Preface

We, an initial and limited representation of a group of practitioners, academics, and policymakers that conduct and facilitate transdisciplinary collaborations (TDC) in the Netherlands, present you this white paper about quality of transdisciplinary collaborations. We came together due to our shared interest in understanding how to improve and support TDCs to maximize their potential for impact on complex societal challenges.

Our aim is to unite practitioners and experts in the Netherlands around what constitutes quality, and around our shared ambition to see TDC make real impact on these urgent issues nationally and internationally. The emerging Dutch Community of Practice NECTR (launched April 3rd 2025) is a platform towards that, and this draft paper is a starting point.

We invite you, reader of this paper, to join us in this ambition. You can do this by

- **critically reading this paper and share your feedback with us,**
- **submitting example transdisciplinary projects, to be added as an appendix in a final version of this white paper,**
- **letting us know whether you want to support our initiative by signing this paper and support us in recognising and fostering quality in TDC.**

Feedback, examples and intentions to sign can be sent to: Marion Stenneke (m.stenneke@tudelft.nl). The publication of a final version of the white paper is intended for June 2025.

This first version of the position paper has been written in 2024-2025 by:

- BinBin Pearce, Delft University of Technology
- Josephine Sassen-van Meer, TNO
- Corinne Lamain, former director of CUCo
- Varsha Kapoerchan, NWO
- Eva Verhoef, Foundation RoboHouse
- Aniek van den Eersten, NWO
- Lotte Krabbenborg, Institute for Science in Society Radboud University
- David Abbink, Delft University of Technology
- Deborah Forster, Delft University of Technology
- Marion Stenneke, Delft University of Technology

In January 2025 we received feedback from a critical sounding board, including:

- Daan Andriessen, HU University of Applied Sciences
- Liesbeth Noordegraaf-Elens, Erasmus University
- Laurens Hessels, Rathenau Institute
- Nikki Brand, Delft University of Technology
- Annelieke van der Giessen, Advisory Council for Science, Technology and Innovation (AWTI)
- Wander van Baalen, Erasmus University
- Michiel van den Hout, Dutch Climate Research Initiative (KIN)
- Barbara Regeer, Athena Institute VU Amsterdam

White Paper

Recognising and Fostering Quality in Transdisciplinary Collaborations

Contents

1. The paradox of quality in transdisciplinary collaborations

How to create impact around the key societal challenges of our times?

Challenges like the energy transition, sustainable healthcare and dealing with labour shortages, are all highly complex. Addressing them is urgent, and requires fundamental transitions in the way we work, live, consume and organise ourselves. Despite the wish for knowledge institutes, governments, corporates and SMEs to organise themselves effectively for targeted societal impact, there are many barriers towards that. Specifically, it is widely accepted that the traditional ways of planning, performing and assessing research and innovation projects may no longer be sufficient. Next to these traditional ways, an additional approach needs fostering. A type of collaboration called **transdisciplinary collaboration (TDC)** is frequently mentioned as an important way forward, which could encompass education, research, innovation or all of these.

What constitutes TDC?

Transdisciplinarity typically sounds vague to people who have not experienced it, and it runs the risk of being used as a buzzword. This is exacerbated by the fact that there are many definitions of transdisciplinarity[1]: even among those practicing and/or financing it, there is insufficient consensus on terminology, methodologies or assessment criteria. Yet three main elements are at its core. **First**, TDC integrates a wide range of different types of methodologies, knowledge and perspectives: academic, as well as from practitioners and citizens. **Second**, in its sensitivity to societal needs, it is participatory and inherently value-driven. **Third**, in order to deal with societal challenges with wide-stretching impact, it takes a system-level approach. Transdisciplinary projects are often executed by larger consortia involving researchers from multiple scientific disciplines and institutions, practitioners from several professions, policy makers, citizens, etc. Some transdisciplinary initiatives have already achieved success, some fail to live up to expectations, and many are still in progress. With this paper we invite practitioners in the Dutch community to submit example transdisciplinary projects/cases (see preface), to be added as an appendix in a final version of this white paper, to give an overview of where we stand as a Dutch community.

Why this white paper?

