
Programme Design for Transformations to Sustainability Research



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[The Belmont Forum](#), established in 2009, is a global partnership of funding organizations, international science councils and regional consortia committed to the advancement of international, interdisciplinary and transdisciplinary science and knowledge for understanding, mitigating and adapting to global environmental change. Belmont Forum members and partner organizations work collaboratively to meet the Belmont Challenge by issuing international calls for proposals, committing to best practices for open data access, and providing transdisciplinary training.

About NORFACE

New Opportunities for Research Funding Agency Cooperation in Europe ([NORFACE](#)), launched in 2004, is a partnership of national research funding agencies in Europe dedicated to leading and developing opportunities for scientists in the area of social and behavioural sciences. NORFACE plays an important part in responding to the grand societal challenges by promoting research of the highest quality, sharing best practices among research funders and especially by making international collaboration between social scientists in Europe possible.

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National Science Foundation (NSF), United States

Netherlands Organisation for Scientific Research (NWO), the Netherlands

Research Council of Norway (RCN), Norway

Research Foundation – Flanders (FWO), Belgium – Flanders

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Programme Design for Transformations to Sustainability Research

A comparative analysis of the design of two research programmes on transformations to sustainability

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Prefatory note

From 2014 to 2019, the International Science Council (ISC) coordinated the Transformations to Sustainability research programme, in this report referred to as T2S1, with funding from the Swedish International Development Cooperation Agency.

From 2017 to 2022, the Belmont Forum, NORFACE network and ISC collectively funded and coordinated a second iteration of the Transformations to Sustainability programme, in this report referred to as T2S2.

The funders of the T2S2 programme decided in 2021 to undertake a study of learning derived from the programme. This study resulted in two reports:

- Mukute, M., Colvin, J., Burt, J. 2024. *Programme Design for Transformations to Sustainability Research: A Comparative Analysis of the Design of Two Research Programmes on Transformations to Sustainability*. Belmont Forum, International Science Council, NORFACE. This report focuses on a comparative analysis of the design of T2S1 and T2S2.
DOI: 10.24948/2024.02
- Moser, S. 2024b. *Social Transformations to Sustainability through a Critical Lens: Integrative insights from twelve research projects funded under the Transformations to Sustainability research programme*. Belmont Forum, International Science Council, NORFACE. This report focuses on insights into transformations to sustainability from an analysis of the outputs of the twelve projects funded under T2S2.
DOI: 10.24948/2024.03

The ISC also commissioned a synthesis study of the T2S1 programme, which resulted in the following report:

- Moser, S. 2024a. Transformative Labour: The Hidden (and Not-So-Hidden) Work of Transformations to Sustainability. Integrative Insights from Three Transformative Knowledge Networks. International Science Council. This report focuses on insights into transformations to sustainability yielded by the three projects funded under T2S1.
DOI 10.24948/2024.04

Together, this package of three reports presents some of the key insights and learning from nine years of research programming on transformations to sustainability.

The NORFACE network, Belmont Forum and ISC would like to thank all project teams, project participants and interviewees who informed these reports.

Disclaimer

The information, opinions and recommendations presented in this report are those of authors of the report, and do not necessarily reflect the values or position of the ISC, the Belmont Forum or the NORFACE network.

List of acronyms

ISC	International Science Council
ISSC	International Social Science Council
NORFACE	New Opportunities for Research Funding Agency Cooperation in Europe
NWO	Netherlands Organization for Scientific Research
Sida	Swedish International Development Cooperation Agency
TKN	Transformative Knowledge Network
T2S	Transformation to Sustainability programme (comprehensively)
T2S1	The first T2S programme, coordinated by the ISSC (later the ISC), with funding from Sida
T2S2	The second T2S programme, funded by the Belmont Forum, NORFACE and the ISC/Sida
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization

Foreword: Breaking the mould with transdisciplinary research for sustainability

The Transformations to Sustainability (T2S) programme came to an end in December 2022 after nine exciting, challenging and rewarding years. The programme, launched in January 2014 by the International Social Science Council (ISSC, one of the predecessors of the International Science Council) with financing from the Swedish International Cooperation Agency (Sida), emerged out of a careful design process to create a research programme that would enable the social sciences to make their unique and much-needed contribution to sustainability science and action. As such the T2S programme was a milestone in the history of international science and is still one of the most significant manifestations of international, interdisciplinary collaboration between the natural and social sciences on sustainability.

Inspired by the ISSC initiative, the Belmont Forum and the NORFACE network of social science funders launched a second phase with the ISSC in 2017, benefitting from top-up funding from the European Commission that made for a hugely significant step up in scale and scope for social science research cooperation and leadership in the domain of sustainability.

These unique international funding opportunities attracted an overwhelming response from a global research community hungry for support for a new type of research for sustainability based on transdisciplinarity. The two phases of the programme made it possible to test innovative transdisciplinary and internationally comparative research approaches and offered opportunities for more equitable research participation and leadership from the Global South. The 15 international research projects funded under the two phases of the programme studied and participated in transformation processes in many dozens of sites all over the world, working with communities experiencing a

wide range of socio-environmental problems. What the projects all had in common was the social framing of the problems and potential solutions, deep involvement of non-academic partners and the effort to understand and facilitate processes of social change towards more sustainable and socially just situations. They shared the ethos of care for people and planet that characterizes transdisciplinary research. Collectively the 15 projects have produced several hundred academic and non-academic outputs, involved thousands of non-academic participants in their research and had significant impacts on the course of communities' lives and on research directions and practice.

The three concluding reports on the T2S programme released in 2024 are rich in insights and learning which validate and extend the body of knowledge on social transformations and transdisciplinary approaches. The T2S programme has confirmed that integrated, transdisciplinary knowledge is an indispensable part of local and global efforts to achieve social and environmental sustainability, but also that science systems are still not conducive to mould-breaking, transformative research. The experience of the T2S programme adds weight to the evidence that science itself needs to transform, in its funding and incentive structures, evaluation cultures, training approaches and interfaces with practice, policy, society and the private sector, to achieve its potential to mitigate the urgent, existential risks to humanity we are facing. We hope that the example of the T2S programme will inspire other funders to mobilize resources for the kind of research that can help accelerate the achievement of the Sustainable Development Goals and long-term sustainable and just development.



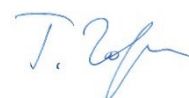
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Executive summary

This report synthesizes learning from a critical comparison of the design of two related but distinct international research programmes on the theme of ‘Transformations to Sustainability’ (T2S) that ran from 2016 to 2019 and from 2018 to 2022, respectively. The programmes were funded by the International Science Council with the Swedish International Development Cooperation Agency (Sida), the Belmont Forum, the NORFACE network and the European Commission.

The comparison focused on the varying programme design features that aimed to support (1) a social framing of sustainability challenges and solutions and (2) interdisciplinary and transdisciplinary approaches to research. It considered how and to what extent these features contributed to knowledge production, capacity building and institutional change. Transdisciplinary research in this context is research that integrates academic knowledge from different scientific disciplines with knowledge from non-academic knowledge partners in co-design, co-production and co-dissemination of knowledge and responses to societal problems (ISSC/UNESCO, 2013). Social transformation refers to large-scale social change, accompanied by a shift in the collective consciousness of a society at or across different scales (ibid.).

The insights relevant to programme design from the first T2S programme reinforce those gained from the second T2S programme. This may be attributed to the commonalities in the two programmes’ research foci, their social framing of sustainability challenges and the insistence on international, transdisciplinary research approaches, rather than the programmes’ funding conditions and programme management approaches. The main differences lie in the degree of Global South and practitioner involvement in research leadership, as well as in programme coordination, which received more attention and resources in the earlier programme, and in the thematic emphases, which were more specific in the latter programme.

In the earlier programme, which had essentially one funder and one coordinating organization, Global South (co-)leadership and strong non-academic involvement brought equity and justice issues to the fore and corrected for imbalances in knowledge

production. Cross-project interaction and learning was financially better supported, opening important opportunities for epistemic advances and capacity building beyond the scope of each project. By contrast, the latter programme, with 13 funders, created greater critical mass, and with more specific thematic foci, offered greater potential for advancing pressing policy questions.

The insights from the programmes are grouped into four categories involving twelve guiding principles for research design, which may be used to inform the establishment, implementation and requirements of future research programmes and calls for proposals.

Context

1. Research foci emerge from contextual drivers and the interests of funders.

Social-ecological and political/policy contexts as well as the state of knowledge at any given point in time influence the focus of research funding programmes; the interests and objectives of funders are also constitutive of research programme design and in multi-funder arrangements may not entirely coincide, leading to working compromises.

