Transdisciplinarity 101: Short-Term Training in Knowledge CoProduction to Face Global Environmental Change

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Executive Summary: The Belmont Forum and the Inter-American Institute for Global Change Research (IAI) organized an online training workshop on transdisciplinary (TD) approaches at the Sustainability, Research, and Innovation Congress (SRI) in 2022. The IAI is an intergovernmental organization that brings together 19 countries from the Americas to support adaptation to the world's changing environment. The Belmont Forum is a consortium of major funders and international science councils to promote knowledge about sustainability science. The workshop aimed to create a safe environment for participants to share their impressions of and experiences about transdisciplinary research, using the Americas (IAI mandate) as a launching point for TD approaches globally. The workshop consisted of two online sessions: Transdisciplinary Approach 101 and Transdisciplinary Case Studies. The objectives of the current workshop report are: 1) to identify the key takeaways regarding common challenges and opportunities for transdisciplinary practice among workshop participants' experiences, upon which to base recommendations for best practices, e.g., managing power imbalances, conflicting priorities and timeframes, enhancing communication and consolidating contextual awareness. 2) to offer insights to build better strategies for "train the trainers'' processes around transdisciplinarity, especially in congresses and short-term events, including using an experience-based approach, offering specific tools and increasing the participation of non-academic partners. This report encourages the implementation of other training processes by experienced transdisciplinary

researchers, practitioners, and funders, in order to build capacities for collaborative approaches in diverse scientific communities.

I. Introduction

Transdisciplinarity (TD) is an approach to research that involves not only different scientific disciplines (interdisciplinarity), but also other forms of knowledge, to develop solutions to concrete socio-environmental problems (Hadorn et al. 2008). Transdisciplinary research is needed when knowledge about a societally relevant problem is uncertain, the concrete character of the problem is disputed, and there is a great deal at stake for those concerned by or involved in dealing with the problem. With the aim of reflecting on the TD approach and its potential for meeting sustainability goals, the Belmont Forum and the InterAmerican Institute for Global Change Research (IAI) organized an online workshop entitled Transdisciplinarity 101 at the Sustainability, Research, and Innovation Congress (SRI), which was held in Pretoria, South Africa, and online from June 20-24, 2022. The workshop consisted of two sessions, and counted on the participation of around 100 attendees in total, among SRI participants. The event is the world's largest gathering of transdisciplinary research and the 2022 edition united more than 2000 global leaders in academia, civil society, policy and the private sector to promote transformations to sustainability.

The workshop aimed to create a safe environment for participants to share their impressions of and experiences about transdisciplinary research, using the Americas (IAI mandate) as a launching point for TD approaches globally. As a training activity, the workshop shared the foundations for TD knowledge production and recognized lessons learned from experienced practitioners. In the first session, a team of experts from the Americas shared key concepts and principles of TD approaches. In the second session, we considered socio-environmental case studies developed in diverse geographical contexts to discuss common sources of conflict and collaborations that TD teams experience. We argue that a TD approach linking experiences in the Americas (the Arctic and Caribbean) and beyond (southern Africa) can help foster a sustainable vision for the Americas. Global Environmental Change (GEC) addresses large-scale changes in the Earth's surface, be they chemical, biological, geological or physical, with special attention to human-caused perturbations and their impacts on society, that are now shared globally. Therefore, it is crucial to link novel approaches being developed worldwide to deal with those changes. This report summarizes the experience of this workshop and recommends strategies for both the application of a TD approach and "train the trainers'' processes around TD, especially in congresses and short-term events. In the following sections we: 1) describe the workshop organizers, theoretical background, and format, 2) show a summary of the case studies, 3) identify the key takeaways regarding common challenges and opportunities of TD practice among workshop participants' experiences and case studies, and 4) propose recommendations for applying a TD approach and for developing training sessions for short term capacity-building activities on TD.

II. Background

The IAI is an intergovernmental organization that brings together nineteen countries from the Americas to support adaptation to the world's changing environment. The institution builds capacity and supports research on strategic themes such as climate change, biodiversity conservation, and renewable energy. Current IAI initiatives gravitate around three concepts: the science-policy interface, transdisciplinary research, and science diplomacy, all of which connect to the growing scientific capacity in the Americas and putting knowledge into action with diverse stakeholders, including academics, policymakers and local communities. Therefore, the institution inherently applies TD approaches: to build tools and convene diverse perspectives for the co-production of knowledge in order to address real-life problems.

