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Making transdisciplinarity happen: Phase 0, or before the beginning

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ABSTRACT

Both within science and society, transdisciplinary approaches are increasingly employed to address today's sustainability challenges. Often transdisciplinary research processes are structured in three core phases: a) problem identification and formation of a common research object; b) co-production of solution-oriented and transferable knowledge; c) embedding co-produced knowledge through transdisciplinary reintegration. In all phases of this ideal-typical model, the involvement of non-academic actors is essential to meet the challenges of real-world problems, and of transformative research practices. Despite existing guidance for the core transdisciplinary process, its initiation often remains an uncharted area because of its strong context dependency. Based on a concrete transdisciplinary case study addressing sustainability transformation in Transylvania, we bring together our learned experience with initiating a transdisciplinary process using a research-driven approach. To this end, we introduce the notion of Phase 0, as an initiating phase prior to beginning an ideal-typical transdisciplinary process. Within Phase 0, we propose three empirically and literature informed sub-phases: Sub-Phase 0.1) selecting the case study; Sub-Phase 0.2) understanding the case study context from a transdisciplinary perspective; Sub-Phase 0.3) fostering premises for coming together. We outline the general rationale behind these sub-phases, and we illustrate how we carried out each sub-phase in practice. By deriving cross-cutting lessons from the three sub-phases, we enhance the practice of transdisciplinary sustainability research with the aim to leverage its transformative potential.

1. Introduction

Sustainability science is evolving into a solution-oriented arena that aims to conduct “use-inspired research” that links both science and practice (Miller et al., 2014:239; Renn, 2021). Transdisciplinarity is thereby widely regarded as a critical research practice in this arena (Schneider et al., 2019). Scholars have proposed using a diversity of design principles and quality criteria for transdisciplinarity in order to yield adequate knowledge that can be used to address fundamental societal challenges. Such proposals include Max-Neef's (2005) laws of transdisciplinarity, Hirsch Hadorn et al. (2008) handbook of transdisciplinary (TD) research, Jahn et al.'s (2012) and Lang et al.'s (2012) design principles, Mauser et al.'s (2013) Future Earth principles of co-design and co-production of knowledge, and Clark et al.'s (2016) framework for crafting usable knowledge for sustainable development. TD research conceptualizations often consist of three customary phases: identifying the problem and forming a common research object (Phase A), co-producing solution-oriented and transferable knowledge (Phase

B), and reintegrating co-produced knowledge within the societal and scientific context (Phase C) (see, e.g., Jahn et al., 2012; Lang et al., 2012). These phases are neither discrete nor linear; rather, they feed into one another, and may be repeated in an iterative process (Enengel et al., 2012; Popa et al., 2014).

Despite the guidelines provided by these “core TD processes,” the *how-to* of initiating a transformative research process, and getting to the point of beginning one of the three customary phases, is generally not documented and only vaguely conceptualized. At the same time, it relies on complex co-production settings (Nikulina et al., 2019). TD research is often carried out at a local scale, within place-based case studies. A case is a single phenomenon that is linked to a general setting within a broader context and is hence conceptually, socially, and culturally framed (Vilmsmaier et al., 2015). Cases are unique and simultaneously related to something general. However, case studies do not simply appear out of thin air, and it is therefore important to determine (a) what happens before co-designing the problem and the research question, (b) what happens before the TD case study even *begins*, and (c) how the TD

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case study comes about.

In this paper, we aim to explore this Phase 0, to make explicit how the initiation phase shapes the ongoing TD process and its outcomes. To date, despite researchers' often implicit or explicit engagement with the initiation phase, most research papers neglect the steps and processes used to initiate a TD process (but see [Muhar et al., 2006](#)). Better understanding this initiation phase – Phase 0 of a TD process – and deliberately designing it as an extended period of exploration and dialogue might also help others to cope with the criticism that TD is often too reflexive and not pragmatic enough to allow it to be effective ([Popa et al., 2014](#)). At worst, a lack of transparency in terms of how a TD project came into being leads to the risk of glossing over the tangible challenges that arise in real-world contexts and prevents them being fully addressed. Such challenges have the potential to shape the process and outcomes of the case study for the remainder of the TD phases ([Leventon et al., 2016](#); [Mitchell et al., 2015](#)).

In this paper, we focus on a research-driven approach to initiating a TD process. We recognize that other approaches to the initiation phase exist, some of which are strongly driven by practitioners (e.g., [Stauffer et al., 2008](#)), whereas others emerge from mutual interaction between different scientific and non-scientific actors, such as policy makers or non-governmental organizations (NGOs) ([Steger et al., 2021](#)).

In order to reach our aim, we constructed a model Phase 0 process, based on our experience in initiating a TD case study in Southern Transylvania, Romania. The TD case study was embedded within the Leverage Points for Sustainability Transformation project ([Fig. 1](#); [Abson et al., 2017](#)). Below, we first describe the case study and highlight its context and background prior to the Leverage Points project (Section 2). We argue that within the Leverage Points project, the specific purpose of Phase 0 was to transition from a project proposal with aims to collaborate into a working TD collaboration ([Fig. 2](#)). We subsequently outline the specific sub-phases needed to do so (Section 3). For each sub-phase, we provide a literature-informed description, and we outline (i) how it played out in practice, (ii) its outcome, and (iii) the main challenge we encountered. While the identified sub-phases are all necessary, exactly how they are taken depends on how a TD project navigates context dependencies and cross-cutting lessons, such as those outlined in Section 4. These lessons are addressed to researchers engaging in TD collaborations, but can indirectly inform non-academic stakeholders as well.

2. Research methodology

2.1. Conceptual foundations

We embed our findings in a broad range of literature that acknowledges the need to look at what happens before the beginning in TD research. Other authors have specifically delineated a Phase 0 ([Bichler et al., 2020](#)), a prospecting stage ([Cockburn et al., 2016](#)), or an

exploration phase ([Steger et al., 2021](#)). These authors share an emphasis on laying solid foundations for TD collaborations in terms of understanding a problem's history and context ([Enengel et al., 2012](#); [Steger et al., 2021](#)), mitigating power asymmetries ([Bichler et al., 2020](#)), and caring about the science–society interface ([Cockburn et al., 2016](#)). Moreover, they recognize the lengthy yet vital nature of this rather “amorphous period” ([Steger, 2020:35](#)). Although their papers suggest the need for the empirical and conceptual development of a Phase 0, the authors do not dedicate much space to the early initiation of TD research.