- ### **2. Insights into transformation processes and pathways emerge from studying interactions across multiple scales and over time.**
- Both programmes highlighted the need to understand how local cases are situated within national, regional and/or global contexts, as well as to give attention to cross-sectoral or cross-industry interactions. A combination of a cross-scalar lens with a historical perspective is necessary for understanding and potentially influencing transformative change processes and pathways.

Funding

- ### **3. Flexible funding and governance are required for complex, multilevel, transdisciplinary research programmes.**
- The two programmes showed the importance of not ‘over-designing,’ that is, of allowing and creating spaces for emergence, learning, consultation and collective decision-making. This entails providing possibilities and resources for co-design, co-production, outreach, scaling

and follow-up activities. Funders as well as funding mechanisms must be flexible enough to accommodate changes that occur during the transdisciplinary research process given its emergent nature.

- 4. An appropriately resourced programme coordination unit is essential for supporting cross-project learning and knowledge production and interactions with the wider research community.** International, transdisciplinary research programmes on social transformations are administratively complex and need to be adequately resourced, at programme and project levels. Both at the programme and project levels, resources needed for technical and scientific coordination, communications and interaction/cross-fertilization support should not be underestimated or sacrificed, as important synergistic value is added from these activities.

- 5. Short research project periods undermine the effectiveness of transdisciplinary research processes.** Generally, there is a need for a shift in research and capacity building funding from short-term and project-based models to a more sustained long-term process to allow for the synthesis and testing of or application of knowledge on sustainability, for development of theory and for continuity of engagement with communities. This is particularly important for lengthy transformations processes that cannot be understood or accomplished in typical short-term research funding cycles.

People

- 6. Research funding for Global South researchers as equal partners in international research directly contributes to global knowledge production and sharing, and structurally rectifies longstanding epistemological injustices.** Funding for (co)leadership from the Global South demonstrated that funders have a crucial role to play in creating the conditions under which Global South researchers can contribute equally to producing global knowledge on transformations to sustainability.

- 7. Funding for non-academic research partners is critical to enabling them to make a meaningful contribution.** The comparison showed that funding that is inclusive of or directly targeted at the Global South and at non-academic partners fosters more equitable relationships between partners and helps counteract the phenomenon of ‘extractive research’ dominated by Northern academic traditions.
- 8. Monitoring, evaluation and learning approaches in transdisciplinary research programming need innovation.** Research programming needs to experiment and innovate more to get the most out of the opportunities for reflexivity and learning provided by transdisciplinary research, without imposing disproportionate reporting burdens.
- 9. Interdisciplinary and transdisciplinary research with a social framing enhances collaboration and can empower marginalized groups.** Research teams that bring together individuals from different countries, disciplines, groups of practice and sectors of society allow different knowledges, perspectives and interests to interact and increase the chances of developing a more complete and nuanced understanding of any challenge, as well as more widely acceptable and feasible responses to pervasive sustainability challenges.
- 10. Capacity building is transformational.** Capacity building and empowerment result in enhanced ability to understand, see, participate in and catalyse transformation. Embedding capacity building for all into transdisciplinary research programmes enhances the programmes’ transformative outcomes. Knowledge exchange, training and capacity building activities should be an integral part of any transdisciplinary research funding programme, and particularly, but not only, for early career scientists. Building such an element into research programmes on transformations makes it more internally cohesive.

Research practice

- 11. Transformative research involves a transformation in knowledge production.** The programmes showed that transformation entails the reframing of sustainability and justice challenges, which in turn involves reframing concepts, frameworks,

methodologies, pathways and actions based on multiple, interacting perspectives and knowledges.

12. The role of the researcher is not just technical/academic but also political.

Transformations to sustainability research requires researchers not to see themselves merely as academic experts who possess more or superior knowledge than non-academics, but rather to be reflexive researchers and change agents. The ethics of doing 'care-full' research requires the researcher to practice political rigour, which entails engaging in difficult conversations with the community to understand the structural and systemic issues they face and enable them to engage with them more effectively.

In sum, the two programmes offer important insights into the effects of programme design features that together point to the need for the following:

- Sustained, long-term funding for transdisciplinary transformations to sustainability research;
- Dedicated funding for Global South research leadership;
- Space for learning and capacity building for and among academic and non-academic communities, across generations and places.

Care should be taken to learn from innovative funding programmes such as the T2S programmes and to adjust them, rather than to revert to traditional models, especially in contexts where rapid learning is essential, such as environmental change. At the same time, patience is needed for the application of learning about transformations to sustainability, which may unfold slowly and silently.

Innovation in research funding building on the T2S experience could help make a huge difference for science and for urgently needed social transformation processes. Science could play a much more significant role if funders would support science to unleash its power in collaboration with its societal partners. Funders themselves must rise to the sustainability challenge by showing both commitment and courage to create common pools of transdisciplinary research funding that incentivizes researchers and science systems to produce societally relevant and usable knowledge.

1. Introduction

1.1 Context and purpose of this report

This report provides learning from a critical comparison of the design of two related but distinct international research programmes on the theme of ‘Transformations to Sustainability.’ The study was undertaken with a view to gaining insights into the effect of programme design features on the achievement of the programmes’ objectives. The intent is to inform and guide funders and designers of future international research programmes in this and related areas.

The potential importance of this report lies in the fact that social transformations towards sustainability is a growing area of research, practice and policy-making. The concept of transformations to sustainability responds to the complexity of interacting, multilevel environmental change and societal challenges, including climate change, environmental degradation, biodiversity loss, disasters, poverty, food insecurity and inequality. This report aims to help answer questions about how to support impactful transformations to sustainability research and how to support researchers to take bold, sometimes risky, transformative approaches to generating usable knowledge.

The report focuses on the programme design features that aimed to support (1) a social framing of sustainability challenges and solutions and (2) interdisciplinary and transdisciplinary approaches. It considers how and to what extent these contributed to knowledge production, capacity building and institutional change, draws tentative conclusions and puts forward recommendations.

Transdisciplinary research, as conceived of in the Transformations to Sustainability programmes, is research that integrates academic knowledge from different scientific disciplines with knowledge from non-academic knowledge partners in co-design, co-production and co-dissemination of knowledge and solutions to societal problems (ISSC/UNESCO, 2013). Social transformation refers to large-scale social change, which is accompanied by a shift in the collective consciousness of a society at or across different scales (ibid.).

The study that resulted in this report was commissioned by the Belmont Forum, the New Opportunities for Research Funding Agency Cooperation in Europe (NORFACE) network and the International Science Council (ISC), funders of the Transformations to Sustainability programmes.

1.2 Background to the Transformations to Sustainability programmes

The first Transformations to Sustainability programme (hereafter ‘T2S1’) was implemented from 2014 to 2019. In the first stage 38 seed grants were awarded to consortia to develop full proposals over a period of six months (ISC, 2021a). In the subsequent stage three international projects, called ‘Transformative Knowledge Networks’ (TKNs), were funded for three years. The International Social Science Council (ISSC; which later became the ISC) coordinated the programme with funding from the Swedish International Development Cooperation Agency (Sida)¹. Funding for the seed grants and projects amounted to €3.7m (i.e., not including programme coordination costs).

The second programme, hereafter ‘T2S2,’ was implemented from 2018 to 2022. It funded twelve international projects, also of three years’ duration, and was coordinated and funded by a multinational consortium of Belmont Forum and NORFACE members and the ISC, with top-up funding from the European Commission. The Netherlands Organization for Scientific Research (NWO) provided the main coordination office for the programme, while other partners in the consortium were responsible, for various ‘work packages,’ e.g., managing the calls for proposals and evaluation processes. The ‘Knowledge exchange and communications’ work package that supported cross-project interaction and learning as well as communication and dissemination activities was principally managed by the ISC with support from NWO. Funding for the twelve projects amounted to €11.5m (i.e., not including programme coordination costs).

¹ Four funding agencies provided ad hoc support for the seed grants: the Economic and Social Research Council UK (Newton Fund), the Swedish Secretariat for Environmental Earth System Science, the National Research Foundation South Africa and the Netherlands Organization for Scientific Research (NWO).