The authors of this white paper – researchers from Dutch academia, practitioners from knowledge institutes, funding agencies and policy makers – have engaged in TDC, and are aware of the barriers involved in setting them up, executing them and sustaining them. Based on this shared experience across different domains, we notice we can readily discern quality in TDC amongst ourselves, but this may not be so easy for those who have not acquired this experience. One might ask: why not simply define what constitutes quality? Answering this question reveals a paradox in defining quality, one that the authors all recognise. Since TDCs are particularly geared towards *the process* of maximising opportunities for unexpected outcomes and impact to emerge over time, it is undesirable to aim for quickly achievable SMART outcomes: this runs the risk of stifling TDC. On the other hand, keeping quality undefined and merely advocating to trust the process is not sufficient to spark confidence in TDC. So how do we clarify how scarce resources could be spent adequately to contribute to societal impact?

We propose key mechanisms that reveal *process quality,* rather than *outcome quality,* across four important phases of TDC: when **initiating TDC** (Section 2), **doing TDC** (Section 3), **assessing TDC** (Section 4) and **enabling the right boundary conditions for TDC** (Section 5). We conclude each section with a set of recommendations in which we emphasise what constitutes quality in TDC for teams,

organisations and ecosystems.

This white paper thereby integrates actionable insights based on our combined experience and network – as well as our collective grounding in the TDC literature. We have contributed to setting up a Dutch community of practice around TDC (NECTR, launched on 3 April 2025), so that we can speak with one voice about how to foster quality in TDC. We hope this contributes to more high-quality coherent responses for societal impact in research and innovation projects.

2. Initiating TDC

Planned intentions towards emergent outcomes

TDC distinguishes itself from 'regular' research projects in that the focus of the work is on the process of integrating different perspectives towards addressing, over time, a complex societal challenge[2]. Note that this integration is an outcome in and of itself, as well as the starting point for developing outcomes or 'products' that would be considered answers to the challenge at hand. The outcomes of TDCs are not necessarily geared towards unified agreement and convergence, but much more towards achieving one step forward towards systems change in the complex societal challenge—maybe not even in the direction that was foreseen.

This process is also relevant in the preparatory phases of initiating a TDC, which include elements of proposal writing (where outcomes and activities need to be linked), consortium building (gathering a sufficiently rich group of people and expertise to start), and contracting (setting up the boundary conditions of a particular TDC project in research, innovation or education). All of these may also benefit from improving the overall boundary conditions for TDCs, which is addressed in Section 5.

During proposal writing, expectations as to the progress and outcomes of the project need to be aligned with the planned activities and available resources. TDC aims to encourage new pathways and transformative outcomes to emerge creatively and organically[3]. This requires openness, flexibility, a long-term commitment to address complex challenges, and a tolerance for uncertainty[4]. At the same time, it is important to set SMART objectives and aim for predictable outcomes in order to inspire confidence and monitor progress among funders and partners. This requires some form of structure, control, accountability, milestoning of sub-projects and the minimisation of risk and uncertainty.

This is where we encounter a **fundamental paradox** in TDC. On the one hand, if practitioners set the optimal conditions for emergence, they risk alienating participants and funders who need to account for the resources spent. On the other hand, if they emphasise predictability and achieving short-term outcomes, they risk stifling the transformative potential of TDC. Ignoring this paradox will result in either TDC being implemented in undefined, unstructured and ad-hoc ways, or TDC being forced into the straight jacket of SMART and linear project planning. In either case, TDC will most likely not achieve its full transformative impact.

How to reconcile this paradox? Clear goals in TDC processes and the emergence of novel directions can be combined by creating predictability in the process. TDC can be organised along strict and well-defined process agreements that have been specifically designed to evoke flexibility and emergence.

We can **recognise high-quality TDC** in proposals when the particular process of doing TDC is rigorous (see Section 3), and also when it includes:

1) plausible mechanisms for linking short-term actions in the proposed TDC to desirable impact, for example by a rigorous Theory of Change approach;
2) plausible mechanisms for consortium building, clarifying which stakeholders need to be at the table, why, and how they affect or are affected by the TDC over time, and also explaining how the submitting partners reached alignment, and if/how they allow new partners during the project;
3) structures and support mechanisms for partners in the TDC that may lack the skills, mindset (necessary to tolerate the ambiguity of TDC) or the time or power (necessary to affect the activities and decisions around the TDC);

4) a communication strategy to help organisations in communicating realistic pathways for societal impact, and not using TDC as fashionable window-dressing ('TDC-washing');

The authors of this white paper have found that participants in a TDC need to commit to a process of highly disciplined work and interaction methods in order to successfully allow for the emergence of novel and innovative ideas, that would not have been possible while working in silos alone. Bringing together diverse perspectives, competing values and interests requires a rigorous process for 'radical' collaboration, as explained in the next section.

