allowed us to understand similarities and differences among practices, meanings, beliefs, and representations in the cases (Hughes and Pennington 2017).

The current study has one limitation worth noting. We describe personal feelings and insights regarding each of the cases, which requires honesty and a willingness to self-disclose. An extensive ethnography of the cases with detailed accounts of some of our observations is not possible here.

Case setting

The first case deals with the transformation of energy systems, framed in the project *Territorialising deep geothermal energy in Geneva: transdisciplinary pragmatic approach (TeGéGE)* in which one of the authors was involved from 2017 to 2020. The project built on a transdisciplinary collaboration with officers from the Canton of Geneva (Switzerland) and the public utility Services industriels de Genève (SIG). It aimed to address societal and institutional issues in the use of geothermal energy to transform the local energy system (Ruef and Ejderyan 2021).

The second case examined the *Transformative Innovation Policy Consortium (TIPC)*,¹ an international consortium that seeks to reorient science, technology, and innovation policy toward a more active and collaborative role in addressing global sustainability challenges (Schot and Steinmueller 2018). The consortium is composed of multiple national science and innovation agencies (such as VINNOVA from Sweden), which funded and actively participated in the research and experimentation program.

1 www.tipconsortium.net

The value of the selected cases lies in the following:

- *TeGéGE* is rooted in transdisciplinary research, and TIPC in transformation;
- each project tapped into the other's approach and dealt with sustainability issues;
- a wide range of societal actors was involved in the research process; and
- participatory methodologies were implemented.

Findings

Our findings are presented under three thematic clusters: 1. the transdisciplinary and 2. transformation dimensions of each case, and 3. how transdisciplinarity and transformation are related in each case.

Geothermal energy in Geneva

The *TeGéGE* project was initiated after a series of encounters at conferences and public events between one of the authors and the managers of the geothermal program in Geneva. The program was, at the time, relying mainly on internal and academic expertise from natural sciences and engineering. However, the project managers felt that the development of geothermal energy in Geneva also needed support from institutions, organizations, and the public. They thought social sciences and humanities could provide knowledge guiding the public engagement strategy for developing geothermal energy.

After a few iterations with the program managers, I² submitted a research proposal for a transdisciplinary project aimed at co-producing knowledge about public engagement and information for the geothermal program. The goal was to assess how actors in Geneva make sense of the proposition of developing geothermal energy and how the program should integrate this sense-making in its activities.

The transdisciplinary dimension

The approach aimed to be transdisciplinary in that it required collaboration with colleagues from science, technology, engineering, and mathematics, providing expertise to the geothermal program, as well as program managers and other policy actors to: 1. identify key issues to be addressed; 2. assess their effect for the development of geothermal energy in Geneva; and 3. jointly develop ways to address potential issues caused by the program's development, such as possible public fear of induced seismicity or reluctance from other public offices to accommodate a new decision flow and additional responsibilities. The core research team was composed of two social scientists and two program managers. Other officers from the canton were occasionally involved. Geologists were consulted in parallel or took part in specific project meetings. While the integration among the social sciences and practitioners was effective, interdisciplinary integration was less deep. Overall results highlighted the need for a carefully reflected public engagement that paid special atten-

tion to the channels through which actors were approached as well as building on local values associated with the development of a "new" technology like geothermal energy (Ruef and Ejderyan 2021).

The transformation dimension

For the geothermal program managers, *TeGéGE* was valued mainly as a transformative research project. Its aim was to identify institutional levers to enable the transformation of the local energy system and to provide guidelines on how to act on these. This included aspects such as adapting authorization procedures or organizational work culture to be more prone to experimentation and transversal contacts between sectors/hierarchies.

During project meetings, participants talked about transition, change, and transformation interchangeably. A program manager stated that developing geothermal energy offered an opportunity "to rethink our organization as a society". He referred to changes in the urban fabric that could be triggered by installing geothermal infrastructure: real estate developers and homeowners could be pushed to pool heating distribution, or installing a distance heating network could lead to rethinking transportation.

The idea of an urgent transformation of institutional structures to enable the energy transition also came out of focus groups we conducted with local communities (Ruef and Ejderyan 2021). This reassured the program management to emphasize more strongly that developing geothermal energy was not simply a technical issue but also a matter of social change.