Beyond these explicit calls for a “Phase 0”, there are other bodies of work that highlight the need to build relationships with participants. This occurs in collaborative research modes beyond transdisciplinarity, wherever there is the need to work closely between participants with different backgrounds and worldviews, for example in community-based participatory research ([Castleden et al., 2012](#)). This literature is relevant for studying how to initiate the early phases of a science–society collaboration, despite it existing under different labels such as participatory action research ([Janes, 2016](#)) or civic science ([Bäckstrand, 2003](#)). Indeed, these are all antecedents to co-production of knowledge ([Wyborn et al., 2019](#)), and often draw on similar principles, with much to learn from each ([Leventon et al., 2022](#)). We especially recognize the long tradition of building relationships in the work of Indigenous scholars ([Johnston et al., 2018](#)), or researchers working with Indigenous peoples ([Nurse-Bray and Palmer, 2018](#)).

The Phase 0 hereinafter draws mostly on the TD co-production literature, where transdisciplinarity is defined 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., 2012:26](#)). Phase 0 connects and partly overlaps with [Lang et al.'s \(2012\) Phase A](#) and [Jahn et al.'s \(2012\) Phase 1](#). [Jahn et al. \(2012\)](#) also consider a brief description of the “starting point of the [TD] project” and mention a succinct appraisal of existing system and transformative knowledge. [Polk \(2015\)](#) includes initiation in the joint problem-formulation phase. [Scholz and Steiner \(2015\)](#) consider an initiation phase prior to a preparation phase that includes defining system boundaries and building a partnership. Interestingly, [Scholz and Steiner \(2015\)](#) also discuss in detail case context and its amenability to transdisciplinarity. Selecting the case and searching for TD partners are also considered in the case study led by [Stauffer et al. \(2008\)](#). Comparably, [Mauser et al. \(2013\)](#) view societal emergence as the initiation point for the TD co-creation of knowledge. However, by and large, the literature on sequencing TD research typically begins with a problem identification phase and rarely specifies what happened before structuring and faceting the problem (as also mentioned by [Cockburn et al., 2016](#)).

2.2. Case study: background and origin

The Phase 0 that we outline in this paper is based on a case study set in the context of Central and Eastern Europe (see also [Panea, 2016](#)) and embedded within the Leverage Points for Sustainability Transformation project ([Fig. 1](#); [Abson et al., 2017](#)). The project engaged over twenty academic researchers who were committed to understanding interventions for deep system change (after [Meadows, 1999](#)) in food and energy systems. It therefore provides a rich illustration for the consideration of Phase 0 due both to the range of worldviews and priorities that we needed to navigate and to the project's real-world importance. The case study acted as a “laboratory” ([McCorry et al., 2020](#)) for applying, validating, and creating conceptual and empirical research from across the broader project.

The case study was predominantly concerned with topics related to the food system as a result of being located in a landscape shaped by food production and associated political, social, and economic drivers. The Southern Transylvanian landscape is economically poor and has a

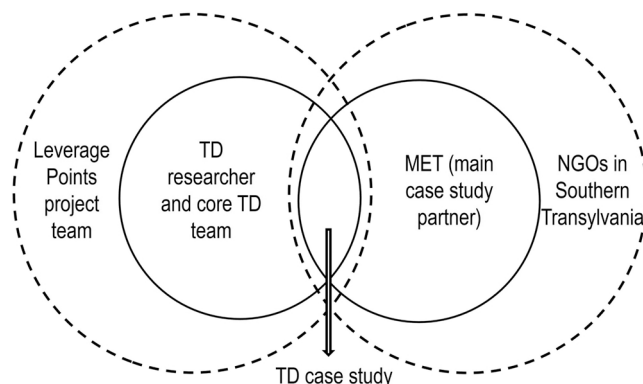


Fig. 1. Organization of the TD case study at the science–practice interface between the Leverage Points project and the sustainability initiatives in Southern Transylvania.