Both T2S1 and T2S2 were explicitly intended to enable the social sciences to make their unique and essential contributions to sustainability research, practice and policy, on the premise that the social sciences were critical to producing usable knowledge for sustainability, but to date had been far less supported in this area of research compared to the physical and natural sciences. The motivation behind both research programmes was furthermore the growing recognition of the following: the limitations of nationally funded and nationally focused research and of disciplinary, institutional and sectoral silos; the dominance of researchers and research traditions from the Global North; and the critical importance of working with different, including non-academic, sources and types of knowledge, actors and institutions in understanding problems holistically and in imagining, developing and implementing just and widely acceptable solutions.

1.3 Study approach and methodology

The study approach was participatory, utilization-focused and iterative. Data were collected through the following methods:

- **Desk review:** Review of over 65 T2S1 and T2S2 programme documents, which included calls for proposals, project proposals, annual and final project reports, academic papers published in special issues, external programme evaluation reports and two T2S1 books (Ely et al., 2021; Walter, 2023), to understand programme contexts, designs, interventions, challenges, opportunities, outcomes and insights. Analysis of relevant literature to appreciate programme contexts and their influence on programmes.
- **Key informant interviews:** Interviews with nine programme stakeholders consisting of three TKN (co-)coordinators from T2S1,² the ISC T2S programme adviser³ and six T2S2 principal investigators and co-investigators⁴ to gain insights into the interaction between programme contexts, mechanisms and outcomes.

² Leah Temper, Acknowl-EJ; Adrian Ely, Pathways; Heila Lotz-Sisitka, T-learning.

³ Susanne Moser.

⁴ Eleanor Fisher, Gold Matters; Neil Adger, MISTY; Nathan Oxley, TAPESTRY; Eduardo Brondizio, AGENTS; Margareet Zwarteveen, T2GS; and Andy Stirling, GoST.

- **Written inputs:** Principal investigators and co-investigators from the CON-VIVA, IPACST, SecTenSusPeace, T2S-H2O and TRUEPATH projects who gave input to the interview questions as project teams.
- **Discussions with the study's Advisory Board:** Seven virtual meetings with the eight members of the Advisory Board of the study, representing funders and project members.⁵
- **Final T2S programme meeting (November 2022):** Received and incorporated reflections from members of T2S1 and T2S2 projects on programme design and implementation shared at the final programme meeting.

All 15 projects from the two programmes therefore contributed primary data for this report.

1.4 Overview of this report

Section 2 describes and analyses the respective contexts of T2S1 and T2S2 and how they may have influenced the design of the two programmes and produced certain similarities and differences in design. This is related in Section 3 to the programmes' outcomes in terms of understanding of transformation, research collaboration, capacity building and research practices. Section 4 presents insights for programme design, which form the basis of the final part of this report: implications for funders interested in developing international research programmes that yield integrated, change-oriented and actionable knowledge that advances equitable transformations.

⁵ Monika Brasser, Emily Hancock, Robert Fletcher, Silke Beck, Janne Niemi, Alexandre Roccoatto, Susanne Moser and Sarah Moore.

2. The contexts of the two T2S programmes

The designs of T2S1 and T2S2 were influenced by evolving social-ecological and epistemological contexts in a number of ways, which are described and analysed in Sections 2.1 and 2.2, respectively. The resulting similarities and differences are outlined in Section 2.3.

2.1 Social-ecological conditions and their influences on programme design

The social-ecological conditions that shaped the design of both programmes were a set of interacting, human-induced, global justice and sustainability challenges that included climate change, biodiversity loss, water and food insecurity, energy production and consumption, rapid urbanization, environmental degradation, poverty, social conflict and inequalities. Research funders were increasingly recognizing the social nature of the causes and consequences of this interacting set of challenges that are now commonly seen as constituting the Anthropocene (Steffen et al., 2015) (or alternatively, the Capitalocene or Chthulecene – Moore, 2016; Haraway, 2016) and, thus, the necessity for the social sciences to play a leading role in contributing to the understanding and tackling of sustainability challenges.

The period leading up to the design of T2S1 in 2011–2013 was particularly formed by an understanding that humanity's global life support systems and resources were under pressure and reaching planetary limits, including the following:

- Risks to water, food, biodiversity and the global climate due to human exploitation, degradation of and pressures on the Earth's systems;
- The interconnected challenges of safeguarding the Earth's natural processes and ensuring the wellbeing of civilization while eradicating poverty, reducing conflict over resources and supporting human and ecosystem health;

- The need to meet the needs of a growing population, while mitigating the negative impacts of unjust growth and use of Earth's resources in highly interconnected and interdependent economic, social and political systems;
- The imperative to make global sustainability a foundation of society (see Brito and Smith, 2012; University of Oslo, 2013).

Future Earth, launched at the Planet under Pressure conference in London in 2012, was an international research coordination effort, co-sponsored by the ISSC among others, to respond to this new understanding, recommending that future science should (i) generate understanding on how planet Earth is changing due to natural phenomena and human activities, (ii) provide the knowledge to address the most pressing needs of humanity and (iii) integrate solution-oriented science that produces knowledge for transformations to sustainability (Future Earth, 2013). Future Earth also noted that innovative funding mechanisms were needed to support disciplinary and transdisciplinary research and coordination of international research activities. T2S1 was intended as the ISSC's contribution to Future Earth.

Against this growing awareness, T2S1 focused on 'concrete problems of global environmental change and sustainability in specific social-ecological settings' and called for research that specifically addressed 'nexus' or interacting social and ecological challenges.

By the time the T2S2 programme was designed, in 2016–2017, the United Nations Sustainable Development Goals (SDGs)⁶ and the Paris Climate Change Agreement⁷ had been agreed. Both international agreements recognized that prevailing pathways of human development were overshooting several 'planetary boundaries' and highlighted the need for urgent action to address interconnected, interacting and dynamic global social-ecological challenges (Raworth, 2012; Government of Sweden, 2016; Griggs et al., 2017; Boehm et al., 2022). The SDGs represent a global consensus on the need for

⁶ The UN Sustainable Development Goals were adopted on 25 September 2015.

<https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

⁷ United Nations. 2015. Paris Agreement. Article 7.5.

https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

transformations across multiple social and environmental domains – represented by the 17 goals. Most questions were by then clearly focused on the governance and finance mechanisms that could help meet the global targets, and how to bring society along in terms of shifts in values and worldviews to support the social and economic changes needed to meet the SDGs and emission reduction goals. These themes are clearly reflected in the call for proposals for T2S2, which defined three substantive and two methodological themes:

- Governance and institutional dimensions of transformations to sustainability;
- Economy and finance of transformations to sustainability;
- Wellbeing, quality of life, identity and social and cultural values in relation to transformations to sustainability;
- Conceptual aspects of processes of transformation;
- Methodological innovation.

A comparison of the social-ecological contexts of the design period of the two T2S programmes suggests that the overarching challenges were similar (if perceived as more urgent in 2016), but that the concern with policy- and action-oriented research for transformations had increased markedly in T2S2.

While not a design consideration, it should be noted that T2S2 was implemented during the COVID-19 pandemic, which affected all research projects during their active data collection, stakeholder engagement and sense-making phases. By contrast, the research projects of T2S1 had officially concluded, even though the research teams were still finalizing outputs. These conditions made research for the T2S2 projects significantly more challenging, resulting in adjustments to research objectives, approaches and project durations.

2.2 Epistemological conditions and their influences on programme design

Conventional knowledge production systems have been characterized as manifesting the following (Fazey et al., 2018):

- A disconnect between people and planet;
- Exclusion of important voices and knowledge holders;
- A narrow definition of knowledge;
- Elitist production of recognized knowledge, predominantly in the Global North;
- Fragmented and compartmentalized (disciplinary) knowledge;
- Knowledge production processes that lack reflexivity, courage, creativity and trust.

The designs of the T2S1 and T2S2 research programmes aimed – in similar and different ways – to address the limitations of academic, disciplinary, sectoral and national silos. Both programmes explicitly recognized the value of interdisciplinary and transdisciplinary research, which emphasize understanding and catalysing just and sustainable transformations through co-design, co-production and co-dissemination of research and integrated knowledge. However, while T2S1 explicitly required and materially supported the co-design and co-production process with seed grants for co-design and funding for non-academic partners, T2S2, because of the constraints of its more complex funding structure and the varying eligibility rules of the participating funders, could only strongly encourage it in principle.