Relationship between transdisciplinarity and transformation

While the project title mentioned transdisciplinarity and I used the term regularly in meetings, the practitioners did not really appropriate it. This does not mean that they did not take part in the research in their multiple roles (as brokers, data providers, or research "subjects") or did not value the proposed approach. They praised transdisciplinarity as an "original" approach offering room for reflection and learning opportunities. Yet, the transdisciplinarity dimension of the project was clearly a "means" to advance the goal of "transformation".

The program's objective to transform the local energy system provided a testing ground for the transdisciplinary approach. The use of transdisciplinarity in this case did not lead to the development of solutions for transformation. Knowledge co-production was seen mainly as a way of paying attention to problems yet to come and anticipating ways to address them.

Transformative Innovation Policy Consortium

I³ joined the consortium, which was meant to co-develop a series of interventions with project partners, as a postdoctoral re-

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2 As this is an autoethnographic exercise, we use the first person in the singular to acknowledge the personal dimension of the lessons and insights presented in this section. The author of this section is *Olivier Ejderyan*.

3 This section was written by *Carla Alvial Palavicino*.

searcher at the beginning of the implementation phase in 2019. The TIPC's work is guided by a set of principles (figure 1) rooted in the sustainability transitions literature, adopting a transdisciplinary perspective. These principles stress that transformative change needs to be addressed in a co-productive, participatory, and inclusive way, both in problem definition and in the creation of actionable knowledge that leads to solutions (Schot et al. 2017).

The transdisciplinary dimension

The consortium referred to transdisciplinarity in several ways. TIPC requires a new form of knowledge production, implying a reorganization of traditional university roles that seeks to achieve a more fluid relationship with society. Multiple times, I heard “we are a transdisciplinary team” or “we are doing transdisciplinary research” in reference to our role within the university context. Sometimes this was used to highlight our difference in methods and goals (i.e., publications) with respect to other research groups. Other times it was used to explain the importance of non-academic roles in the different projects, such as in public engagement.

Transdisciplinarity was referred to in relation to co-production, which underpins the TIPC methodology based on reflection, experimentation, and learning. This method contrasts with traditional science, technology, and innovation approaches that focus on short-term results, incremental solutions, and account-

ability. Co-production meant redrawing the boundaries between experts and practitioners, and it was implemented differently in the consortium's projects. In some cases, project partners were asked to be deeply engaged in things such as the methodological design of the project and to reflect on every step. In others, a more tailored approach was used to suit their needs and availability, not requiring such a committed engagement. This led to differentiation on using the methodology and on the understanding of co-production. As I heard in a discussion among researchers in one group, “it's not about delivering a service, it is about making them [practitioners] think”. At times, this led to tensions, as partners needing to deliver on specific projects within a given timeline did not clearly understand the added value of this approach, which is time-consuming. TIPC researchers might have felt that the practitioners were not really willing to reflect and transform their practices.

The transformation dimension

A joint interest in working on transformation initially brought together the different partners of the TIPC. Following the motto “transforming our world” embodied in the United Nations' *Sustainable Development Goals*, partners believe in the power of science, technology, and innovation to drive radical changes in systems. The way to implement this transformation is deeply rooted in the multi-level perspective or MLP (Rip and Kemp 1998).

This system change theory understands that change in socio-technical systems occurs through interactions between novelty (niches) and established practices (regime); socio-technical systems can change either through niche breakthrough, changes within the regime, and/or because of pressures at the landscape level. This is driven by changes in “rules” – the norms, beliefs, and values that shape societies, such as mass consumption, or the value of car-based transportation.