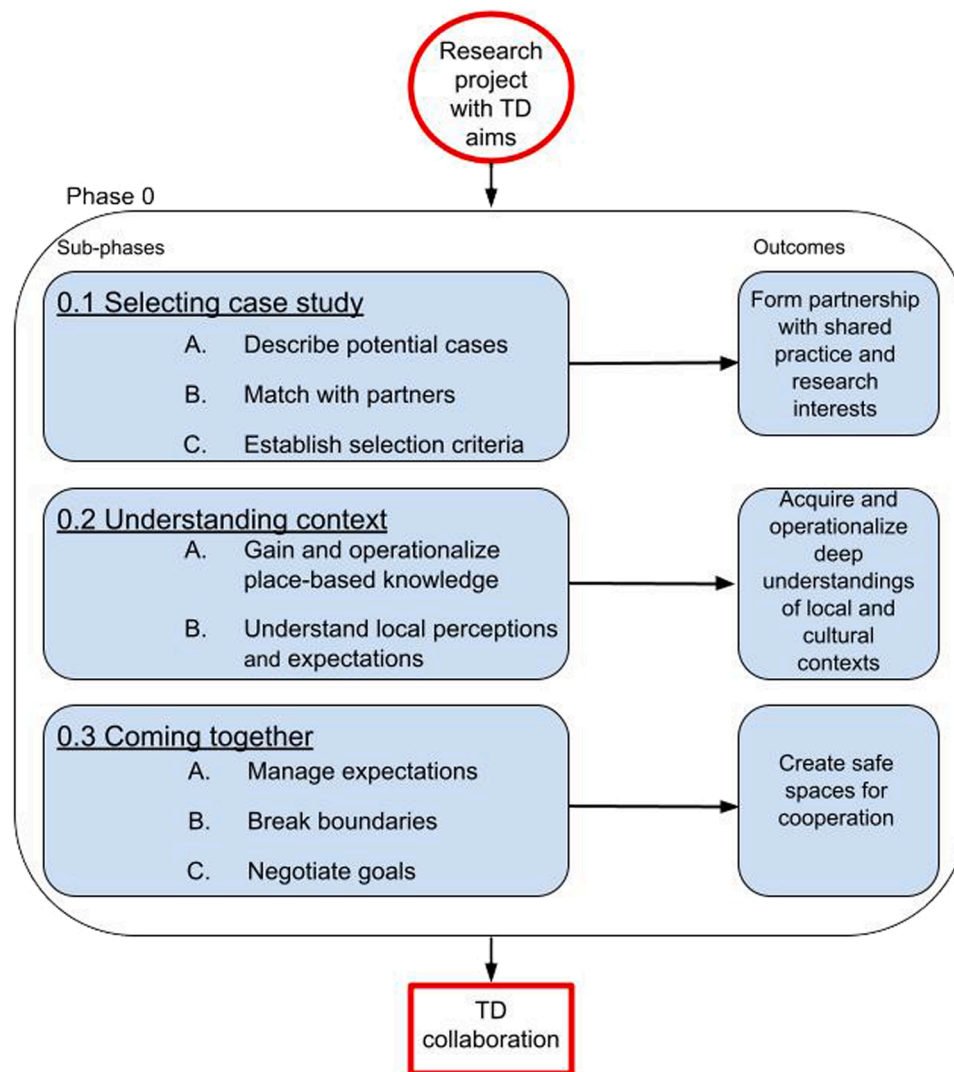


Fig. 2. A model of the Phase 0 process, with exemplary sub-phases to progress from a research project with transdisciplinary (TD) aims toward a true TD collaboration.

great deal of smallholder farms engaged in extensive agriculture, thereby leading to heterogenous landscapes and problems of rural poverty and social exclusion (Horcea-Milcu et al., 2016). The purpose of the case study was to enable sustainability-transformation processes in Southern Transylvania with a special focus on increasing the impact of local sustainability initiatives (Lam et al., 2019, 2020, 2021). In Transylvania, sustainability initiatives by non-governmental organizations are numerous, vibrant, and locally relevant in terms of shaping and leading the way toward sustainable futures. They span from natural or cultural heritage conservation, to supporting small-scale farming, rural education, community development and eco-tourism. However, these sustainability initiatives are often individual, and key actors generally do not collaborate (Nieto-Romero et al., 2016).

Our starting point for the Transylvanian case study within the Leverage Points project lay in existing social-ecological knowledge about the case study area, issues relating to the food system, and the actor landscape in the area. This knowledge was gained from a prior social-ecological research project that shared an overlapping case study area (Loos et al., 2016). During this previous research project, we gained an understanding of the ecology (Dorresteijn et al., 2015), the human-nature relationships (Horcea-Milcu et al., 2016), and the broader political economy (Mikulcak et al., 2015) of the area. In addition, during this prior research, a shared vision for the future of Southern Transylvania in 2043 was co-developed via a scenario-building exercise

(Hanspach et al., 2014).

While there was a degree of continuity with the previous social-ecological research project (e.g., some overlap in terms of researchers, baseline knowledge), the Leverage Points project represented a new beginning as it involved many new researchers. The case study was primarily coordinated by one postdoctoral researcher (henceforth, TD researcher). It received input and support from eight professors engaged in the project and involved interactions with four PhD candidates and three other postdoctoral researchers. Further, the focus shifted from a descriptive analytical approach toward an action-oriented one, i.e., from investigating biodiversity and land-use change toward co-producing actionable knowledge (Caniglia et al., 2021) that can support sustainability transformation processes in Southern Transylvania. To that end, through Phase 0, the number of practitioners with whom we interacted was significantly higher compared with former research in the area. Although our case study built upon and expanded the system knowledge and social relationships that had previously been developed in this area, we designed the Phase 0 model (below) with TD projects in mind that do not share such a background.

2.3. Reflexive lesson building

During Phase 0, from August 2015 to September 2016, the TD researcher spent a total of approximately five weeks in the field during

two field visits (Table 1, Rows B and D). During this time, she met with local change agents, conducted participant observations, and attended events organized by these actors. After each field visit, she held presentations within the project team in order to update its members and familiarize them – if necessary – with the principles of TD research. Some of the professors engaged in the Leverage Points project as well as some PhD candidates and other postdoctoral researchers joined her for short periods of time in Transylvania for scoping purposes.

Throughout this Phase 0 time, and beyond into the project, our Phase 0 description was constructed using empirical and literature informed reflections (e.g., Bichler et al., 2020; Enengel et al., 2012; Muhar et al., 2006; Polk, 2015) by the TD researcher and the co-authors, as well as in conversation with the broader project team. In particular, the authors of this paper considered and discussed how we encountered barriers and opportunities in establishing the case to the point where we could begin the problem identification phase of the research. Phase 0 is thus the product of reflective processes, field notes analysis, and conversations (Eigenbrode et al., 2007; Freeth and Caniglia, 2020; Guimaraes et al., 2019), which we refined based on the feedback we received after

Table 1

Summary of key research activities, events, and involved people in the Phase 0 of the transdisciplinary case study.

Row	Date	Sub-phase and activities	Short description	Who was involved?
A	November 2015–February 2016	Sub-Phase 0.1: Selecting the case study	Description, specification, and assessment of the case study proposals against selection criteria	Project PhDs, post-doctoral researchers, professors, potential project partners
B	January 2016	Scoping fieldtrip	Pre-selected cases were scoped in order to clarify and focus on areas of converging societal need and research interest indicating the presence of a real-world problem	The TD researcher, two professors, potential project partners
C	February 2016–September 2016	Sub-Phase 0.2: Understanding the case study context from a TD perspective	Providing background information about the study area and presenting former research carried out there	Project PhDs, post-doctoral researchers, professors
D	May 2016	Second scoping fieldtrip	Various project team members met with case study stakeholders in the field	The TD researcher, project PhDs, post-doctoral researchers, project partners, other stakeholders
E	November 2015–September 2016 (but continued for the entire duration of the case study until March 2019)	Sub-Phase 0.3: Fostering premises for coming together	Keeping communication and documentation channels open within the project and with case study partners, and regularly using these	The TD researcher, project PhDs, post-doctoral researchers, professors, project partners, other stakeholders

presentations at two international conferences (Transformations 2017 and Leverage Points 2019).