Additionally, T2S1 aimed to directly address the fact that scientific knowledge creation was then (and continues to be) dominated by the Global North. This led to the requirement in T2S1 for leadership or joint leadership of projects by researchers in the Global South. By contrast, designers of T2S2 – a consortium made up of mostly national funders – were bound to a more traditional model of funding their own nationally-based researchers. While the amount of funding markedly increased in T2S2, and the principles of social science leadership and interdisciplinary approaches were maintained, T2S2 could not structurally address the need for greater transdisciplinarity, Global South research capacity and leadership and what was called ‘epistemic justice’

by the ACKnowl-EJ TKN in T2S1 – by which is meant valorization and recognition of other forms of knowing and other life-worlds (Temper et al., 2016) – in its funding mechanisms.

By 2014, a number of schools of thought on transformations had emerged, including the following: transformative adaptation linked to social-ecological resilience (Olsson et al., 2014); socio-technical systems transitions concerned with transition management (Loorbach et al., 2017); and the development of a ‘pathways’ perspective on transformations to sustainability (Leach et al., 2010). Moreover, T2S1 was also directly influenced by the ‘Transformative Cornerstones’ report (ISSC, 2012), which underlined the importance of social science attention to the following:

- **Historical and contextual complexities**, to help better ‘understand the political economy of climate and other processes of environmental change, and to understand how these processes relate to a multitude of other social crises’;
- **The consequences of environmental change**, to expose ‘the diverse realities of living with global change’;
- **Conditions and visions for change**, to understand ‘how change happens, at what levels and scales, and in what directions’;
- **Interpretation and subjective sense-making**, to confront ‘the personal and collective values, beliefs, assumptions, interests, worldviews, hopes, needs and desires that underlie people’s experiences of and responses’ to sustainability challenges;
- **Responsibilities**, to foreground dominant actors’ ‘obligations, duties and responsibilities to the poor’;
- **Governance and decision-making**, to better understand ‘how decisions are made in the face of uncertainty, what pathways are available for influencing decision-making, what determines the success or failure of political agreements and what drives political will.’

T2S2 defined a set of themes (see above) that resonated with the political concerns at the time of its design, chiefly about how societal transformations can be governed and steered (Moser, 2016; Massarella et al., 2021).

2.3 A brief overview of similarities and differences in T2S1 and T2S2 programme design

Conceptual and structural similarities between T2S1 and T2S2 included the following:

2.3.1 Framing

Social science framings and social science leadership were considered critical to knowledge on and for transformations to sustainability.

2.3.2 Approach

Interdisciplinary research was required in both programmes; transdisciplinary research was required in T2S1 and strongly encouraged in T2S2.

2.3.3 High-level goal

To generate engaged, solutions-oriented knowledge that enabled a broader and deeper understanding of the conditions, processes, outcomes and impacts of transformative social change in the context of sustainability challenges.

2.3.4 Geographic scope

A minimum involvement of research teams in three countries was required in both programmes; in T2S1, the countries had to span two regions of the world.

2.3.5 Funding duration and scope

Project funding was for a three-year period, and there were resources for cross-project interaction and dissemination activities.

These were the key differences between the programmes:

2.3.6 Thematic focus:

- a) T2S1 was thematically open within the broad theme of understanding processes and dynamics of social transformation to sustainability, in relation to concrete problems of global environmental change and sustainability in specific settings.
- b) T2S2 was thematically more focused, as mentioned above.

2.3.7 Geographic scope and Global South involvement

T2S1 was able to fund researchers in virtually any country in the world, and moreover demanded Global South leadership and North–South collaboration, requiring that research be carried out in a minimum of three countries. T2S2 required project teams to involve a minimum of three countries but the majority of participating funders could only fund researchers in their own countries, therefore Global South participation was not a funding requirement. T2S2 consequently had less participation of middle- and low-income country researchers compared to T2S1.

2.3.8 Research budget

T2S1 awarded grants of €850,000 to each of the three projects, which each had eight national teams on average, rather evenly distributed across Global North and South. Global South partners required much smaller budgets, which helped to increase their number. The small number of projects may have helped create a more intimate community in which programme-level co-learning and networking was easier. Representatives of the other projects were invited to annual project meetings. The larger T2S2 research budget increased opportunities for experimenting with transdisciplinary and other approaches across a wider number of social-ecological issues and settings, and also created a larger community with more critical mass. The programme awarded grants of an average of €950,000 to each project. There were usually four or five partners in each project.

2.3.9 Co-design

In T2S1, seed funding of €30,000 for each of 38 teams enabled consortia to jointly develop full proposals and to extend their partnerships. The seed grants were highly valuable, resulting in many academic outputs, including a special issue of a journal, and other research outcomes (Moser, 2016), and ultimately also producing more mature full proposals in response to the subsequent call for full proposals compared to those which had not been seed grant awardees. All three selected full proposals had originated in a seed grant.

T2S2 projects did not have a seed grant phase, but rather an outline and full proposal process. It seems that T2S2 projects depended largely on existing research partnerships because of the short response time for the call for proposals.

2.3.10 Programme coordination

A well-resourced programme coordination team in T2S1 enabled cross-project learning, community building, dissemination and profile-raising through annual in-person, cross-project workshops with project members (five over five years), other in-person and virtual workshops and capacity building activities, support for joint production of outputs, sessions at conferences and webinars for the wider public, communication and dissemination support through websites and social media, and nomination of T2S researchers for UN and other science-policy processes and consultations.

Programme coordination in T2S2 was more complex as a result of the multilateral nature of the programme. Several funding partners contributed significant in-kind support for the programme through staff time for various coordination tasks, and all partners contributed to a common pot to fund certain essential coordination elements, including cross-project interaction and communications support. However, it was decided by the partners at the outset not to invest in a scientific coordination position, but rather to maximize the research funding. The funds available to convene in-person cross-project meetings were also proportionally significantly lower than for T2S1. In the event, the COVID-19 pandemic disrupted T2S2 to the extent that there were no in-person meetings between the kick-off and the final meeting, four years apart. However, many virtual meetings and events were held.

2.3.11 Capacity development

T2S1 included a skill-building component in the annual workshops and funded a research school requested and designed entirely by early career researchers.

Programme-level capacity building opportunities were less prominent in T2S2, not least because of the impacts of the COVID-19 pandemic.

Overall, T2S2 was somewhat less free to experiment with programme design than T2S1 in various dimensions, and this had tangible effects. In T2S1, the Global South (co-)leadership and non-academic involvement brought equity and justice issues to the fore and corrected for imbalances in knowledge production. Cross-project interaction and learning was financially better supported in T2S1, opening important opportunities for epistemic advances beyond the scope of each project. By contrast, T2S2 was funded at nearly four times the level as T2S1, creating greater critical mass, and due to its more specific thematic focus may have offered greater potential for advancing pressing policy questions.

3. Programme outcomes and challenges

The programme design features and considerations outlined in the preceding section seem to have influenced the outcomes of the programmes in the ways suggested below.

3.1 Understanding of transformation processes

Reconceptualization of social transformation and methodological innovation were two important knowledge contributions of the two programmes that were clearly heavily influenced by the interdisciplinary and transdisciplinary approaches. These entailed reframing sustainability problems with multiple stakeholders and envisioning alternative processes and pathways towards more just and sustainable futures.

Some of the most important high-level contributions of T2S1 projects to knowledge about transformation include:

1. **Developing the concept of transgressive learning as a form of transformative and transdisciplinary learning in transformations to sustainability.** This included identifying the qualities and processes of ‘transgressive learning’ that could challenge and transform unjust and unsustainable norms and practices. These were characterized by co-engagement and co-critique, recognition of diversity, ethics and empathy, and reflections on the foundations for building alternative praxis and change.
2. **Developing a resistance-centred perspective on transformation that integrated environmental justice and sustainability considerations.** This entailed integrating scientific and political rigour – that is, engaging in the politics of knowledge praxis and contributing to epistemic justice by aiming to understand and take account of structural and systemic inequities in knowledge production and co-production processes.
3. **Developing action-oriented methodologies and frameworks for transformations to sustainability,** such as the T-learning methodology (T-Learning), the Alternatives Transformation Framework and the Conflict Transformation Framework (ACKnowl-EJ) and alternative pathways to transformation (Pathways). The latter moved beyond understanding sustainability pathways as directions of change to trying to alter those directions, supporting alternative pathways with a commitment to environmental sustainability, poverty alleviation and social justice.
4. **Emphasizing transformation as being concerned with social justice, equality, flourishing and environmental sustainability** through challenging societal norms and conditions of domination, injustice and unsustainability via cognitive and emotional learning, developing models of innovative solutions and learning and acting together in implementing these solutions (Ely, 2021; Lotz-Sisitka et al., 2016; Rodriguez et al., 2023).