The Belmont Forum was created in 2009 by major funders of environmental change research and major international science councils to improve knowledge of sustainability science. The Forum is an international platform that brings together members from five continents, who jointly fund environmental change research under a shared vision of implementing the United Nations Sustainable Development Goals. Recognizing the value of international cooperation, the Belmont Forum's

actions are guided by "supporting international transdisciplinary research providing knowledge for understanding, mitigating and adapting to global environmental change." The Forum supports multinational and transdisciplinary collaborative research with the participation of different scientific disciplines from natural, social, and humanities backgrounds, and stakeholders to jointly co-create knowledge and promote sustainability. The Sustainability Research and Innovation (SRI) Congress is a joint initiative of the Belmont Forum and Future Earth and was created to be the world's largest TD gathering for the global sustainability community where experts from different sectors of society work together to co-create knowledge and move towards a more sustainable and inclusive world. Therefore, the SRI also acts as a space for enhancing networks of like-minded, skillful TD scientists and practitioners.

Both leading institutions and the SRI Congress acknowledge the importance of transdisciplinary collaborations to face GEC issues, inherently transnational and complex problems that cannot be solved by one sole perspective. Over the past few decades, a fair amount of effort has been expended in applying such an approach to complex socio-environmental problems, resulting in a consistent body of literature (Lawrence et al. 2022). The degree of impact of human activity on earth's ecosystems is so strong that scientists are suggesting that we are experiencing the dawn of a new geological epoch: the Anthropocene, which begins with the rapid industrialization of human societies (Mahli 2017). The Anthropocene poses the need to rethink collectively the solutions to GEC, such as biodiversity loss and climate change, and recognize new collaborative pathways through the co-production of knowledge (Jasanoff 2004; 2021). Co-production broadly refers to collaborative methods of knowledge production—that is, ways of knowing that take into account the perspectives of those affected by the problems that science aims to address (Turhout et al. 2020). TD provides a framework capable of grasping the complexity of GEC problems in the Anthropocene. By encompassing diverse academic disciplines, from the natural and social sciences and addressing local and indigenous knowledges, TD is able to link general scientific knowledge to case-specific problems to develop practices that promote the common good (Hirsch-Hadorn et al. 2007; Dieleman 2017). The outcomes of such research are locally-relevant, solutions-oriented, and enable teams to provide knowledge that is specifically useful for local communities, social actors, on-the-ground stakeholders, and policymakers to facilitate transformative change (Becerra-Fernandez and Sabherwal 2014).

TD can foster democracy and more equitable power relations in knowledge production, as well as improve how science interfaces with policy and society for a sustainable and just future. A recent notable shift in TD scholarship has been the reconceptualization of TD as a way of life rather than as an academic discipline: a renewed literature considers TD a way of being since it is inseparable from personal life and extends far beyond the professional activities of a researcher (Rigolot 2020). By dealing with real-life problems, researchers develop bonds with the stakeholders they work with, developing new forms of seeing the world and coping with non-scientific perspectives. This rethinking of TD also closely aligns with emerging frameworks from key thinkers in the Global South. These frameworks include: fabrics of life (Diaz et al. 2022), nature's contributions to people (Diaz et al. 2019), and cognitive justice (Odora Hoppers 2021). To create the needed common ground to mobilize TD collaborations, TD researchers/practitioners must undergo both an individual process of self-reflection and a collective process of unlearning to decenter academia from knowledge production (Alonso-Yanez et al. 2019). The workshop followed recent contributions to the TD literature that urge for a change in scientific values to broaden science's capacity for genuine participation of diverse stakeholders. Our aim in the workshop was to have a strong conceptual framework through which we could take a deep dive into practice to recognize important issues that cut across the TD research approach. Our goal was to use firsthand experiences, especially in the Americas as a site for inquiry, enriched by the practical challenges and opportunities found by the participants in applying TD.