In order to be transparent about the initial steps of TD processes, we, the authors, provide explicit insights that we find important, but that have typically remained undocumented and overlooked as tacit knowledge. In so doing, we substantiate the value of an early reflexive or process-oriented (rather than output-oriented) phase of sustainability research (e.g., Binder et al., 2015). Here, by reflexivity we understand the questioning and reviewing of assumptions and privileges that shape the scientific inquiry. In particular we highlight four aspects of our positionality that likely impact our interpretation of Phase 0. First, the TD principles we followed (Lang et al., 2012) assume a certain separation between the societal and scientific practice, although science may be considered as an integral part of society. Second, within our operationalization of TD principles, we had a focus on the sustainability problem, although other authors may prefer to refer to the term “situation” instead of “problem” in order to avoid “the closing-down effect” of “solving a problem” (Mitchell et al., 2015:90). Third, members of the Leverage Points project team made an early commitment to some level of engagement with the TD case study; however, this commitment was not consistent throughout the project’s duration following the additional challenges that transdisciplinarity posed in terms of accomplishing project deliverables (e.g., PhD thesis). Fourth, as academics working in an East European context, we became aware of some of the privileges (*sensu* Schmidt and Neuburger, 2017) we experienced, such as available resources to organize workshops and to ensure researchers’ mobility in a large field area, but also of some constraints, such as the accountability toward the funding institutions and the limited time allocated to doctoral graduation. On this final point it is important to note that the lead author is from the same country as the case study location, has long term connections to the area, and shares a language with the participants.

3. Phase 0: What we did before the beginning

We identified three core sub-phases that were particularly important in getting to the point of realizing the TD collaboration (Fig. 2): Sub-Phase 0.1 – Selecting the case study (Table 2); Sub-Phase 0.2 – Understanding the case context from a TD perspective; and Sub-Phase 0.3 – Fostering premises for coming together. We acknowledge that Sub-Phase 0.2 has some parallels with what Lang et al. (2012) term “Phase A: Collaborative problem framing and building a collaborative research team”. However, we find it important to be explicit about the investments of time and energy of actors from science and other societal domains alike. We therefore add Sub-Phase 0.2 to highlight the need to understand context as a precondition before TD processes can commence, and not something to be considered only once they are underway. Similarly, we note parallels between Lang et al. (2012) and Sub-Phase 0.3. But in contrast to the former’s framework, Phase 0 seeks to legitimize the additional resources needed to create the appropriate nurturing space for the formation of a collaborative research team.

3.1. Sub-Phase 0.1: Selecting the case study

Sub-Phase 0.1 identifies potential TD case studies deemed relevant from a project perspective using a research-driven approach (Table 1, Row A). It covers the delineation of boundaries around the case in terms of location, timeframe, and focal topics, and is often a process that occurs largely within, and motivated by, the research team. From a research project perspective, Sub-Phase 0.1 determines how to select a case for testing and ground truthing, as well as for generating conceptual and empirical insights for the broader project. To this end, we propose two parallel process strands: The practitioner-driven strand involves TD researchers contacting or being approached by various local actors about their own sustainability problems. The science-driven process includes: a) describing the potential cases, b) matching them with

Table 2

Example of three selection criteria applied to the MET, the main trans-disciplinary partner.

Case study	Content criterion: Fit with the expressed societal demand and interest	Process criterion 1: Existing relevant contacts, and knowledge	Process criterion 2: Clearly formulated commitment
Support of farmers' association(s) in order to access a communal pasture; in partnership with the Mihai Eminescu Trust foundation (MET)	The sustainability challenges expressed by the MET link to the research interests formalized within the project's work packages and thematic fields.	The farmers' association had already been established prior to Phase 0, yet various factors, such as local corruption, put a lot of pressure on the continuity of this institution. The MET has vast experience in supporting community development and in carrying out sustainability initiatives. We had a prior positive experience working with the MET.	During dialogues with the MET, we detected the highest level of commitment for achieving a successful TD collaboration. During a later stage, this commitment was formalized via a memorandum of understanding between Leuphana University and MET.

research interests, and c) assessing them against refined selection criteria (Fig. 2).

Following case description and delineation, the process of matching the potential cases to research interests investigates how relevant the case study proposals are to the broader research project. It ensures their suitability to the wider research project by taking into account the foundational concept(s) of the project, comparability to other existing case studies in the project, and links to specific work packages and thematic fields in the overall project. Beginning from what a case study should generally fulfil – that is, it should be specific yet also be “related to something general” (Scholz and Tietje, 2002) – the matching should rate the potential case studies based on content- and process-based criteria in order to balance between scientific goals and societal demands. These criteria can be derived from the iterative input of project members and checked against the literature. Content-based criteria include societal and scientific relevance and the overall fit of the research interests expressed by the project team members with the real-world problem identified by the practitioners. Process-based criteria include the availability of relevant contacts and knowledge, a clearly formulated (and – at a later stage – formalized) commitment to engage in the case study, the avoidance of actor fatigue, practicality and pragmatism.

In practice, within the Leverage Points project, Sub-Phase 0.1 involved a significant amount of open discussion and negotiation between the TD researcher and project team members on the one hand, and the TD researcher and potential collaborating partners on the other. These discussions revolved around key concepts and research interests of the project team members (e.g., “leverage points”, “human-nature connectedness”), and also around place-based concerns brought forward by practitioners, such as the future of communal pastures, the promotion of a regional ecotourism network, and the establishment of an interdisciplinary social-ecological center in the area. Between August and December 2015, the TD researcher invested time in informing the rest of the team about the previous research completed in Transylvania, potential TD partners, and practitioners' topics of concern. This updating was done through workshops, presentations, making documents

available, and group discussions. Project members were asked to contribute with topics that were important to their research and to make suggestions about what they needed from the TD case in order to fulfill their project tasks. Using this information, the TD researcher collated an initial range of process and content criteria. For example, content criteria were centered around the relevance of the case studies to the project in terms of their contribution to specific work packages or thematic fields (e.g., the transformation of food systems, processes of institutional change). Based on their previous TD collaborations, project team members were invited to contribute descriptions of potential cases and then specify them against selection criteria. Using these criteria iteratively, key actors from six potential case studies were visited by the authors in January 2016 (Table 1, Row B). This scoping trip served to clarify with potential partners, the areas in which the societal need and the research interest for carrying out TD research converged, outlining the presence of a *real-world problem*. Three case studies were shortlisted after the scoping fieldtrip.