5. **The knowledge produced by the T2S1 programme influenced the development of subsequent individual research trajectories** and of major international research initiatives, the research agendas of participating institutions and beyond and the work of some international bodies such as UNESCO (United Nations Educational, Scientific and Cultural Organization).

The T2S2 projects also developed conceptual and methodological innovations, including the following:

1. **Identifying assumptions, structural, socio-cultural (including visual), technical, political-economic, data legitimacy conditions and forces that ought to be addressed** in just and sustainable transformations (e.g., AGENTS, CON-VIVA, Gold Matters, IPACST and Waterproofing Data).
2. **Transformation as involving multi-scale, multi-space (patches of transformation) contestations, dialogue and co-creation** both in the short and long term (e.g., TAPESTRY and TRUEPATH).
3. **Methodological processes for facilitating vital collaborations across natural and social science fields in pursuit of transdisciplinarity**, and more inclusive/grounded futures-oriented methodologies of approaching transformation (e.g., CON-VIVA and H2O–T2S).
4. **How multiple actors, perspectives, praxes and positionalities can together shape transformations to sustainability.** For example, AGENTS found that ‘local knowledge and cultural memory are crucial for sustainability pathways because they maintain flourishing cultural and biological diversity’ (Londres et al., 2023).
5. **Sub-themes in the politics of transformation, which consider the diverse ways in which marginalized individuals, groups and organizations seek to sustain their livelihoods, beliefs and identities**, often in the face of powerful dominant views and practices of the political and economic elites (e.g., TRUEPATH and SecTenSusPeace).

6. The dominant pathways to transformation create organizational and structural lock-ins that undermine place-based identities, wellbeing, mobilities and emancipations.

Both generations of research projects made important progress in advancing research methodologies adapted to studying transformation processes, and both made novel, if incremental progress in understanding the importance of the six ‘transformative cornerstones’ for understanding, governing and intervening in transformation processes. The importance of justice perspectives and the deepening of the critical social science lens on transformations stand out as the key overarching contributions of the programmes.

3.2 Integrated transdisciplinary research partnerships and community building

The T2S1 projects (known as TKNs) brought together academics, practitioners and stakeholders in participatory, equity-sensitive research processes involving South–South and North–South collaborations. Each TKN had to work hard to find a common language and understanding across epistemologically diverse and geographically widely dispersed members. The establishment of durable research partnerships and networks was considered to be one of the most valuable outcomes of the programme, as illustrated here:

Perhaps the most important transformations were the relationships, friendships and collaborations formed. The project was hugely successful in creating generative almost sacred spaces at each of our project meetings as well as the [programme-level] T2S gatherings and Living Aulas. Our gatherings became spaces for playful experimentation, sharing, debate and intimacy. The sense of community was created that was immensely powerful and is already leading to numerous impacts, future projects and joint initiatives. Our early career, PhD and activist researchers, as well as our board members often commented that they had never been in an academic space that operated in such a way.

(ACKnowl-EJ unpublished final project report, 2020, p. 12)

The coordination support of the ISSC/ISC furthermore allowed personal relationships and collaborations to develop across all three TKNs, to the extent that spontaneous cross-project collaboration continued, even after the end of the projects. The enthusiasm and commitment of the early career researchers in all three TKNs were instrumental in this respect.

The composition and approach of the T2S2 research partnerships were quite similar to those of T2S1, although with less direct participation of non-academics as main partners and spread across fewer countries. It may have been easier to coordinate smaller project teams internally, but harder to establish working relationships across all 12 projects. Moreover, because T2S2 received somewhat less coordination and cross-project networking support from the leaner ISC team, and because of the long periods of shut-down during the COVID-19 pandemic, project interactions and cross-project learning were restricted to mostly online/virtual and shorter meetings. The difference in the number and strength of interactions across T2S2 projects compared to the TKNs was palpable to the programme coordinators, and was felt by them to have been an even greater loss because of the potentially much larger community of T2S2 members. At the final programme workshop in Paris in November 2022, several members of T2S2 projects who had not been at the kick-off meeting in 2018 remarked that they felt part of the wider community of T2S for the first time and realized what they had been missing. This suggests that in-person meetings are critical to creating lasting, personal connections and that virtual interaction can complement but not replace face-to-face connection.

The inclusion of societal partners in knowledge co-production had created a greater sense of place, relevance and community and helped the academics gain important insights into the political nature of research and knowledge production partnerships. For example, the GoST project members noted the following:

The political and performative nature of knowledge production also raises questions about the authority, agency and authority asserted in it and consequently about accountability, representativeness and legitimacy of experts who claim to speak for the group. (GoST unpublished final report, 2022, p. 13)

The added value of transdisciplinary research partnerships in T2S1 and T2S2 included the following: (i) intense reflection on researchers' own socio-political positionality, (ii) the broadening of a systems perspective and (iii) non-academic stakeholders' critical questioning of and contribution to research results. These observations from the T2S programmes reaffirm well-established insights on the benefits of transdisciplinary, engaged research in the literature.

3.3 Research capacity for transformative research

The T2S1 fostered the development of transdisciplinary research capacity in various ways. Much of it happened 'naturally,' within the projects, by way of learning-by-doing in co-design and co-production. The projects afforded opportunities to researchers at all career stages to broaden and enhance their skills in transdisciplinary research methods, methodologies and theory development around transformations to sustainability. Capacity development also occurred through the emergence of an early career researchers' network, knowledge exchange and skills-building components in the annual programme-level workshops, and a self-organized, programme-funded research school for early career researchers. T2S1 had privileged involvement of post-docs rather than PhD researchers, but several PhD students achieved their PhDs during or following the end of the projects. Capacity development for early career researchers was rated by programme members as one of the major programme outcomes.

The T2S2 also contributed to researcher capacity development in the learning-by-doing mode within the projects. At programme level, there were fewer occasions and resources for the project members to meet across projects; moreover, the COVID pandemic arrived at the mid-point of the projects. The projects therefore engaged in quite frequent online peer learning and exchange during the pandemic. This itself was a capacity that had to be acquired for both the programme coordinators and the project members. On balance, the online interaction was not as rewarding as in-person opportunities, although some formal training could be delivered very effectively online, such as a science communication workshop for early career researchers. In a 'post-COVID' world in which online interaction and teleworking have become much more common, and the environmental impact of flying is not decreasing, a balance must be struck between in-person and online meetings – between efficiency and community.

The final evaluation of the programme noted that the short duration of the projects (three years, but extended to 3.5 years), made it difficult to bring PhD projects to completion, particularly in transdisciplinary work.

3.4 Changes in research practice

The T2S1 contributed to change in research practice by establishing more equal relations between Global North and Global South partners. Both T2S1 and T2S2 promoted and demonstrated the critical role of social science in transformations to sustainability and social and epistemic justice via transdisciplinary research. In particular, the research programmes contributed to the following changes in research practice:

- Reframing challenges by considering the diverse perspectives, knowledges and power of stakeholders, especially those of the marginalized communities.
- Developing methodological innovations, frameworks and models that recognized and tapped into diverse perspectives and knowledges.
- Establishing trustful and mutually respectful knowledge co-production relationships between academics and societal partners.
- Validating hidden and undervalued types of knowledge and the perspectives and visions of marginalized peoples.
- Developing the capacities and agency of senior, mid and early career researchers and of local partners to jointly design and/or conduct research with diverse stakeholders for the development of new knowledge and potential solutions to complex, context-specific sustainability and justice challenges.
- Influencing the adoption of a participatory and consultative planning processes in policy and decision-making processes at the case level.

3.5 Challenges

The funding conditions produced some similar and some different challenges for the programmes.

- **The short, three-year duration of the research projects:** Transformations are typically lengthy, multiyear, even multidecadal processes. Any short-term research can only capture a snapshot of a transformation process. The ambition to understand the whole of transformations processes (as expressed in the calls for proposals for T2S1 and T2S2) was thus incommensurate with a three-year funding programme. Projects found it difficult not just to complete empirical research and synthesize findings, outcomes and insights given the complexity of the multicase, multicontext comparative, transdisciplinary research; they also were unable to stay engaged in the transformation processes after the formal project, given the high investment in relationship- and trust-building, and the expectations that raises for non-academic research partners.
- **Lack of follow-up funding:** This meant that conceptual insights, prototype methodologies, frameworks and tools could not be systematically tested, replicated, scaled and improved beyond the initial project funding. In addition, as mentioned above, the limited short-term engagement meant difficult expectation management and limited ability to understand transformations processes more fundamentally. One TKN described the discontinuity as ‘scientifically wasteful, politically damaging and ethically questionable’ (Pathways, 2021).
- **Limited cross-project learning in T2S2:** The more limited resources for programme coordination in T2S2 reduced the potential for cross-project learning, which was further exacerbated by COVID 19 and the limitation to short virtual cross-project meetings. Travel and gathering restrictions resulting from COVID-19 (2020 and 2021) constrained fieldwork and data collection, and in-person meetings between the researchers in T2S2. It impacted some intended cross-TKN writing work after the closure of T2S1. Overall, COVID-19 slowed the implementation of research projects in T2S2, changed researchers’ and practitioners’ thinking on key challenges and probably undermined or at least delayed the practical work on transformations (ISC, 2021).