Aspects of quality

Team level:

- Teams initiating the TDC invest in development of transdisciplinary attitudes and competencies, such as personal and group reflexivity, acceptance of unpredictability and uncertainty, a whole-system view and a willingness to engage with all partners on equal terms.
- Teams embrace mechanisms to ensure knowledge accumulation from sufficiently different perspectives, mechanisms for integrating knowledge (the cognitive and analytical competencies of TDC) and mechanisms for interventions and navigating group dynamics.

Organisational level:

- Organisations develop and use reliable TDC practices, grounded in knowledge integration and methodological pluralism across disciplinary and practice boundaries. Examples include joint problem framing, intentional design of collaboration processes, transformative learning and reflection-in-action.

Ecosystem level:

- Transparency is ensured by communicating the nature of TDC's inherent uncertainty to all stakeholders, framing it as a necessary part of achieving transformative results.
- Broad, flexible goals provide a sense of direction without being overly prescriptive. For example, focus is on process outcomes (collaboration quality, learning experiences) alongside product outcomes (specific results).
- Iterative planning allows initial goals to evolve as new insights emerge. This allows funders and participants to see progress without stifling creativity.

3. Doing TDC in practice

How can we recognise quality in running TDC projects, after agreeing on the guidelines, mechanisms, starting point and initial consortium during the initiation phase discussed in Section 2? Before detailing this for an individual project, we want to highlight that due to the often-long-term concerted effort needed to contribute to a societal challenge, there is often also the challenge of integrating various related projects *over time*, leveraging insights and trained talent and consortia that strengthen over time.

A practice of practices

Since the societal challenges at hand are in essence systemic, an individual TDC aiming to address them needs to be approached as such. This requires not merely gathering actors with deep (disciplinary) expertise, but also engaging mechanisms for stimulating collaboration, cross-pollination and cross-contamination to reduce blind spots and overcome knowledge gaps. Doing TDC is about safeguarding sufficient *plurality* of stakeholders (and corresponding perspectives and practices), rather than constructing an amalgam of them. In other words, we see TDC practice not just as a collection of practices but as allowing a reconfiguration of the contributing practices. While doing TDC, cross-pollination and cross-contamination between pragmatic ways of knowing and various research methods are inevitable and essential. Therefore, TDC is an emergent 'meta-practice' of different 'communities of practice'[5], and high-quality ways of doing TDC constitute a **'practice of practices'**.

In practice, this is not easy. For example, disciplinary perspectives are distinct in what they consider evidence, data structures, and credible analysis. Expert researchers and practitioners mostly identify with their own way of knowing. Overcoming such methodological challenges requires a deliberate design of a mixed-methods process. A requirement for sufficient richness in contributing practices will include at least methods that are process-dependent, oriented to systems-thinking, and are conducive to learning/knowledge creation and knowledge integration.

Roles and responsibilities

TDC integrates knowledge across disciplines from both academic and non-academic stakeholders. It is a hybrid science-society approach[6] for knowledge production. Following this definition, a transdisciplinary project consists of at least researchers from two different (academic) disciplines and a practitioner from professional practice (or policy). These actors are involved in a different but equal manner, and their contributions are different but of equal value[7]. All involved share responsibility for the TDC.

The paradox is that, on the one hand, fixed and clearly discerned roles and responsibilities are required for the quality of TDC. On the other hand, it is inherent to TDC that participants need to be **flexible** in defining and taking up roles and responsibilities and the quality of the project and collaboration between the parties within the project, will diminish when parties are inflexible.

Competencies

TDC requires the input of various experts who can have radically different (disciplinary, cultural and/or demographic) backgrounds. Compared to mono- or interdisciplinary projects, the variety of the backgrounds of the participants is wider. But more importantly, the challenge of TDC is to **integrate perspectives**, rather than have them co-exist as in multidisciplinary collaborations. Consequently, participants in TDC can have widely

differing views on science, work, life, truth and the norms and values they uphold can be radically different.