Sub-Phase 0.1 led to the initiation of a partnership between the Leverage Points project and a societal actor based on shared practice and research interests (Fig. 2, Table 2). The TD researcher presented the results of the description, specification, scoping, and shortlisting during a Leverage Points project team retreat in February 2016. During this meeting, the entire team deliberated how the shortlisted cases fit to the selection criteria, such as opportunities for the research vision to be realized as well as the availability and commitment of the partners. The Mihai Eminescu Trust was found to be best suited for the Leverage Points for Sustainability Transformation project to engage with as main partner (Table 2). The foundation is dedicated to the conservation, regeneration, and revival of villages and communities in Transylvania by being an active member of these communities. The foundation completed initiatives that focused on social equity and nature conservation, thus contributing toward local sustainability.

The core challenge we faced during this Sub-Phase 0.1 lay in negotiating and understanding the different realities of all participants (i.e., those of academia and practice). In countries with low levels of civic participation, such as Romania (Mikulcak et al., 2015), initiating a TD case study is less likely to emerge from societal demand. The articulation of clear criteria by the academic team might represent a more solid foundation for defining collaboration (e.g., Table 2); however, in our case, formulating the criteria was not straightforward. It was predominantly a process within the project team that was also iteratively reflected against the wishes of potential partners as they were narrowed down and selected. With an interdisciplinary team of over twenty researchers, wishes and priorities were diverse. Additionally, such criteria formulation was needed in the early stages of the project, when many of the PhDs and post-docs were outlining their own research proposals. Among the team, there was often a sense of not knowing how to begin: Was it better to have a clearly defined case study and design individual research proposals (e.g., PhD theses) around it, or to have clearly defined individual research plans and design the TD case around them? There was a risk of spending a large amount of time within the time-limited project visiting and revisiting this phase as individual plans evolved. To overcome this challenge, strong leadership, diplomacy, and instinct were needed from the TD researcher in order to find a TD partner with sufficient commitment and areas of engagement with the project interests. At this stage, case selection became a balancing act between creating a vision that was broad enough to meet a range of expectations and narrow enough to have direction and purpose.

3.2. Sub-Phase 0.2: Understanding the case study context from a TD perspective

Sub-Phase 0.2 explicitly recognizes the primary importance of a) gaining place-based knowledge, and b) deeply understanding local perceptions and expectations before embarking on TD processes (Fig. 2; Table 1, Row C). Contextualizing the case broadly refers to taking an

inventory of existing system and target knowledge about the case study, and to assessing the implications of such knowledge for setting up a TD process. It also refers to understanding divergent perceptions and priorities within TD case study members which have the potential to undermine the TD collaboration (Freeth and Caniglia, 2020). This sub-phase anticipates how to tackle issues of power asymmetry, of competing views on the problem framing, of creating ownership of problems and solution options, and of dealing with unexpected transaction costs (Balvanera et al., 2017; Cvitanovic et al., 2019). Notably, the literature on knowledge co-production has increasingly called for attention to be paid to power relations between researchers and stakeholders, as well as among researchers within a project (Turner II et al., 2016; Turnhout et al., 2020). An awareness of power structures and of differences in problem ownership helps in preserving the representativeness and legitimacy of participatory processes within TD research (Matuk et al., 2020; Pohl et al., 2010; Schipper et al., 2019).

Context is key because it creates opportunities and conditions that influence TD practice and knowledge co-production (Belcher et al., 2019; Ruppert-Winkel et al., 2015; Steger et al., 2021). Initiating transdisciplinarity in various socio-economic contexts – such as in a former socialist country or in the Global South – requires approaches that are adaptive under high degrees of uncertainty. Depending on the context, both the mode of collaboration, the notion of commitment or shared objectives might need altered to encourage engagement (Reed et al., 2018). Fluid versus rigid networks, trust, conflicts, and cultural factors (Vilmsmaier et al., 2017) all appear in a different light in highly controlled professional environments compared with the more control-free and unpredictable environments. Especially with regard to cultural differences, an unquestioned focus of TD research on building consensus might prevent a more fundamental work with rather than against the cultural differences of the participants (Klenk and Meehan, 2015). Similarly, having a deep understanding of context may foreshadow factors such as decreased problem ownership and low commitment, which limit the TD process's ability to achieve its collaborative and ultimately transformative potential.

Within our concrete case, we examined the Transylvanian context in light of foreseeable TD challenges. This examination drew on the TD researcher's foundational knowledge of the area. As other TD projects may not begin with previously acquired system knowledge, the length and intensity of this sub-phase may need to be amended accordingly. It is difficult to describe this sub-phase according to pre-defined, tangible steps because it is not possible to determine which discussions, workshops, or actions that we undertook were the most relevant for contextualizing the case. Rather, we deliberately sought out reflective discussions and opportunities in order to understand the perceptions and expectations of our partners and collaborators regarding the purpose and roles of an ideal-typical TD case. Collectively, we investigated a range of questions in order to consider what would facilitate or constrain the transformative potential of a TD approach. In answering these questions, we examined the case context for issues of power and became aware of mandates, interests, existing relationships, prejudices, and prior conflicts. Taking this context awareness into account, we initially used small group formats and many one-to-one meetings. We then used this context awareness to configure larger groups meetings and steer appropriate group deliberation and engagement techniques. For example, in one of the last workshops of Phase 0, we employed non-confrontational design-based facilitation in order to mediate power inequalities (Peukert et al., 2021).

This sub-phase yielded profound understandings of local and cultural contexts. We used these understandings to foster ownership among practitioners with the objective of developing a transformation pathway toward a sustainable future for Southern Transylvania based on local sustainability initiatives (Fischer et al., 2019; Lam et al., 2019). To that end, we connected the current TD case to an already widely shared and disseminated vision for the future of Southern Transylvania (Hanspach et al., 2014). This vision outlined a future that balances economic wealth

with social and ecological sustainability. Many actors were able to relate to this vision in terms of their own roles or interests (Nieto-Romero et al., 2016). It acted as a boundary object for centering and concretizing collaboration through the TD case. Thus, realizing Sub-Phase 0.2 helps researchers acquire and operationalize deep understandings of case contexts for TD collaboration (Fig. 2).