The "Transdisciplinary Approach 101" was organized by Science Technology and Policy Fellows (STeP) and hosted by the IAI and the Belmont Forum. The STeP fellowship program places early

career researchers in host governments and private organizations to develop skills on decision-making and facilitate the uptake of scientific knowledge in policy processes. STeP fellows collaborated with partners experienced in TD to decide on the format and development of the workshop. The invited institutions included: California State University, University of Calgary, START International, Université du Québec à Montréal, and Jamaican Women in Coffee (JAWIC). The workshop consisted of two two-hour online sessions:

Transdisciplinary Approach 101
In this introductory session, an experienced TD team composed of Lily House Peters, Gabriela Alonso, and Marshalee Valentine shared main concepts of TD approaches, highlighting how they differ from other types of collaborative research, and offered insights on rethinking the balance of power in knowledge co-production. Following the aforementioned recent shifts in TD literature, they presented the importance of recognizing overlying power structures and recognizing TD as a way of life.

Following this didactic section, participants were divided into breakout rooms with Spanish and English language options to share perspectives and experiences on conducting TD research. The discussion was guided by two main questions: "Whose knowledge about the project counts, to whom, and under what conditions?" and "What challenges and opportunities do you see in decentralizing research and sharing power in collaborations?". To help the collective reflection on these questions, jamboards were also used to collect ideas and comments from participants, and ended with questions and a plenary.

After the discussion, the speakers shared lessons learned from applying TD, including teamwork organization, engaging with diverse social actors and stakeholders, moving from science, to policy, to action by using communication strategies, and examples from their experience with a project in Central America.

Transdisciplinary case studies
This session further explored best practices and lessons learned in applying a TD approach to research in diverse geographic settings. Three TD teams shared insights from projects developed in the North American Arctic, Africa, and the Caribbean (See Case Studies below). The case studies followed a template provided by the IAI and Belmont Forum organizing team, including their geographical location, length of the project, the story of the collaborations, examples of teamwork and contested topics, and examples of outputs the project produced.

These case studies detailed their experiences on the "process of forming TD teams, engaging with stakeholders, and bringing research to inform action." The case study presentation was followed by a moderated discussion with the audience to connect the case studies to participants' experiences. The collective reflection was guided using jamboards and the following questions: *Can you identify practices that enhance equitable collaborations in TD?* and *What are the common sources of conflict/controversy in TD?* The session ended with a Q&A in a plenary and a final wrap up of the entire workshop experience.

After the workshop at SRI, the lecturers, case study presenters, and organizers debriefed to discuss the results, evaluate the workshop, recognize crosscutting issues, and develop recommendations for best practices in applying TD approaches and for future training activities in TD.

III. Case studies

i. Jamaican Women in Coffee (JAWiC)
Jamaican Women in Coffee (JAWiC) is a non-governmental organization that seeks to connect women across the coffee industry, recognize women's contributions to the industry, and empower a sustainable, equitable future, especially for farmers in the Blue Mountain and High Mountain regions in Jamaica. The organization has designed and implemented three major projects so far: 1) Pilot Survey, 2) "Strengthening the capacity of women coffee farmers in Jamaica through Training: Phase 1", and 3) "Strengthening the capacity of women coffee farmers in Jamaica through Training: Phase 2". JAWiC seeks to address main challenges of the industry, namely gender inequality in the distribution of coffee farming resources, reductions in quality and quantity of coffee, and reduced quality of life for small farmers due to insufficient income. All three projects had the common goal of empowering

women in the Jamaican coffee industry through strategies such as: increasing womens' voices in policy arrangements, providing direct assistance for inputs for agriculture, providing support for exposure to international markets, and capacity-building in marketing, business management, coffee production and processing, sustainable farming practices, and climate change adaptation.