Bringing together the perspectives of all participants is pivotal for the quality of TDC projects, but not self-evident nor easy to achieve[8]. Ideally, the same relational and systemic approach is already applied while initiating TDC. This creates a state of mutual trust within the system that helps bringing in the different perspectives and strengthens the collaborative element.

In order to successfully integrate perspectives, certain **competencies** are needed for the participants in TDC. Numerous literature studies have come up with various sets of competencies, such as self-awareness, self-reflection and self-regulation; emotional and mental resilience; analytical and creative thinking; systemic thinking; flexibility, adaptive behaviour and tolerance for ambiguity; motivational ability and communication skills & ability to collaborate effectively. To this list we might add the competency of *paradoxical thinking*: the ability to simultaneously hold two opposing truths, and resist the urge to choose one-sidedly or to compromise, but instead to look for reconciliation between the polarities[9]. Important to note here is that these competencies should not have to reside within each individual, but should be cultivated within the consortium as a whole. This can be done, for example, by actively working on epistemic intelligence to create understanding among disciplines to recognise their differences and ask the right questions.

While teams can develop and sharpen their TDC competencies as they work together, TDC also requires *unlearning:* skills and habits that guarantee successful careers in business or academic contexts may be counterproductive in TDC contexts. Both learning and unlearning of competencies can be actively organised for with onboarding and training[10].

A TDC consists on the one hand of **specialists** with deep and focused expertise in each of the several domains of the system that is being considered. On the other hand, it involves **generalists** that can take a step back, zoom out and see the bigger picture of the system that is being considered. Few people know how to do both at the same time. To increase the quality of TDC, both specialist and generalist experts should be present, and the skill of the team are honed to iteratively zoom in and zoom out. The generalist and specialist perspectives ideally merge together, and do not stay separated.

In order to successfully do TDC, holding and enabling a flexible but structured project planning is necessary. It needs to be practical and fitting to all stakeholders and to the process of doing TDC. When unexpected insights emerge, the planning needs to allow for adaptation. More fixed key decision and go/no-go moments are evidently needed to keeping TDC going.

Aspects of quality

Team level:

- The various roles, responsibilities, tasks, as well as what everyone involved contributes in the project are co-defined and clearly described[11]. Special attention is paid to flexibility (switching, replacing or redefining roles), epistemic justice (equality, power dynamics), diversity and leadership.
- Teams take time to develop *epistemic intelligence*[12] as required for productive collaboration across practices.
- Teams proactively search for and construct *boundary objects*[13] (objects that hold different meanings in different communities and a common meaning to facilitate cooperation between these communities). They engage in boundary spanning

activities.

- By introducing common language, using protocols for communication and agreeing on deliberate ways of working, the teams develop and sharpen their TDC competencies throughout the collaboration.

Organisational level:

- The individual is not lost in the system. How individuals participate in system-level phenomena is tracked.
- Organisations are contracted to participate as co-creators of relevant knowledge, from beginning to end. By committing a larger group of stakeholders to participate in periodic knowledge sharing sessions, whole-system insights emerge that defy/counterbalance everyday hierarchical power relations.
- Organisations develop shared cultural sensibilities that can contest and/or leverage the emerging knowledge from transdisciplinary teams.
- Time and effort spent on honing TDC competencies is reckoned for and the budgets needed to regularly practice these competencies and discuss the collaboration is seen as an essential part of TDC.

Ecosystem level:

- A TDC community of practice allows ecosystem-level circulation of best practices between and across projects.
- Ecosystem-level training opportunities ensure career pathways for disciplinary, professional practitioners as well as TDC knowledge integrators.
- The complexity of TDC requires funding bodies to take on a broader role than for basic research[14]. They can incentivise as well as broker new transdisciplinary teams.

4. Assessing TDC

Recognising high-quality TDC projects

The assessment of (research) proposals, outputs, outcomes and impact is of great importance to ensure the quality of TDC. This means that funding bodies need to set up assessment procedures adjusted to the characteristics of TDC. This entails a different focus in who assesses, what is assessed and when assessment takes place. Examples of a coherent strategy for demonstrating how activities towards outputs, outcomes and impact are related include the Theory of Change approach[15].

TDC projects need to be assessed by a **heterogeneous committee** in which relevant disciplines and societal actors are represented. Such transdisciplinary assessment groups encounter similar difficulties as transdisciplinary teams, due to their cultural, linguistic and epistemic differences[16].