- **Complex financial administration processes:** T2S1 operated with a common pot and distributed funding to one lead institution, which redistributed funds to the other 7–8 project partners around the world. The T2S1 project coordinators reported frustration with the administrative burden related to contracting and fund management across institutions with different currencies, financial systems and practices. T2S2 was in principle simpler, with each country funding its own researchers; however, in practice, receiving European Commission top-up funding creates a funding arrangement which is not necessarily simpler overall, but shifts the main administrative burden onto to the funders rather than the researchers' institutions. In addition, the temporal alignment of multiple national funding process is difficult to achieve.
- **The monitoring and evaluation approach:** The T2S1 programme experimented with 'theory of change' and 'logical framework' approaches and searched mostly for evidence of multidimensional learning among the projects, in a relatively light reporting framework. The T2S2 programme applied a traditional reporting framework with an online reporting interface, but reporting requirements varied according to the respective direct funders of the project members. Both approaches were considered by the projects not to have been particularly helpful for learning. A major reason for this gap was the lack of a theorized approach to evaluation. It should also be noted that neither programme built in a follow-up evaluation/monitoring component.

Despite these challenges, T2S funding provided great and rare opportunities that should not be taken for granted. These include funding international social science-led transdisciplinary research partnerships, which made social science and practitioner knowledge count; and enabling researchers from the Global South and Global North to co-produce knowledge. Co-leadership from the Global South was particularly appreciated in T2S1 because it helped researchers there to contribute knowledge as equal partners.

4. Insights for programme design

The insights relevant to programme design from T2S1 and T2S2 are similar in many ways. This may be attributed to the overlap in their research goals, the common social framing of sustainability challenges and international, transdisciplinary approach, similar funding conditions and programme management approaches. The main differences lie in the degree of Global South and practitioner involvement and programme coordination, which received more attention and resources in T2S1, and the greater thematic focus on governance and economy in T2S2.

The insights from the programmes below are organized around 1) context, 2) funding, 3) people and 4) research practice.

The insights are summarized into four categories and twelve guiding principles for research design, which may be used to inform future research programmes and calls for proposals. The principles take into account comments from programme funders, researchers and members of the coordination team of T2S1 and T2S2 during the reflection workshop held towards the end of 2022. Many of the insights also chime with learning from a comparative analysis of the T2S programmes with the Leading Integrated Research for Agenda 2030 in Africa 2023 programme, also coordinated by the ISC, which are captured in a chapter in the recent *Handbook of Transdisciplinarity: Global Perspectives* (Paulavets et al., 2023).

4.1 Context

1. Research foci emerge from contextual drivers and the interests of funders.

Social-ecological and political/policy contexts as well as the state of knowledge at any given point in time influence the focus of research funding programmes – this is not surprising, and it was very evident in the T2S programmes. The interests and objectives of funders are also constitutive of research programme design and in multi-funder arrangements may align somewhat imperfectly, leading to working compromises.

2. Insights into transformation processes and pathways emerge from studying interactions across multiple scales and over time. Studying transformations to sustainability entails engagement with complexity. Both sets of projects highlighted the need to understand cross-scale interactions in transformation processes, with particular emphasis on local cases and how these are situated within national, regional and/or global contexts, as well as giving attention to cross-sectoral or cross-industry interactions. The need to focus on local cases within their multi-scalar context is seen as particularly important when issues of equity and justice regarding sustainability outcomes are foregrounded (Ely, 2021; Fisher et al., 2022; Lotz-Sisitka, 2022; Fletcher et al., 2023; Londres et al., 2023; Rodriguez et al., 2023). A combination of a cross-scalar lens with a historical perspective is necessary for understanding and potentially influencing transformative change processes and pathways, which are neither smooth nor linear (Brondizio et al., 2021).

History, context and interests

For transformations-focused programmes, designers should pay adequate attention to history, context and the interests and power of stakeholders, as they are a major part of both the problems and the potential solutions. Stakeholders, including funders, also set boundaries on the matters of concern. It is important to be aware of both dominant and less visible histories, contexts and interests, and the tendency of research programming to focus on the visible and dominant, thereby perpetuating unjust power relations.

System and scale

Transformations-focused research programmes should encourage system change at the site level, but also across scales, sectors and structures, conscious of complexity and uncertainty, to be truly transformational.

4.2 Funding

- 3. Flexible funding and governance are required for complex, multilevel, transdisciplinary research programmes.** The T2S programmes underlined the importance of not ‘over-designing,’ that is, of allowing and creating spaces for emergence, learning, consultation and collective decision-making. This entails integrating possibilities and resources for co-design, co-production, outreach, scaling and follow-up activities. In this way, emerging insights, opportunities and challenges can be integrated. Flexible funding is needed to enable adaptation to complex changes – e.g., in conflict-affected areas, under changing legal regimes or during pandemics. Flexible funding needs to be accompanied by a programme governance structure that accommodates and is adaptable to different institutional and national particularities and changes.

Funders as well as funding mechanisms must be flexible enough to accommodate changes that occur during the transdisciplinary research process given its emergent nature, and particularly when research is taking place in countries that are experiencing critical situations (of political, economic or environmental natures), and where activities need to be constantly adapted to changing contexts. Sida and the Belmont Forum and NORFACE funders were generally accommodating in these situations, and the European Commission also showed flexibility within its limits, but ultimately some hard deadlines had to be imposed.

- 4. An appropriately resourced programme coordination unit is essential for supporting cross-project learning and knowledge production and interactions with the wider research community.** International, transdisciplinary research programmes on social transformations are administratively complex and need to be adequately resourced, at programme and project level. This may seem a truism, but it needs to be emphasized in a context in which coordination funds (or ‘glue money’) are difficult to secure. Both at programme level and project level, resources needed for technical and scientific coordination and communications support should not be underestimated or sacrificed, or added value will be lost. Project budgets should include sufficient resources for administrative, financial and communications

support. Training and support for the administration of grant funding in the beneficiary institutions may be needed.

Programme coordination brought a great deal of added value to the projects and the field of research, which was apparent from the difference in resourcing and opportunities between T2S1 and T2S2. Programme coordination was still important in T2S2, but was less well-resourced and from the mid-point of the programme had to contend with the COVID-19 pandemic and the shift to digital-only interaction. Even though the consortium provided a reasonable amount of funding for scientific meetings and dissemination, the lack of a dedicated scientific programme coordinator for T2S2 was finally considered to have weakened the programme and its potential impact.

5. Short research project periods undermine the effectiveness of research

processes. Three years is too short for developing a sustained programme to build understanding of social transformations to sustainability. This is in part due to the length of transformation processes, but also due to the nature of international, comparative, transdisciplinary research where this capacity is not already established. It takes significant time to accomplish (i) complex contracting processes across different institutional financial management practices, (ii) project co-design, (iii) conducting empirical work as part of the social science work required to generate necessary information and evidence, (iv) building researcher capacity and agency and (v) reflecting on and communicating the emerging knowledge. Lack of follow-up funding undermines impact by not enabling the testing, improvement and wider application of conceptual insights, new methodologies, frameworks and tools. This fails to meet the expectations of research communities and stakeholders and is potentially counterproductive.

Generally, there is a need for a shift in research and capacity building funding from short-term and project-based models to a more sustained long-term process to allow for the synthesis and testing of or application of knowledge on sustainability, for development of theory and for continuity of engagement with communities. This would allow for more cross-case and cross-project analysis and ultimately stronger theoretical contributions to knowledge (as opposed to methodological or praxis-

based contributions). Research proposals should include reflection on the ‘exit strategy’ – how they plan to wind up the collaboration with communities after the project ends.

Research coordinators must also factor in time after the programme to track and follow up on and support outputs and outcomes.