JAWiC is led by a team that includes farmers, processors, marketers, researchers, roasters, quality management professionals, coffee importers, geologists, sustainability and climate change experts, and information technology (IT) technical experts. This constitutes a broad range of stakeholders from diverse disciplines. Team collaboration was crucial in identifying the overall vision and strategic objectives of JAWiC in order to adequately address the problems at hand. Each member had unique knowledge and insights into areas of cultivation, sustainability, research, farming, industry challenges, quality control, marketing, etc., to manage an overall initiative that has never been explored in Jamaica, since previous projects usually addressed one issue at a time without team collaboration. Through a TD approach, JAWiC was able to create projects that identified and addressed the systemic issues within the industry, namely, climate change, lack of resources to employ best practices throughout the production cycle, knowledge gaps in coffee production, few or no linkages between farmer and buyer, and lack of structured and institutionalized leadership in communities. Examples of these collaborations were: experts from research and IT collaborated to design a pilot survey tool with data analysis/reporting that served as a basis for the development of projects 2 and 3; and quality experts collaborated with soil and disease management professionals to design training materials in accessible language for farmers.

These lasting relationships built a network that empowers women in the coffee industry, and made it possible for JAWiC to become a hub for all Jamaican women in coffee. Collecting data on women working in the coffee industry was highly innovative for understanding their most pressing needs, and setting benchmarks for quantifiable results. Those baselines inform all processes moving forward and promote a network among women in the Jamaican coffee industry, ensuring that members of JAWiC are retained throughout the project. One specific challenge faced by JAWiC in the early steps was to find funding for the initial baseline database. Detailed studies had never been done, and so there was very little understanding, by all stakeholders, about the challenges at the community level. Outputs of JAWiC projects include: capacity building for farmers in climate-smart production, organic farming, pest and disease management, and soil and water management, a video story recorded and published to share the experiences of women in the community, an Icon-Based Farmers' Diary for keeping record of farming activities, a summary of the content delivered in workshop sessions, and relationship networks formed with the Canadian Funding Agency and the Jamaica Agricultural Commodity Regulatory Authority.

ii. From Nunavik to Iceland: Climate, human, and culture across time throughout the coastal (sub) Arctic North Atlantic (NICH-Arctic)

NICH-Arctic is a collaborative TD project on culture-environment interactions in response to climate change in the subarctic North Atlantic, developed with the Belmont Forum's support over 4 years. The project brings together researchers from different fields of the natural and human sciences who work together on the subarctic climate in four regions of the North Atlantic (Nunavik, Labrador, Greenland, and Iceland), using a holistic perspective (natural science, archaeological, and culture) and different types of archives to document climate change in those regions. The basic research by members of the team remains disciplinary, but there are fruitful interactions, exchanges, and discussions, leading to the development of interdisciplinary projects and offering opportunities for young researchers to be initiated to or to develop TD approaches. NICH-Arctic is developed around three foci: 1) natural variability of sea ice, climate, and vegetation, 2) adaptation of local human populations to their habitat, and 3) cultural representations and perceptions of the natural environments by local and outside-of-the-region populations. Targeted impacts encompass: database management, integrated documentation, resilience evaluation, knowledge dissemination and workshops involving researchers and local community members, including students.

NICH-Arctic primarily works on archaeology and climatology. One example of an activity engaging stakeholders is the Qajartalik project promoted by the Avataq Cultural Institute in Quebec, Canada. Avataq is a non-profit organization and cultural leader for Nunavik Inuit peoples and a reference for Inuit culture in Canada and beyond. Qajartalik is a site on an island north of Nunavik in the Hudson Strait, where unique petroglyphs of human facial representations have been found. The petroglyphs were carved by Dorset peoples, who inhabited the Kangiqsujuaq region in Nunavik from around 2,400 to 900 years ago. To promote the uniqueness of the Qajartalik site, the Avataq Cultural Institute, on behalf of Nunavimmiut stakeholders, plans to apply for formal recognition of Qajartalik from UNESCO as a world heritage site. In this context, the project collaboratively integrated data documenting the climate, human occupation, land, and marine environment in the Kangiqsujuaq region to investigate the potential relationship between climate change and cultural transitions that occurred in Nunavik. An important output of the NICH-Arctic project so far is about a "face to face for the climate, a dialogue about a hot topic that can give you chills." This interactive workshop was developed to exchange views on the climate and climate change with high school students. In this project, 180 students participated in an interactive workshop on climate change and the methods to document the past climate. The activity also led to the development of a Sprint of Science entitled "Bad Weather for Neanderthals." The Sprint of Science is a participative conference that offers high school students the opportunity to get acquainted with scientific approaches and, in this case, to reconstruct a past climate. To date, within a couple of months, the Sprint of Science "Bad Weather for Neanderthals" has reached approximately 625 students across Canada.