The process design and the set-up of the team are key quality indicators for TDC and need to be taken into account in the assessment process. When funders provide the opportunity to discuss these elements in an application and how the project design fits the programme goals and envisioned impact, TDC consortia can plan for sufficient time and responsibility for the TDC process in terms of facilitation of the collaboration, integration activities and evaluation.

TDC evaluation does not end after the funding has been allocated. Since TDC needs to plan for flexibility, it also requires more intensive monitoring and evaluation during the project to make sure it stays on track for impact while changes are being made. Monitoring, in addition, needs to take into account the process as well as the tangible outputs, as in TDC the process of collaboration is part of the outcome of a project and good collaboration is essential for reaching the envisioned impact. The TDC team needs to plan for evaluations and funders can provide supportive monitoring tools. Advisory committees of experts can also play a role here.

Aspects of quality

Team level:

- In their application, the team details how the logistics and administration of ‘doing TDC’ will take place, and how this fits the programme goals and their project (taking into account the ‘epistemic gaps’ in knowledge, the size of the consortium etc.)
- In their application, the team also makes clear that they spent sufficient time to create a ‘common vocabulary’ and identified plausible pathways toward the desired impact, for example through an Impact Plan (e.g. based on Theory of Change).
- The application makes clear that the value of the proposal lies in TDC and the envisioned societal impact, not just in the topic (urgency, scientific impact, methodology).
- After obtaining funding, doing TDC is given sufficient attention, and the quality of the collaboration is monitored by the team.

Organisational level:

- Applicant teams are supported during the application process, and are given feedback throughout the proposal development stages so that TDC expertise is built up.

Ecosystem level:

- Calls for proposals clearly indicate the programme goals and the impact expected

from the TDC applications to ensure fit-for-purpose assessment.

- Assessment criteria are clear, covering not only the quality of the research plan, but also the plans for doing TDC (the process), and a description of (the balance in) roles in the team. The process of how an application was set up (question framing, involvement partners etc.) can be an indicator of the proposed collaboration.
- Both reviewers and assessment panels have been trained on the design of the assessment, and are aware what the programme goals are, and what kind of projects are desired to meet these goals, to avoid a more conservative stance than that of the call for proposals.
- Assessment panels are diverse and cover the main disciplines related to the call, and also include other actors such as citizens and practitioners. They are facilitated in working together and bringing together different viewpoints, while avoiding conflict between these different viewpoints.
- Reviewers and assessment panels acknowledge that the assessment of TDC asks for different evidence or concerns different skills than in a monodisciplinary project, and funders offer consortia dedicated and sufficient room to discuss this in their application.
- Funders support project teams in monitoring the quality of their collaboration.

5. Enabling the right boundary conditions for TDC

Barriers for high-quality TDC

When setting up TDC, ample institutional barriers exist that limit the impact potential of transdisciplinary processes and outcomes. We see these barriers manifest in at least four contexts:

(1) Although the paradigm has been changing slowly, organisational cultures may still primarily focus on **short-term outcomes, accountability, deliverables and 'solutions'**. However, strategies that address complex societal issues require longer-term perspectives, as well as an openness to piloting a set of strategies over time. A simple solution is usually not available. Moreover, addressing complex challenges through TDC means that the process of working towards outcomes yields emergent insights which contribute to a deeper and more fundamental understanding of discerning future actions. This process is characterised by co-learning, co-creating and learning-by-doing across knowledge domains which require more patience, and better recognition and rewards for establishing fruitful collaboration processes than today's organisational cultures are comfortable with.

(2) TDC is rooted in an **extensive body of knowledge.** However, many organisations also do not facilitate access to specialised boundary organisations or to Integration & Implementation Science specialists or Integrators[17] to increase the quality of TDC. There often is insufficient or no TDC training available for participants who are not yet familiar with the field of transdisciplinarity to increase the quality of the TDC they are about to engage in.

(3) Despite promising developments in **Recognition & Rewards** policies across Dutch universities, which are shifting from individual towards team science, especially early and mid-career academics continue to run into barriers when embarking on TDC journeys[18]. Due to the extra time and effort required for TDC that are not supported or incentivised by institutions, TDC is not an attractive or even viable way of working for researchers looking for a permanent home in institutions. Due to the disciplinary organisation of most universities, those who fall in between disciplines or who work outside of the norm of specific disciplinary norms have a more challenging time finding a place to do innovative new work which incorporates TDC seriously. A recent report by Rathenau[19] found that despite high ambitions hardly any change is happening.