- 6. Research funding for Global South researchers as equal partners in international research helps them directly contribute to global knowledge and structurally rectify epistemological injustices.** Historically, the Global South has contributed less to global knowledge on transformations to sustainability partly due to resource constraints. The T2S1 funding conditions, which included (co)leadership from the Global South, demonstrated that funders have a crucial role to play in correcting the conditions under which Global South researchers can equally contribute to producing global knowledge on transformation.

- 7. Funding for non-academic research partners is critical to enabling them to make a meaningful contribution.** Current academic research funding systems generally cannot finance the participation of non-academic participants, which severely curtails their capacity to contribute to research, and therefore for transdisciplinary research to be realized. The T2S1 programme enabled non-academic partners to be financed for their participation, which changed the power dynamics in the knowledge partnerships. There is a need for more funding that is inclusive of or directly targeted at the Global South and at non-academic partners, to foster more equitable relationships between partners and to counteract the risk of supporting ‘extractive research’ dominated by Northern academic traditions.

8. Monitoring, evaluation and learning approaches in transdisciplinary research programming need innovation. It is well discussed in the literature that conventional research evaluation approaches are not well adapted to transdisciplinary research. Neither T2S1 nor T2S2 approaches to monitoring, evaluation and learning, at programme or project level, were innovative, although both had positive features. Research programming needs to experiment and innovate more to get the most out of the opportunities for reflexivity and learning provided by transdisciplinary research, without imposing disproportionate reporting burdens.

Targeted, long-term and adaptive programming and funding

Programme design should aim to enable programmatic reflexivity, learning and adaptive flexibility, *in the long term*, to accommodate experimentation, emergence and the unpredictable challenges and opportunities of doing transdisciplinary research, particularly in the domain of social transformation. Dedicated funding for programme and project coordination and for research and infrastructure in the Global South and for the participation of non-academic partners, is essential.

4.3 People

9. Interdisciplinary and transdisciplinary research with a social framing enhances collaboration and can empower marginalized groups. Working in research teams that bring together individuals from different countries, disciplines, groups of practice and sectors of society creates the conditions for different knowledges, perspectives and interests to interact and increases the chances of developing a more complete and nuanced understanding of any challenge, as well as more widely acceptable and feasible solutions. Transdisciplinary research on transformations to sustainability pays attention to the underlying social dimensions of sustainability challenges and integrates marginalized social groups and voices, drawing on their relatively invisible, alternative imaginaries and practices. This can help to contest, break or subvert unjust and unsustainable dominant pathways; reveal and amplify previously hidden alternative pathways; or shape new, recombinant pathways, within the context of epistemological plurality, social justice

and environmental sustainability. These are well-established benefits of transdisciplinary research, and were confirmed in the T2S programmes.

10. Capacity building is transformation. The process and outcomes of capacity development activities in the T2S programmes suggest the importance of facilitating intergenerational learning. Researchers develop emotionally and cognitively while also expanding their spheres of influence and contributing to societal change. Capacity building and empowerment are essential parts of the transformation process, as they result in enhanced abilities to understand, see, participate in and catalyse transformation. Thus, embedding capacity building as a core part in transdisciplinary research programmes enhances the programmes' transformative outcomes.

It was also clear from both programmes that the skills required for transdisciplinary research need to be continually tested, developed for and adapted to context. Knowledge exchange, training and capacity building activities should be an integral part of any transdisciplinary research funding programme, and particularly, but not only, for early career scientists.

Building capacity for co-production

Interdisciplinary and transdisciplinary research with a social framing is fundamental to advancing co-produced and comprehensive understanding of and practice for transformation. Greater collaboration across the social and natural sciences is needed, as well as greater recognition of and ability to work with different kinds of knowledge.

It is important to offer opportunities for co-design of research proposals and for fostering skills for transdisciplinary work in the early stages of a programme. Co-design is a difficult process, especially with new partners, and it is important to ensure that research programme design provides enough time and support for this critical step. The skills required for transdisciplinary research need to be continually tested, developed for and adapted to context. Knowledge exchange, training and capacity building activities should be an integral part of any transdisciplinary research funding programme, and particularly, but not only, for early career scientists.

4.4 Research practice

11. Transformative research involves a transformation in knowledge production.

Transformations research intends to produce not only new knowledge (in concepts and processes) but also to contribute to the transformation of the social-ecological and epistemological conditions that are unsustainable and unjust. This was seen in the research approach, process and outcomes of the projects. The T2S projects showed that transformation entails reframing of sustainability and justice challenges, which lays the basis for reframing transformation concepts, frameworks, methodologies, pathways and solutions based on multiple, interacting perspectives and knowledges. This is conducted in a process of politicizing and pluralizing transformation. Research programming for transformations to sustainability should aim to accommodate and support action- and justice-oriented, transdisciplinary research.

12. The role of the researcher is not just technical/academic but also political.

Transformations to sustainability research requires researchers not to see themselves as academics who possess more or superior knowledge than non-academics, and rather to be reflexive researchers and change agents. The ethics of doing 'care-full' research requires the researcher to practice political rigour, which entails engaging in difficult conversations with the community to understand the structural and systemic issues they face and enable them to engage with them more effectively. At the same time, the researcher's positionality shapes the roles and influence they might have in a transformation process. In a transdisciplinary role, researchers may add significant value by contributing directly to the governance of transformation processes as facilitators (trying to level the playing field or to create or support 'safe spaces' for participation), catalysts (trying to speed-up ongoing processes or support active resistance movements) or change agents in a political process aiming at deliberate transformation (Bastiaensen et al., 2021). These researcher roles come with different kinds of power, which is linked to the researcher's perspectives and values, which can either enable or constrain the visibility of certain imaginaries and practices in transformation processes. The imaginaries and practices that are made visible inform the building of new

authoritative knowledge providing legitimacy and guidance to collective knowledge co-production efforts.

Outcome and process: Frame both outcome and process purposes for a research funding programme, because both have implications for sustainability and social justice.

Contribution: Design research programmes that produce not just context-specific thematic, theoretical or methodological advances but that also contribute to wider and just transformational processes within science and multiple fields of study.

There are particular pressures on transdisciplinary researchers to produce both traditional academic outputs *and* outputs targeting and serving non-academic partners and publics; and this moreover in an increasingly digital world. Many T2S researchers reported spending significant amounts of time producing or co-producing non-academic outputs that were not formally recognized or valued by their institutions, although encouraged and expected by the T2S programme funders. Many also reported needing support to produce non-traditional and more diverse forms of outputs and to make these seen using new and digital media.

5. Conclusions

The funders of the two T2S programmes have made a significant contribution to generating knowledge for transformations to sustainability that should not only be commended but should also be built on and expanded. The two programmes offer important insights into the effects of programme design features that point to the need for the following:

- Sustained, long-term funding for transdisciplinary transformations to sustainability research;
- Dedicated funding for Global South research leadership;
- Space for learning and capacity building between academic and non-academic communities, between generations and between places.

Care should be taken to learn from innovative funding programmes and to adjust them, rather than to revert to traditional models, especially in contexts where rapid learning is essential, such as in the face of existential challenges. At the same time, patience is needed for the application of learning about transformations to sustainability, which may unfold slowly and silently.

Innovation in research funding building on the T2S experience could help make a huge difference for science and for urgently needed social transformation processes. Science could play a much more significant role if funders would support science to unleash its power in collaboration with its societal partners. Funders require both the commitment and courage to create common pools of transdisciplinary research funding that incentivizes researchers and science systems to produce societally relevant and usable knowledge (ISC, 2021b).