The main challenge associated with this sub-phase was in the transaction costs of talking, reflecting, and creating understanding within case study participants, be it practitioners or researchers (see also Steger, 2020). Initially, the local actors we contacted in Transylvania were slow to respond, which led to greater investments of time than expected. It became necessary to plan for extended field visits and face-to-face interactions and experiences. We used this extended time spent in the field to collect examples of framings that local actors saw around enabling sustainability transformation in Southern Transylvania. Identifying the concerns of local actors is recognized as a best practice in this exploratory sub-phase (Steger, 2020). Based on our social-ecological system understanding, we also sought to demonstrate the need for practitioners in Southern Transylvania to tackle and avoid unsustainable development trajectories such as economic growth without considering the environment. Participation was also challenging among researchers of the Leverage Points project. As in Sub-Phase 0.1, researchers faced multiple time demands and needed to meet outputs within their PhD or postdoctoral research. As a result, the investment that was needed to reflect on and understand the case study was de-prioritized by many, and some researchers disengaged from the study at this time. The hierarchical organization of the academic system also to some extent contributed to the lack of flexibility in adjusting research interests to the emerging case study contextualization.

This challenge raises two questions with regard to the need for commitment in TD research: 1) Is the commitment of all researchers and practitioners a *sine qua non* condition for conducting a TD case? and 2) What constitutes a TD researcher? By exploring these questions of Sub-Phase 0.2, a TD process pays attention to participants' perceptions, and weaves them into a foundation for TD collaboration. Specifically, in our case study, we strove to make explicit the level of commitment needed for a TD collaboration, and encourage transparency about the level of commitment both researchers and practitioners were willing to invest. Such a foundation is a necessary precursor to both Sub-Phase 0.3 and the first customary phase of TD research (problem understanding). It overlaps with these phases to some extent and should indeed be iterative. However, it is a key stage in and of itself because without understanding context-based expectations and priorities early on, the collaboration struggles to proceed.

3.3. Sub-Phase 0.3: Fostering premises for coming together

This sub-phase (Table 1, Row E) builds on the foundations created in Sub-Phase 0.2. It focuses on fostering the pre-conditions necessary for a group of researchers and actors to come together (see also Bichler et al., 2020) by a) managing expectations, b) breaking boundaries, and c) negotiating goals (Fig. 2). First, it is vital to give due attention to expectation management in order to avoid raising commitment levels based on false premises. Sub-Phase 0.3 requires a transparent unpacking of the scientific goals written in project proposals when communicating with TD partners or local change agents. We argue that this unpacking needs to be carefully implemented on both the practice and the science side due to divergent expectations from science as both a knowledge-producer and a contributor to solving societal problems. Practicing humility when unpacking project goals favors trusting relationships (Steger et al., 2021). Second, we suggest explicitly allocating efforts toward weakening professional and disciplinary boundaries, re-negotiating societal roles (Posner and Cvitanovic, 2019), and allowing for new ones to emerge (Fam et al., 2020). Supporting trustful bonding (Cvitanovic et al., 2021), epistemological agility (Haider et al., 2018), and active listening fosters honesty and counters expectations of

finding consensus, allowing for more genuine coming together. Finally, we suggest that building coherence at the level of participants' goals and intent is key in achieving the co- in co-design and co-production (Hakkarainen et al., 2022). TD is a highly communicative, emergent, and dialogical process that benefits from a priori attention directed toward “becoming transdisciplinary” (Augsburg, 2014). Perhaps of the three sub-phases, 0.3 is best covered in the literature, especially by the Indigenous-related literature which has the merits of highlighting issues of trust and relationships building (Johnston et al., 2018; Parsons et al., 2016; Reid et al., 2021; Woodward and Marrfurra Mctaggart, 2016) with every attempt at establishing a just and respectful Indigenous-academic research collaboration (Tipa and Panelli, 2009), or tribal-university partnership (Matson et al., 2021).

Within the interdisciplinary team of the Leverage Points project, we held regular meetings striving to jointly understand and translate into the scientific practice of the individual researchers what was meant by ‘transdisciplinary’. As a counter-reaction to the temporary dissolution of well-defined roles, we were often confronted with legitimate requests for clarification, such as *Who are we? What are we doing? Why are we doing it? What are our methods? Can we be more concrete? and What will the output be?* while practicing a balancing act between concreteness and openness. This is not unusual in TD research and is in fact part of the process of “becoming transdisciplinary” (Augsburg, 2014), but it feels uncertain and never-ending to those involved. We responded to these questions by increasing process transparency to build trust and sensitize the interdisciplinary Leverage Points team to accepting ambiguity. Another way of responding to the insecurity and discomfort that arose following the blurring of professional or disciplinary boundaries was to employ non-confrontational initiation methods in joint activities, such as serious games (Horcea-Milcu et al., 2019) or design prototyping (Peukert et al., 2021).

As a main outcome, Sub-Phase 0.3 laid the foundation stone for a safe and simultaneously vulnerable space for cooperation (Fig. 2) (see also Freeth and Caniglia, 2020) while recognizing that enhancing capabilities and interest in collaboration is a continuous TD endeavor (Lang et al., 2012). Progressively prompting reflections within regular project meetings, informal coffee breaks, or field visits, about the underpinning values and intent that shape scientific and practice goals was tantamount to fostering a sense of togetherness. Subsequent TD workshops (beyond Phase 0) were further dedicated to surfacing and building coherence between the normative paradigms that underlie possible sustainability pathways in Transylvania (Fischer et al., 2019).

The core challenge we faced in Sub-Phase 0.3 was resistance by case study members, researchers, and practitioners alike to redefining societal roles, rethinking collaboration structures, managing disciplinary tensions, and overcoming professional identity crises. Indeed, this was a significant point of tension within the project (see also Freeth and Vilsmaier, 2020). In order to tackle discomfort and uncertainty at the boundaries of disciplines and identities, we extensively discussed and reflected on the conceptualization of science as being both from outside and from within the system that is being intervened (Fazey et al., 2018). Situating the different research steps and researchers' positionalities as being from outside, from within, or both, helped us to navigate the “undisciplinary” journey (Haider et al., 2018; Robinson, 2016). Time, space, and resources were also actively or reactively allocated to voicing worries and perceived failed expectations without seeking information extraction or the traditionally considered “productive” activities within academia (Paasche and Österblom, 2019).

4. Cross-cutting lessons

In Section III, we introduced three sub-phases particularly important in creating premises for lifting TD case studies off the ground, the general rationale behind these sub-phases, and how they proceeded in our example TD case. In the current section, building on our case experience, we draw five cross-cutting lessons, show how they feed into the sub-

phase(s) (Table 3), and how they are embedded in the broader literature.