(4) Finally, the voices of societal partners in TDC are often not included in meaningful ways in the framing of research questions or knowledge agendas. A lack of adequate settings and underutilisation of methods for joint problem framing and value elicitation leads to the framing and knowledge agendas of projects to be primarily defined by (Western) donors and academics[20]. This raises the potential for **epistemic injustice**[21], where those most affected by research outcomes are not represented or included in shaping the objectives of the research.

Addressing these types of barriers will strengthen TDC professionalism, experience and expertise, improving the quality of the collaboration.

Aspects of quality

Team level:

- Knowledge about transdisciplinary processes and best practices are shared with others engaging in TDC (e.g. through peer-reviewed publications, but also through more engaging and accessible formats like blog posts, white papers, videos, visuals or podcasts)
- Process coaches and integration specialists are involved to strengthen processes

and outcomes.

Organisational level:

- Process coaches and integration specialists are structurally embedded and engaged, for example in a pool where transdisciplinary teams can turn to when seeking support or advice.

Footnotes

[1] The authors acknowledge that there is ample (empirical) experience within the Dutch TDC community, which we aim to collectively represent. We also acknowledge the body of academic knowledge around TDC quality (including Belcher, B. M., Rasmussen, K. E., Kemshaw, M. R., & Zornes, D. A. (2015). Defining and assessing research quality in a transdisciplinary context. *Research Evaluation*, **25**(1), 1–17. https://doi.org/10.1093/reseval/rvv025 ; Lux, A., Schäfer, M., Bergmann, M., Jahn, T., Marg, O., Nagy, E., Ransiek, A., & Theiler, L. (2019). Societal effects of transdisciplinary sustainability research—How can they be strengthened during the research process? *Environmental Science & Policy*, **101**, 183–191. https://doi.org/10.1016/j.envsci.2019.08.012 ; Schäfer, M., Bergmann, M., & Theiler, L. (2021). Systematizing societal effects of transdisciplinary research. *Research Evaluation*, **30**(4), 2021, 484–499. https://doi.org/10.1093/reseval/rvab019 ; Kny, J., Claus, R., Harris, J., & Schäfer, M. (2023). Assessing societal effects: Lessons from evaluation approaches in transdisciplinary research fields. *GAIA - Ecological Perspectives for Science and Society*, **32**(1), 178–185. https://doi.org/10.14512/gaia.32.1.17). To the best of our knowledge, there is no overview of basic characteristics of how quality around the process of TDC can be determined.

[2] Praktijkgids Transdisciplinair Werken - Tips en gereedschappen voor succesvol samenwerken bij de cocreatie van kennis en toepassingen. Het Groene Brein. see: https://www.sociaalcirculair.nl/wp-content/uploads/2023/04/Praktijkgids-Transdisciplinair-proces.pdf

[3] Hoverstadt, P. (2022). The Grammar of Systems: From Order to Chaos & Back. SCiO Publications.

4 Agazarian, Y. M. (2006). SCT in Action: Applying the Systems-Centered Approach in Organizations. London: Karnac Books.

[5] For more information on Communities of Practice, see https://www.wenger-trayner.com/introduction-to-communities-of-practice/ or van Turnhout, K., & Andriessen, D. (2024). 7. Experimenting with Novel Knowledge: a Plea for Communities of Practice. *Applied Design Research in Living Labs and Other Experimental Learning and Innovation Environments*. http://dx.doi.org/10.1201/9781003491484-9

[6] Celliers, L., Scott, D., Ngcoya, M. *et al.* Negotiation of knowledge for coastal management? Reflections from a transdisciplinary experiment in South Africa. *Humanit Soc Sci Commun* **8**, 207 (2021). https://doi.org/10.1057/s41599-021-00887-7

[7] "Equality of Knowledges" <source to be added>

[8] Sassen – van Meer, J.P., Lamain, C., Gemerden van, F. (2023). Transdisciplinary Research: If it's so important, why aren't we all doing it? From attractive conceptual notion to real-world applied practice. AWTI Newsletter, June 2023. See: https://repository.tno.nl/SingleDoc?find=UID%20e30d6d65-e2fc-47fa-97fb-aa1043cda93e