This view of transformation is embodied in the TIPC methodology. Partners think through the MLP framework and ask themselves: How can they change the regime? What niches should be supported? Through the process of engagement with project partners, the methodology provides a coherent framework for transformation in each context, which is often perceived as a fuzzy problem. In doing so, the TIPC chooses to focus on aspects that are relevant to the MLP framework,



FIGURE 1: Guiding principles of the Transformative Innovation Policy Consortium (TIPC). Source: Schot et al. (2017, p. 8).

which strongly focuses on social and institutional change processes. It does not connect directly to the type of goals or key performance indicators (KPIs) that funders and policymakers are more used to working with, such as the reduction of CO₂ emissions. In the understanding of the TIPC, transformation is a long-term process, and the TIPC's methodology is a way to contribute and steer this change in a desirable direction. How to operationalize this aim within the logic of two-to-three-year projects or programs has been one of the larger practical challenges of the consortium.

Relationship between transdisciplinarity and transformation

The TIPC sees transdisciplinarity as a core aspect of their work. System transformation requires actively engaging different knowledges in a process of social learning and collectively exploring and making choices about the direction of change. Transdisciplinarity provides a framework to achieve this change in a socially responsible way. Some of the tools at the center of the TIPC approach, such as *Theory of Change* or participatory research, are borrowed from the transdisciplinary toolkit. One key difference between transdisciplinarity and transformation as practiced in the TIPC is rigidity in the use of the MLP as a guiding theory, compared to transdisciplinary knowledge production processes in which there is more space for conceptual innovation beyond traditional academic theories.

In sum, transdisciplinarity is understood as a framework, a way of organizing work or a way of thinking, more than a specific process or set of methods. It is also a means validating the type of organizational change necessary for the consortium to operate within the traditional university environment, as transdisciplinarity seems to be broadly a “goal” for the science, technology, and innovation system of the future.

Discussion

In what follows, we discuss our findings and draw lessons for a deeper engagement between transdisciplinarity and transformation based on two pathways: 1. from transdisciplinarity “for” transformation to transdisciplinarity “as” transformation; and 2. in identifying concrete opportunities for cross-fertilization between discourses.

From transdisciplinarity “for” transformation to transdisciplinarity “as” transformation

A relevant pattern we identified is the instrumental nature of the relationship between transdisciplinarity and transformation approaches. Transdisciplinarity is considered a method or an approach to enable transformation by bringing together multiple stakeholders to co-produce knowledge (Pohl 2008). In this line, it is a means “for” transformation, being in line with the problem-solving discourse of transdisciplinarity (Klein 2014).

The *TeGéGE* project is exemplary of such a relationship in which transdisciplinarity is considered a means to support a

transformative process. It was used for its capacity to connect different disciplines and enable structured exchange between involved practitioners and social scientists. Such an approach to transdisciplinarity clearly makes it a means “for” transformation.

However, the instrumental nature of a transdisciplinarity for transformation is not driven only by funding agencies or transformation researchers looking for tools to enable transformation (ISC 2021). Indeed, transdisciplinary researchers underline that transdisciplinarity has great potential to contribute to addressing the challenges of the transformation to sustainability (Otero et al. 2020, Lam et al. 2021). By doing so, they contribute to its societal relevance. As such, the instrumentalization of transdisciplinarity for transformation can also be considered an opportunity to mainstream this approach.

Further, even if transdisciplinarity is embraced by transformation research to implement change, it is not necessarily reduced to being only a means. In the TIPC, transdisciplinarity is understood as a way of thinking that should influence all aspects of projects. Early working documents from the consortium mentioned the idea that for a transformation to thrive, we need to change the way we do science and innovation (Schot and Steinmueller 2018). Transdisciplinarity and its methods would enable the consortium to do so.

In the TIPC, partners were policymakers who tried to implement solutions but fell short with the use of traditional methods. They entered the consortium looking for new frameworks and solutions and realized that when adopting these, they also needed to change their institutions. They experienced transdisciplinary research as transformation because it enabled them to develop new forms of expertise, such as the capacity to experiment within their institutional frameworks and, hence, change them. Researchers did not provide solutions; instead, they helped co-produce spaces for this transformation to happen.

Here we see a shift within the “usual” way of depicting the transdisciplinarity-transformation relationship: from transdisciplinarity “for” transformation, as a set of tools and methods to instead transdisciplinarity “as” transformation, where adopting a transdisciplinary perspective is part of what individuals and organizations do in the process of transforming themselves.