One challenge that participants faced when applying a TD approach was being able to understand each other due to biases resulting from participants' respective expertises. Another challenge was the diversity of time scales among the different studies that comprise the project, dealing with long histories over decades, centuries, and millennia—according to the stakeholders—which are important as an environmental legacy, but more difficult to perceive from a present-day and generational perspective. This issue is particularly critical in the dialogue between academics and stakeholders, which makes the development and implementation of a project more complex.

iii. Future Resilience for African Cities and Lands (FRACTAL)

The FRACTAL project is a transdisciplinary group of researchers working on resilience for African cities and lands, especially in southern Africa. The project aimed to advance scientific knowledge about regional climate responses to human activities and work with decision-makers to integrate this knowledge into climate-sensitive decisions at a city-regional scale. FRACTAL also worked across sectors, fostering strong collaboration between researchers, city government officials, and key decision-makers in southern Africa. The project was implemented in eight cities spanning southern Africa, namely Blantyre, Cape Town, Durban, Gaborone, Harare, Lusaka, Maputo, and Windhoek. It was initiated in June 2015 as a four-year project. A funded extension phase was completed in mid-2021. The project was coordinated by the Climate Systems Analysis Group at the University of Cape Town and was part of the multi-consortia Future Climate for Africa (FCFA) program – jointly funded by the UK's Department for International Development (DFID) and the Natural Environment Research Council (NERC).

Methods included *inter alia* field trips, games and roleplays, city-to-city learning and knowledge exchanges, development of Climate Risk Narratives and visioning processes, social events, dialogues, and high-level breakfasts, and embedding researchers in decision-making contexts. Learning Labs anchored city learning processes and created spaces for many of these methods. Learning Labs are facilitated events that bring together a broad range of stakeholders who, in this case, were actively involved in the co-production of climate change knowledge. The "Embedded Researcher" approach "embeds" early career researchers from within universities in the local governments, and vice-versa (START 2022). This approach enabled the Embedded Researchers to act as the 'glue' between the universities and the local governments.

The relationships, trust, and camaraderie that were developed through FRACTAL's various learning

processes supported the sharing of perspectives, knowledge, and evidence amongst a broad group of city stakeholders. Several participants have expressed an appreciation for approaching climate issues in southern African cities in a more collaborative way and are hoping to carry this forward through various avenues of work. Given the large size of the consortia, achieving safe TD spaces, trust, and lasting legacies was a challenge that required a great deal of time and iterations. Outputs included academic publications, communication products, reports, and policy and governance briefs. Many of these outputs have been applied in the FRACTAL cities, and legacy work has included further research and practical work. Additionally, FRACTAL work has resulted in significant impacts, including the building of trust, relationships, and a strong network of researchers and academics. One such example is the implementation of recommendations from FRACTAL in the city of Harare, which has now formed a Climate Desk under a centralized environmental management unit that coordinates all things related to the environment and climate.

IV. Key takeaways

In this two-part workshop, we identified several recurring issues that arose from participant discussions. Therefore, we synthesize the main challenges and opportunities of TD practice that arose through theoretical reflections and case study presentations. For the sake of clarity, we have divided these common threads and crosscutting issues in three categories: overlying issues, sources of controversy, and sources of collaboration, as proposed at the workshop.

i. Overlying issues: Whose knowledge counts?

Workshop participants widely agreed that research and TD practice should include active efforts to incorporate the perspectives of local populations, who experience the impact of the given activities and outcomes. Affected populations, especially the most vulnerable ones, have historically been marginalized or excluded, thus demonstrating the importance of ensuring their inclusion and participation. A core TD principle is the inclusion of diverse sets of knowledge that should be valued equally. However, actors with the greatest economic and political leverage tend to have more strength in decision-making even when a TD approach is being implemented. Oftentimes, Western and academic knowledge is valued over local and indigenous knowledge, which translates into power asymmetries in projects and collaborations, in the on-the-ground TD experiences for both workshop participants and case study presenters. For instance, academic knowledge tends to have a larger weight in policymaking. This was the case for coffee policies in Jamaica, for instance, where women's demands have not been sufficiently addressed, although they are the main working force in the industry. It is still necessary to work towards a fairer representation of diverse groups when developing policies related to GEC in the Americas and beyond, especially in the global south. There is a need to overcome the extractive and colonial science model and advance towards more epistemic justice and equitable forms of collaboration.