[9] Smith, W. K., & Lewis, M. W. (2011). Toward a theory of paradox: A dynamic equilibrium model of organizing. Academy of management Review, 36(2), 381-403

[10] Zie bijvoorbeeld het trainingsaanbod van CUCo, https://unusualcollaborations.ewuu.nl/tools-methods/training/

[11] De Jong, J. (2021). Competente mensen, incompetente teams: Handboek voor het interveniëren met impact in samenwerking. Amsterdam: Boom

[12] van der Bijl-Brouwer, M. (2022) Design, one piece of the puzzle: A conceptual and practical perspective on transdisciplinary design, in Lockton, D., Lenzi, S., Hekkert, P., Oak, A., Sádaba, J., Lloyd, P. (eds.), *DRS2022:* Bilbao, 25 June - 3 July, Bilbao, Spain. https://doi.org/10.21606/drs.2022.402

[13] Leigh Star, S. (2010). This is Not a Boundary Object: Reflections on the Origin of a Concept. *Science, Technology, & Human Values*, **35**(5), 601-617. https://doi.org/10.1177/0162243910377624

[14] Schneider, F., Patel, Z., Paulavets, K., Buser, T., Kado, J., & Burkhart, S. (2023). Fostering transdisciplinary research for sustainability in the Global South: Pathways to impact for funding programmes. *Humanities and Social Sciences Communications*, **10**(1). https://doi.org/10.1057/s41599-023-02138-3

[15] See Impact Plan Approach of NWO based on Theory of Change, or the EUR page on Theory of Change, including founding references

[16] Zuiderwijk, J., Kaltenbrunner, W., & Krabbenborg, L. (2023). *Exploring the evaluation of inter- and transdisciplinary research proposals: Lessons from Dutch research funding reform*. https://doi.org/10.55835/6442c1344c613a12228926e8

[17] See: Bammer G. (2012) Disciplining interdisciplinarity: integration and implementation sciences for researching complex real-world problems. ANU Press, Canberra; Hoffmann S., Deutsch L., Klein J.T. et al. (2022) Integrate the integrators! A call for establishing academic careers for integration experts. *Humanit Soc Sci Commun* 9:147; Hendren C.O., Ku S.T. (2019) The interdisciplinary executive scientist: connecting scientific ideas, resources and people. In: Hall K, Vogel A, Croyle R (eds). *Strategies for team science success*. Springer, Cham. pp. 363–374

[18] See for example: CUCo. Finding joy, creativity and meaning through unusual interdisciplinary collaborations. *Humanit Soc Sci Commun* **11**, 1159 (2024). https://doi.org/10.1057/s41599-024-03634-w ; Müller, R., & Kaltenbrunner, W. (2019) Re-disciplining Academic Careers? Interdisciplinary Practice and Career Development in a Swedish Environmental Sciences Research Center. *Minerva* **57**, 479–499; Daniel, K.L., McConnell, M., Schuchardt, A., Peffer, M.E. (2022) Challenges facing interdisciplinary researchers: Findings from a professional development workshop*. PLoS ONE* **17**(4): e0267234. https://doi.org/10.1371/journal.pone.0267234; Carolan, M. (2024) Do universities support solutions-oriented collaborative research? Constraints to wicked problems scholarship in higher education. *Humanit Soc Sci Commun* **11**, 382. https://doi.org/10.1057/s41599-024-02893-x

[19] Van der Lee, R. et al., Balans van de Wetenschap 2024. https://www.rathenau.nl/nl/werking-van-het-wetenschapssysteem/balans-van-de-wetenschap-2024

[20] Triyanti, A., Lamain, C., Duncan, J. and Student, J. *Understanding exclusion, sharing benefits and building in*

reflection in transdisciplinary collaborations. (2024, July 1). Integration and Implementation Insights. https://i2insights.org/2024/06/25/improving-transdisciplinary-collaborations/

[21] Triyanti, A., Paassen, B., Lamain, C., Duncan, J., Student, J., Colen Ladeia Torrens, J. and de Roo, N. *Towards fair transdisciplinary collaborations that honour epistemic justice*. (2024, June 25). Integration and Implementation Insights. https://i2insights.org/2024/05/28/fostering-epistemic-justice/