Identifying concrete opportunities for cross-fertilization between discourses

Part of the “solutionism” debate (Wehling 2022) criticizes transdisciplinarity for promoting technical solutions (using social science to “help” implement technical solutions). In this perspective, transdisciplinarity contributes to the depoliticization of problems by focusing on the “problem-solving” aim. This neglects other understandings of transdisciplinarity that look into transgressive discourses (Klein 2014). Based on our analyses, transdisciplinarity contributes to enable transformation, meaning processes of societal change that precisely require going beyond the technical dimension.

Transformation is often discussed in spaces traditionally held by policymakers and practitioners, characterized by incremen-



tal solutions with a limited ability to deal with systemic problems (Patterson et al. 2017). From a transformation perspective, it is necessary to create conditions where solutions can be enabled, understanding that transformation is a long-term and complex process involving multiple actors. This constitutes a space in which cross-fertilization between both discourses could happen.

A second cross-fertilization space relates to the role of reflexivity in transdisciplinary projects (Knaggard et al. 2018). Such projects enable practitioners to question the meaning of their actions and open room for a renegotiation of instruments and procedures as we witnessed with the program managers in the *T&G&E* project. The TIPC methodology offers a third example of cross-fertilization. It focuses on enabling experimentation and learning among project partners for transformation. Here, reflexivity is a key element, as it helps participants to reflect on their assumptions about the nature of problems and their solutions and to think of novel possibilities based on systems transformation.

Language constitutes a fourth space for further cross-fertilization. Both transdisciplinarity and transformation use concepts and theories. When engaged in joint projects, transdisciplinary and transformation researchers should provide opportunities to exchange about concepts, confront them, and explore productive ways of combining them. The transformation agenda brings together societal actors with diverse interests and backgrounds and could be an opportunity to expand transdisciplinarity beyond academic circles.

Conclusions and recommendations

We have systematized insights and experiences from two European cases to draw pathways between transformation and transdisciplinarity. We conclude that the two approaches are gener-

ally conceived as complementary by researchers and practitioners. We elaborate on three recommendations to cross-fertilize these approaches.

First, transdisciplinarity offers a methodological toolkit that makes this approach particularly attractive to address issues of transformation to sustainability. The *T&G&E* case shows a good example of practitioners enthusiastic about transdisciplinary methods.

Second, it is important not to reduce transdisciplinarity to a set of methods but to foster discussion about transdisciplinarity as part of the vision of larger transformation and how it influences the way research roles, practices, and institutions are organized. However, the problem-solving dimension of transdisciplinarity should not be rejected, as it offers a pathway to dissolve boundaries among stakeholders.

Third, the notion of transformation offers a means to scale up a transdisciplinary approach to address complex problems. It is a way to mainstream multiple small experiences of “problem-solving” that might otherwise remain local and end up being anecdotal regarding grand challenges. Strong context relevance is important for change to be effective, but transformation enables it to amplify experiences and link transdisciplinary endeavors to multiple issues of sustainability.

The expected durability of the relationship between transdisciplinarity and transformation offers potential for mutual learning but needs to be exploited and planned in collaborative research processes. The complexity of the challenges of transformation to sustainability necessitates context-specific approaches to the development of solutions (Lam et al. 2021) for which transdisciplinarity is particularly adapted. We advocate for joint

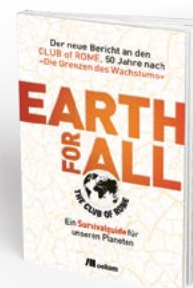
Überlebensprogramm für die Menschheit

Der bekannte Think Tank Club of Rome legt in »Earth for All« einen Survivalguide für die entscheidende Dekade der Menschheit vor. Wissenschaftlich basiert zeigen die Autoren Hebel auf für die Bekämpfung von Armut und Ungleichheit und eine nachhaltige Zukunft.

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learning efforts in which processes, practices, and theories can be enriched by making these connections more transparent and enduring.

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Author contribution: CAP: corresponding and lead author, OE, BVB: co-author, CAP, OE, BVB: conceptualization, manuscript writing, CAP: literature review on transformations, case study 2, OE: literature review transdisciplinarity, case study 1, BVB: methodological approach, manuscript writing – review.

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