ii. Sources of controversy

The biggest challenges identified by the workshop participants relate to divergent expectations and goals among actors in the case study projects. Frequently, there is little alignment between funders' and researchers' objectives. In many of the case studies, funders requested revisions to project proposals to suit the priorities of the funding agency, often in conflict with the priorities of the project creators. As a result of these competing demands between funders, policy makers, and academics involved in the project, TD projects do not frequently reflect local communities' needs and timeframes. It is rare that urgent community demands take center stage. This commonly leads to divergent expectations, leading to conflict. Workshop participants and speakers agreed that more transparent communication can help avoid or mitigate conflict. Effective communication requires a willingness to listen and let all voices speak throughout the whole process, especially voices of marginalized groups. Despite the fact that science communication tools are becoming more available, participants shared many miscommunication experiences that arose from a lack of communication skills or will by one or many project participants. Such situations are aggravated by the fact that, oftentimes, many stakeholders involved in the project have their own full-time jobs and have limited time to dedicate to the project, making it difficult to agree on convenient meeting times and set aside time for thoughtful communication. Last

but not least, funding constraints were repeatedly mentioned as a challenge to TD projects encompassing: 1) inequitable budget division among partners, 2) difficulties in budget planning due to the surprises of TD practice, and 3) issues in finding adequate long-term funding, given the great amount of time and effort needed for stakeholder engagement.

iii. Sources of collaboration

Key ideas that came out of the workshop for enhancing TD collaborations encompassed:

- Listening deeply and with attention to all stakeholders involved in a crucial aspect for avoiding and mitigating existing conflict in pathways and priorities. This means that a humble attitude from all project participants is needed to build trust and create spaces for co-learning.
- Caring about language and meaning is an important tool to break barriers between cultures. Translation between languages can help but, furthermore, project members must be willing to include ideas from people who do not speak the same language into the discussion.
- Art is a powerful tool for understanding the human dimensions of environmental change.
- Opening the dialogue about decolonial and socially legitimate approaches is a source for more in-depth collaboration.
- A variety of team exercises, such as role-playing games and ice-breaking dynamics, can help explore and reveal unconscious biases.
- Joint learning and training experiences can develop a common ground that can help the project thrive.

Workshop participants and case study presenters acknowledged that funding for TD projects is increasing worldwide. Although many constraints in funding persist, the group noticed that a growing number of institutions and agencies are interested in learning more about actionable research and transdisciplinarity.

V. Recommendations

The workshop's takeaways were based on the experiences shared by workshop attendees as they learned about the conceptual framework of TD and select case studies. Therefore, the recommendations stated below were generated from this collective, empirically-based wisdom. First, based on the recurring challenges and opportunities, we identify best practices for TD projects in the form of recommendations that can foster fruitful collaborations among diverse stakeholders in community-engaged, action/research-oriented projects. Second, we present recommendations regarding the workshop format itself: what worked and what did not work, for others to provide training in TD approaches to socio-environmental problems, specifically in tight timeframes and highly structured events such as seminars and congresses.

i. Recommendations for applying a TD approach in projects

- **Identify possible conflicting priorities** from the beginning of the project, to avoid unreachable expectations within the project's timeframe or budget. This can be achieved through teamwork in early stages, e.g., during proposal writing, and should be re-evaluated throughout the project. Constant communication between project members in recurring meetings is necessary to identify conflicting priorities and recognize common objectives.
- **Enhance communication, transparency, and participation of all stakeholders** to build the knowledge that communities and decision-makers need. Creating safe spaces for people who normally are not allowed or encouraged to speak is key. Possible strategies include using a speaking object to facilitate holistic participation in meetings. Other ice-breaking dynamics, such as the rotation methodology, can be interesting tools to guarantee fair communication. TD projects should build a common language and identify shared communication tools. Prioritizing trust-building and focusing on active, engaged listening processes and co-development is also crucial.
- **Make an active effort to center local time frames**. We saw that time frames for budgets, project completion, and deliverables are usually not consistent between communities, policy-makers,

funders, nonprofits. Therefore, TD projects should adapt their time frames to local communities' needs, which should be central to any TD project.