4.1. Lesson 1: The importance of leadership

Throughout Phase 0, in our case, the process needed leadership. The TD researcher took the role of negotiating and mediating the spaces of collaboration between case study participants (including the academic researchers). She took responsibility for creating the communication structures and knowledge exchange processes necessary to define criteria (0.1), understand context (0.2), and foster collaboration (0.3). In this context, leadership meant being the person who had an understanding of the context and who provided opportunities for everyone else to be involved. By aiming for inclusivity, the leadership focused on smoothing out dissonances and offering a buffer space through empathetic, active listening and non-violent communication. This leadership style enhanced collaboration in both the scientific and the practice environment as well as at their interface (see also Reed and Abernethy, 2018).

The need for leadership became particularly obvious during the intense discussions that accompanied the description, specification, and assessment of case study proposals (Sub-Phase 0.1). In order to avoid ineffective debates, the TD researcher sought to consistently focus the discussion back on the selection criteria and to maintain a high degree of transparency around how and why the criteria had been derived. As is customary in TD research, fine-tuning how much control to exercise in the research process (Rosendahl et al., 2015; West et al., 2019) and how much control to cede to joint leadership was a tightrope walk. Specifically, the TD researcher sought to find balance between meeting the needs of project members who wished for more outside guidance and leadership, and simultaneously addressing the concerns of those who believed their autonomy, creativity, and freedom were being hampered

Table 3
Cross-cutting lessons for implementing Phase 0.

Lesson	Impact on Sub-Phase		
	0.1 Selecting the case study	0.2 Understanding the case study context from a TD perspective	0.3 Fostering premises for coming together
The importance of leadership	Mediating spaces of collaboration and opportunities for engagement	Bringing together and curating key knowledge for all engaged	Maintaining transparency, trust, and a vision to come together around
Managing the trade-off of togetherness	Uncovering, considering, and trading off divergent interests and goals	Understanding problems and solutions through a range of context-relevant lenses	Creating a need to embrace exploration through discomfort, loss of control, and unpredictability
Togetherness with shared values	Creating coherence at the level of intent is a powerful way to support co-creation across all of Phase 0		
Making scientific goals explicit	Placing scientific goals and interests on equal footing with contributions to transformation	Linking the case to broader scientific understandings from beyond the case context	Being comfortable with new roles and expectations of one another (e.g., transformation participant vs. academic)
The awareness of timing and time	Comparing the time frames of researchers at different career stages (e.g., early career researchers) and the time frames of practice priorities	Longer histories of science-practice collaboration providing greater awareness of the case context and scientific process, and fostering trust	Coordinating and aligning the time frames of practice partners and the time frames of the scientific project for the duration of the collaboration

by such guidance.

4.2. Lesson 2: Managing the trade-off of togetherness

TD endeavors re-imagine the process of coming together and offer alternatives to the science–society dichotomy. The trade-off of coming together refers to a common tension in TD research between expectations of the individual (the *I*) and the team (the *we*) (Fam et al., 2020). Perceived group *gains* and perceived individual *losses* coexist, thereby making group dynamics a vital component of TD research (Schauplenhner-Kloyber and Penker, 2015). Within our case study, the beauty and necessity of dealing with this trade-off became highly apparent when carrying out Sub-Phase 0.3 as the coming together triggered various professional identity crises among the case study participants. Researchers' questions about their own identity were partly tackled through formative accompanying research – a methodology that “combines learning about a collaborative research team, with learning with and for the team” (Freeth and Caniglia, 2020; Freeth and Vilsmaier, 2020). Practitioners' identity concerns were mainly tackled by the TD researcher through active listening. Importantly, a tension between the *I* and the *we* persisted.

Redefining or renouncing boundaries paves the way and sets the scene for building trustful relationships, and thus for co-creating the TD space. By practicing humbleness and modesty, and challenging entrenched frameworks, both practitioners and scientists moved toward problem-solving. Care is needed from academics to address local people at their own level, meeting them where they are, with their own interests, resources and capacities (Moriggi et al., 2020). Transcending academic paradigms may prove especially difficult for well-established academics as disciplinary maturity could hinder the necessary flexibility in TD processes. Giving up boundaries is uncomfortable. However, it is from this discomfort, loss of control, and lack of predictability that growth, evolution, transformation, innovation, and creativity emerge. During a TD process, embracing complexity, differences, and uncertainty while attending to emotions and “moments of cringe” (Greenaway and Russell, 2014) is one of the most difficult yet rewarding lessons. Despite its apparent step-by-step organization, transdisciplinarity is a highly unpredictable process that is reflective and iterative, to say the least. Not only is there no single formula for it, but there are several concomitant paths that lead toward it.

4.3. Lesson 3: Togetherness with shared values

In order to deliver the multifaceted leading role across Phase 0, the TD researcher must take a flexible position that includes building trust, running project tasks, and adhering to accepted procedural norms. A sense of deeply shared values, beliefs, and norms – or transparency with these items – fosters trustful science–practice relationships. For example, we opened many of our group interactions with practitioners with a reflection on their guiding values and personal motivation for taking actions toward a vision of sustainability in Southern Transylvania. These deeper motivations and values were generally shared more so than the ways to act on them. According to recent literature, such reflexive inquiries may unleash the potential of values to generate change from within (Davelaar, 2021). Specifically, our ongoing dialogue with practitioners revealed that one of their deeply held intentions was to increase the self-esteem of Southern Transylvania peasants. During one of our scoping trips, we were directly approached by a practitioner who lamented, “If only you could support us in raising their [the peasants'] self-esteem”.

Engaging with individual and collective intent and held values are considered to generate high leverage for sustainability transformation (Abson et al., 2017). The need to engage with such values pushes researchers toward TD approaches in an effort to create positive changes around sustainability problems (Leventon et al., 2021). Being transparent about intentions and normative goals goes beyond a particular

instance of coming together (e.g., a workshop). This is different from “[c]reat[ing] joint understanding and definition of the sustainability problem to be addressed” (Lang et al., 2012:29) in that the shared agreement takes place at a deeper intentional and values' level. These less concrete but nonetheless powerful intent and values subsequently become operationalized in a more concrete sustainability problem and associated solution options. At the very least, making the underlying motivation and intent clear might ease the pressure of setting communication, networking, and co-creation rules. We posit that defining rules for collaboration might be important, but it should be complemented with trusting intentions and the sharing of held values and intent.