References

- Bastiaensen, J., Huybrechs, F., Merlet, P., Romero, M. and Van Hecken, G. 2021. Fostering bottom-up actor coalitions for transforming complex rural territorial pathways. *Current Opinion in Environmental Sustainability*, Vol. 49, pp. 42–49.
- Boehm, S., Jeffery, L., Levin, K., Hecke, J., Schumer, C., Fyson, C., Majid, A., Jaeger, J., et al. 2022. *State of Climate Action 2022*. Berlin and Cologne, Germany, San Francisco, CA, and Washington, DC, Bezos Earth Fund, Climate Action Tracker, Climate Analytics, ClimateWorks Foundation, New Climate Institute, the United Nations Climate Change High-Level Champions and World Resources Institute. <https://doi.org/10.46830/wrirpt.22.00028>.
- Brito, L. and Smith, M. S. 2012. 'State of the Planet Declaration', Planet Under Pressure: New Knowledge Towards Solutions Conference, London, 26–29 March 2012, https://council.science/wp-content/uploads/2017/08/state_of_planet_declaration.pdf
- Brondizio, E., Andersson, K., de Castro, F., Fudemma, C., Salk, C., Tengö, M., Londres, M., Tourne, D., et al. 2021. Making place-based sustainability initiatives visible in the Brazilian Amazon. *Current Opinion in Environmental Sustainability*, Vol. 49, pp. 66–78.
- Ely, A. (ed.) (2021). *Transformative Pathways to Sustainability: Learning Across Disciplines, Cultures and Contexts* (1st ed.). Routledge. <https://doi.org/10.4324/9780429331930>
- Fazey, I. et al. 2018. Ten essentials for action-oriented and second-order energy transitions, transformations and climate change research. *Energy Research & Social Science*, Vol. 40, pp. 54–70.
- Fisher, E., Brondizio, E. and Boyd, E. 2022. Critical social science perspectives on transformations to sustainability. *Current Opinion in Environmental Sustainability*, Vol. 55, <https://doi.org/10.1016/j.cosust.2022.101160>.
- Fletcher, R. Massarella, K., Ferraz, K., Kiwango, W., Komi, S., Mabele, M., Marchini, S., Nygren, A., et al. 2023. The production-protection nexus: How political-economic processes influence prospects for transformative change in human-wildlife interactions. *Global Environmental Change*, Vol. 82. <https://doi.org/10.1016/j.gloenvcha.2023.102723>

- Future Earth. 2013 *Future Earth Initial Design: Report of the Transition Team*. Paris: International Council for Science (ICSU).
- GoST project. 2022. Final report. Unpublished.
- Government of Sweden. 2016. Government Communication 2016/17:60. *Policy framework for Swedish development cooperation and humanitarian assistance*. Stockholm: Sweden.
- Griggs, D. J., Nilsson, M., Stevance, A. and McCollum, D. (eds.) (2017). *A Guide to SDG Interactions: From Science to Implementation*. Paris, ICSU.
- Haraway, D. (2016). *Staying with the Trouble: Making kin in the Chthulucene*. Durham, NC: Duke University Press.
- International Science Council. 2021a. *Transformations to Sustainability programme: Annual report 2020*. Unpublished.
- International Science Council. 2021b. *Unleashing Science: Delivering Missions for Sustainability*, Paris, France, International Science Council.
- ISSC. 2012. The Transformative Cornerstones of Social Science Research for Global Change. Paris, International Social Science Council. pp. 16–22.
- ISSC/UNESCO. 2013. *World Social Science Report 2013: Changing Global Environments*. Paris, OECD Publishing and UNESCO Publishing.
- Leach, M., Scoones, I. and Stirling, A. 2010. *Dynamic Sustainabilities: Technology, Environment, Social Justice*. London, Earthscan.
- Londres, M., Salk, C., Andersson, K., Tengö, M., Brondizio, E., Russo Lopes, G. Siani, S., Molina-Garzón, A., et al. 2023. Place-based solutions for global social-ecological dilemmas: an analysis of locally grounded, diversified and cross-scalar initiative in the Amazon. *Global Environmental Change*, Vol. 82. <https://doi.org/10.1016/j.gloenvcha.2023.102718>
- Loorbach, D., Frantzeskaki, N. and Avelino, F. 2017. Sustainability transitions research: transforming science and practices for societal change. *Annual Review of Environment and Resources*, Vol. 42, pp. 599–626.
- Lotz-Sisitka, H. B., Belay Ali, M., Mphepo, G., Chaves, M., Macintyre, T., Pesanayi, T., Wals, A., Mukute, M., et al. 2016. Co-designing research on transgressive learning in times of climate change. *Current Opinion in Environmental Sustainability*, Vol. 20, pp. 50–55. <https://doi.org/10.1016/j.cosust.2016.04.004>

- Lotz-Sisitka, H. B. 2022. Transformative, transgressive, transdisciplinary and together: Elaborating the nature of transformative learning in transformations to sustainability. Draft unpublished article.
- Massarella K., Nygren, A., Fletcher, R., Buscher, B., Kiwango, W. A., Komi, S., Krauss, J. E., Mabele, M. B., et al. 2021. Transformation beyond conservation: how critical social science can contribute to a radical new agenda in biodiversity conservation. *Current Opinion in Environmental Sustainability*, Vol. 49, pp. 79–87.
- Moore, J. W. 2016. (ed.) *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism*. Oakland, CA, PM Press.
- Moser, S. 2016. Can science on transformation transform science? Lessons from co-design. *Current Opinion in Environmental Sustainability*, Vol. 20, pp. 106–115. DOI:10.1016/j.cosust.2016.10.007
- Olsson, P., Galaz, V. and Boonstra, W. J. 2014. Sustainability transformations: a resilience perspective. *Ecology and Society*. Vol. 19, p. 1.
- Pathways. 2021. Pathways Knowledge Network follow-up report. Unpublished.
- Paulavets, K., Moore, S. and Denis, M. (2023). 'Advancing transdisciplinary research in the Global South', in Lawrence, R. (ed.), *Handbook of Transdisciplinarity: Global Perspectives*. Edward Elgar Publishing.
<https://doi.org/10.4337/9781802207835.00027>
- Raworth, K. 2012. A safe and just space for humanity: Can we live within the doughnut? Oxfam Discussion Papers. Oxford, Oxfam GB.
- Rodriguez, I., Temper, L. and Walter, M. (eds.). forthcoming. *Just Transformations: Grassroots struggles for alternative futures*. Pluto Press.
- Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O. and Ludwig, C. 2015. The Trajectory of the Anthropocene: The great acceleration. *The Anthropocene Review*.
- Temper, L. and Del Bene, D. 2016. Transforming knowledge creation for environmental and epistemic justice. *Current Opinion in Environmental Sustainability*, Vol. 20, pp. 41–49.
- University of Oslo. 2013. Proceedings of Transformation in a Changing Climate, 19–21 June 2013, Oslo, Norway, University of Oslo.

Appendix

Research projects funded under the T2S programmes

T2S1 Transformative Knowledge Networks

Academic-Activist Co-Produced Knowledge for Environmental Justice (ACKnowl-EJ)

Ten case studies in Argentina, Bolivia, India, Venezuela, Lebanon, Turkey, Belgium and Canada

Transformative Pathways to Sustainability: Learning across disciplines, contexts and cultures (Pathways)

Six regional hubs working in three pairs of similar sustainability challenges: Argentina–UK (agriculture/food systems), Mexico–India (water and waste) and Kenya–China (energy resources). A seventh project member was based in Sweden.

Transgressive Social Learning for Social-Ecological Sustainability in Times of Climate Change (T-Learning)

12 cases in nine countries: Colombia, Ethiopia, Malawi, South Africa, Zimbabwe, India, Vietnam, Sweden and Netherlands.

T2S2 Projects

AGENTS: Amazonian Governance to Enable Transformations to Sustainability

Brazil, Bolivia and Peru

CON-VIVA: Towards Convivial Conservation: Governing Human–Wildlife Interactions in the Anthropocene

USA, Finland, Brazil and Tanzania

Gold Matters: Sustainability Transformations in Artisanal and Small-scale Gold Mining: A Multi-Actor and Trans-Regional Perspective

Brazil, Burkina Faso, French Guiana, Ghana, Guinea, Suriname and Uganda

GoST: Governance of Socio-technical Transformations

Kenya, India, UK, USA and Germany

H2O-T2S: Water and Transformation to Sustainability in Urban Fringe Areas

India

IPACST: The Role of Intellectual Property to Accelerate Sustainability Transitions

Germany, UK, Sweden and India

MISTY: Migration, Transformation and Sustainability

Bangladesh, Ghana, Mozambique, Belgium, Netherlands and USA

SecTenSusPeace: Securing, Sustainable Peace? The challenges of localizing land registration in conflict-affected countries

Burundi and the Democratic Republic of Congo (DRC)

T2GS: Transformations to Groundwater Sustainability: joint learnings from human-groundwater interactions

Algeria, Chile, India, Morocco, Peru, Syria, Tanzania and USA

TAPESTRY: Pathways to Sustainability in Marginal Environments: responding to climate change uncertainties in marginal environments in South Asia

India and Bangladesh

TRUEPATH: Transforming Unsustainable Pathways in Agricultural Frontiers: fostering bottom-up actor coalitions for transforming complex rural territorial pathways

Nicaragua

Waterproofing Data: Engaging Stakeholders in Sustainable Flood Risk Management for Urban Resilience

Brazil, Germany and the UK