- **Create awareness of overlying power imbalances**. As discussed above, TD projects need to actively overcome impediments imposed by colonial structures and other forms of privilege, including knowledge systems, funding, representation, and roles in the project. Joint processes of creating common goals and languages can help to unpack these overlying assumptions and create openness, especially for those coming from Western institutional contexts.
- **Consolidate contextual awareness**. Build awareness of the dynamics of the local context (power dynamics, local practices, local processes, ways of governance, etc.) and how those affect the project activities.
- **Develop additional methodologies and continue building capacity**. All participants, including attendees, organizers, facilitators, and case study presenters, recognized that TD researchers need to further develop skills, attitudes, and capacities to meaningfully engage with stakeholders in order to build trust and effective collaboration. This needed capacity-building should be developed both during TD projects and continually inside universities, congresses, and other events. Skilled facilitators are needed to effectively promote joint learning experiences.

The below recommendations aim to encourage the development of more TD training, including short-term events such as congresses, to foster leadership skills including cognitive frameworks, emotional intelligence, arts, communication strategies, and other alternative tools and methods.

ii. Recommendations for future workshops on TD capacity-building

- *Base training on experience, e.g., of facilitators and attendees.* The workshop's design, beginning with the theoretical basis, followed by collecting workshop attendees' own experiences and wrapping up with a discussion-based presentation of case studies served to highlight both general and context-dependent aspects of TD practice. If you have little time, it is more effective to present concepts briefly and to show them in action, rather than to focus on an in-depth history of ideas.
- *Know your audience.* This key feature of any engaged pedagogy is even more crucial when developing a TD training, as the audience's proximity to TD practice will depend on their identity. If possible, get to know your audience beforehand. If not, add a component at the start of the workshop dedicated to learning about participants' backgrounds and identities.
- *If you are including case studies, provide a template for presenters.* The organizing team of the workshop offered a template for the case studies. This enabled all case studies to follow a similar storyline, which made it much easier for the audience to follow, recognize similarities and differences, and systematize common threads.
- *Use collaborative boards.* The use of a common board (physical or virtual) where attendees could share and aggregate their thoughts was productive both for audience engagement as well as for generating a sense of belonging for TD practitioners. Although our sessions were online, flipcharts could be used for in-person workshops. The boards were especially effective for showing attendees that they are not alone in facing challenges when practicing TD.
- *TD 101 training can be complemented by workshops on specific methods.* One of the main gaps identified by the audience was the lack of available and accessible tools that could be used to face the identified challenges on applying a TD approach to knowledge production. Therefore, we encourage training on specific methods that enhance TD collaborations such as group dynamics, participatory mappings, group management, or using theater tools to enhance group belonging.
- *Increase training activities for non-academic partners.* We acknowledge that TD training activities are still very much restricted to academic members of TD teams. We advocate for training activities to focus more on non-academic partner audiences, while

recognizing that time and scheduling can be challenging. Therefore, it would be important to privilege congresses and spaces for training that already include other stakeholders, such as the Sustainability Research and Innovation Congress (SRI) that actively invites non-academics to the audience.

VI. Conclusion

The workshop was well-received by attendees and was considered a success by organizers, facilitators, and case study presenters. The workshop achieved its goals of deepening perspectives and creating a feeling of belonging for those already practicing TD and, at the same time, highlighted common and recurring features of the process for those wishing to start engaging in it. The team recognized the value of sharing insights drawn from practice in diverse settings when developing recommendations, which made it possible to: 1) identify common threads that any scientist, policymaker, or practitioner thinking about committing to a TD endeavor should be aware of, and 2) recognize that there are some specific traces to be followed in TD training workshops that can be further explored in future training activities. The workshop recommendations show that exploring experiences of applying a TD approach in the Americas can be an excellent launching point for transformations to sustainability globally. Furthermore, current GEC challenges make the case for an urgent reorientation in knowledge production to include more collaborative perspectives. We hope that this piece encourages more and more events to generate capacities in transdisciplinary approaches.

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