4.4. Lesson 4: Making scientific goals explicit

This lesson is especially derived from the negotiation of goals under Sub-Phase 0.3. The TD practice needs to balance the societal side, i.e. contributing to sustainability transformation, with the scientific side, i.e. delivering new scientific insights. One side often dominates, however. For example, there is a void regarding the university ethical requirements of a TD case study (but see Cockburn and Cundill, 2018). From a transformative perspective, most research ethics clearance procedures from sociology or psychology would be too conservative, while from a scientific rigor perspective, the matter of reproducibility is at stake in TD research. Focusing exclusively on delivering new scientific insights would often disable researchers from establishing trust and allowing the project to unfold the effectiveness of contributions to the societal transformations that are needed.

Similarly, in the context of research for sustainability transformation, researchers tend to step into roles such as transformation participants or process facilitators, which go beyond that of a traditional researcher (Bulten et al., 2021). For example, in Transylvania, we communicated the background and intent of the project using analog materials designed for a lay audience, including flyers and booklets. We used digital tools, such as a constantly updated social media page, blog entries, and instant-messaging platforms for rapidly clarifying potential questions or spontaneously taking part in local events in order to ensure a continual presence in the case study area. We were motivated by an increasing body of literature that acknowledges alternative roles and activities for transformation researchers (Horlings et al., 2020; Karcher et al., 2021; Temper et al., 2019; Wittmayer and Schöpke, 2014). In Transylvania, by making the researchers' scientific goals transparent and explicit before beginning the study, we avoided situations where scientific goals overshadow the creation of actionable knowledge. Indeed, there is clear evidence that transdisciplinarity is a more time-consuming mode of conducting research and potentially yields less academic output – especially at the beginning of a project – compared to traditional science (Newig et al., 2019; Steelman et al., 2021). Accordingly, researchers have increasingly called for questioning the productivity paradigm of academia (Jaremká et al., 2019) and for alternative evaluations of research outcomes away from publication and citation metrics toward valuing the depth of collaborative work (Fam et al., 2020; Chapman et al., 2019).

4.5. Lesson 5: The awareness of timing and time

The relevance of integrating time dimensions in governing sustainability transformations has started to be discussed in the literature (see Weiser et al., 2017). In this regard our case study presents an opportunity to learn about the difficulty of coordinating funding logics for research with the timing of NGOs or grassroots initiatives. Conducting TD research in a long-term setting is a privilege that can lead to additional conditioning. The value of having already conducted research in the TD case study area lies in an increased sense of recognition and trust, and in the opportunity to capitalize on the growing momentum initiated by the previous collaborative learning processes. Within our case study, our ongoing engagement with Southern Transylvania from 2011 onward

(Loos et al., 2016) prepared us and set the stage for realizing transformative research. This continuity in research led to an increased sense of the legitimacy (“researchers returned”) and made our main TD partners, the MET, more confident, trustful, and prepared. In particular, previous science-practice interactions helped the practitioners understand scientific work more easily. This specific contact with academia in the form of researchers who had formerly been involved in studying the area and who continued to be part of the TD case served as a strong motivation, but also put pressure on the researchers. Both practitioners and researchers alike viewed the initiation of the TD case study as a chance to capitalize on the experience and to continue the knowledge-and-learning loop with the benefit of less fragmentation caused by limited time and funding.

A TD case study often forms complex temporal interrelationships. Some of the aspects of Phase 0 might have been completed in previous research projects, while others may overlap with the ideal-typical problem framing phase, in line with the reflexive and iterative character of TD. Compared with more descriptive analytical case studies, transdisciplinarity needs more time to *produce*, which does not often go hand in hand with the narrow project-funding mentality. Similarly, the routines and requirements of different actors involved in TD processes often have diverging temporal logic. In other words, while scientists are setting up Phase 0, they might merely be catching up with other actors or be the first on the scene. Practitioners’ work may be ongoing, or they may have just begun their own initiative that only later becomes reconceptualized as a strand of the TD collaborative work. This temporal dimension adds another layer of complexity that functions as a source of misunderstanding and tension, but also as a form of support in planning for long-term sustainable development (Weiser et al., 2017). Finally, in recognizing the inherent messiness of the TD process, we note that Phase 0 – similarly to the other customary phases – cannot be perfectly delineated from the entire TD process in terms of time. For example, in the case of the Leverage Points project, Phase 0 was followed by a problem framing phase (Lam et al., 2019), a knowledge co-production phase (Lam et al., 2021), and a phase of knowledge reintegration within society (Fischer et al., 2019).

5. Summary and conclusion

Our work complements the commonly discussed phases of a TD process (e.g., Wolff et al., 2019). Our contribution is to systematize and provide guidance on the *how to* of initiating a mutual learning process between actors from science and other societal domains. By dedicating this paper entirely to the *setting-up* of a TD process, we emphasize its importance in enabling the transformative potential of TD place-based research. In so doing, we also want to acknowledge the many researchers working similarly hard to get transdisciplinarity off the ground, despite on-going institutional and practical challenges. Our work is centered around an in-depth case study set in an Eastern European context, and around our shared reflective processes. It outlines a science-driven Phase 0 that can help when launching TD projects. This Phase 0 starts before the more established customary phases of TD research including co-design and co-creation begin. We break Phase 0 into three sub-phases that are necessary for setting the foundations for TD work: 0.1 Selecting the case study; 0.2 Understanding the case study context from a TD perspective; and 0.3 Fostering premises for coming together. We acknowledge that the *how* of completing these sub-phases is different in every project and context, and we propose five cross-cutting lessons to which TD researchers should pay attention: 1. The importance of leadership; 2. Managing the trade-off of togetherness; 3. Togetherness with shared values; 4. Making scientific goals explicit; and 5. The awareness of timing and time.

Our description of Phase 0, its sub-phases, and cross-cutting lessons should be of use to anyone who is at the beginning of their TD research journey. We hope it will help particularly scientists to navigate the early stages of co-design and to create premises for building meaningful co-

creation processes. Future extensive analyses of TD projects and case studies may streamline the design of Phase 0 or explore the extent to which our proposed sub-phases overlap with the way in which the *before-the-beginning* phase is addressed. Acknowledging that researchers and practitioners face hardships from different vantage points and positions will not only ease levels of frustration, but also encourage to join forces to foster sustainability transformations.

CRedit authorship contribution statement

AIHM led the conceptual work and writing of the manuscript, coordinated and drafted the revisions with input from JL and DJL. JL produced Fig. 2 and supported the conceptualization. All co-authors contributed to the writing, editing and revising the text.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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