

Advancing transdisciplinary adaptation research practice

Transdisciplinary research is increasingly seen as critical for advancing climate change adaptation. Operationalizing transdisciplinary research in the global South, however, confronts ingrained cultural and systemic barriers to participatory research.

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As we face an unprecedented planetary crisis¹, we must urgently scale up our capacity to adapt to climate change impacts (Fig. 1). Any attempt to address the climate emergency requires well-coordinated collaboration between the scientific, policy and social domains². Planning for climate change adaptation, however, often requires information and knowledge granularity that are not always available for the specific local context³. Decision-making processes addressing weather and climate-related disasters need to account for complex urban and rural contexts⁴. This presents challenges because there is a time lag between policy needs and the urgency of the corresponding response and the generation of robust climate change information and knowledge³. Transdisciplinary research, a type of research guided by overarching conceptual frameworks that transcend disciplinary siloes⁵ through mutual and joint learning processes⁶, has been identified as a potential avenue to bridge the temporal and knowledge gaps hindering adaptation because it enables the integration of knowledge from different disciplines and social actors⁷.

The impacts of climate change are not evenly distributed, with less-resourced communities and governments in both the global North and South already bearing the brunt of recent extreme weather events^{1,8,9} and reaching adaptation limits^{10,11}. Transdisciplinary research can aid by improving the understanding of the local context on the basis of local communities' knowledge and experiences and supporting collaborative solutions to manage adaptation constraints at the local scale. It can also strengthen the local adaptive capacity by creating opportunities for less and well-resourced as well as smaller and larger inter- and intra-jurisdictions to share tacit and local knowledge, expertise and data to better inform and design adaptation decisions¹⁰.

However, decisions occur within political settings, which have recently led the climate agenda, and the scientific agenda more specifically, to lose traction in various countries, including those in the global South¹². Additionally, climate change is abstract for the general public: it is often seen as a global and long-term issue rather than a local and immediate priority, and its inherent uncertainties cause mistrust¹³. Because transdisciplinary research aspires to strengthen the science–policy–society interface¹⁴, it may also contribute to the restoration of society's trust in science and inform decisions hampered by climate science uncertainty^{13,15}.

While a number of general barriers to transdisciplinary research processes have been identified in the literature¹⁶, the discussion of and reflection upon other ingrained cultural and systemic barriers is less prominent^{17,18}. These include colonization legacies that still shape social relationships in many countries, especially in the global South^{16,19}. For example, while transdisciplinary research has been seen as a process that promotes the inclusion of different perspectives and sources of knowledge and as important for achieving transformative pathways for climate adaptation³, the dominant scientific, technological and innovation discourses in some countries follow a deeply rooted hierarchical and technocratic process.

Like other colonized countries, Brazil has inherited a political culture in which authoritarian government positions in combination with political clientelism have led to a resistance to public engagement in policy-making. This extends to the scientific community and underpins its reluctance to reduce its autonomy through collaborating with or responding to the needs of societal groups that lie outside of the academic community²⁰. Recently, changes in the national political scene further challenged the place of science



Fig. 1 | Inundation of the waterfront on a sunny day in Santos, São Paulo. The port city of Santos was one of the first Brazilian cities to develop a local climate change adaptation plan. Santos is also a leader in the resilient cities project, which aims to share data and expertise to better understand the impacts of climate change at the local level. Credit: Santos Civil Defence.

in Brazilian society, which led to a confrontation between Brazilian researchers and the anti-science movement²¹. It also reinforced debates around the country's deeply entrenched colonial tradition, which, for a long period of time, was contrary to freedom of thought and restricted higher education opportunities to small parts of the elite whilst supporting simplistic and dualistic debates around research funding and outputs²². As the Brazilian scientific community struggles to engage with the wider society, it unintentionally reproduces perverse hierarchical colonial practices and further disempowers already disadvantaged social groups, which is especially concerning given that climate change impacts also exacerbate social inequalities.

This context reinforces the need for the research community to rethink their academic traditions and perhaps embrace transdisciplinary research more widely in the quest to help solve urgent societal problems. We stress that real solutions

concerning climate change adaptation also depend on how a pluralistic society is represented in the research context itself. We thus suggest five areas for further consideration to create a non-elitist, inclusive research tradition more aligned and conducive to transdisciplinary research to advance climate change adaptation in Brazil and other countries confronting similar political and cultural contexts.

New evaluation criteria

Typically, Brazilian funding agencies tend to promote traditional research approaches and evaluate research bids primarily on the basis of traditional research outputs (for example scientific papers). They are usually less likely to positively evaluate projects that make an extra effort to incorporate science outreach activities and engage non-academic actors in the co-production of actionable knowledge. Additionally, the highly competitive nature of available funding schemes, especially in times of crisis and economic austerity, means that successful bids are often awarded to large research groups and well-established consortia, with a bias toward traditional approaches rather than transdisciplinarity²³. When assessing proposals for transdisciplinary research, funding agencies should therefore develop and apply specific evaluation criteria that recognize the experience of the team beyond scientific publications or advanced academic degrees and instead evaluate the engagement of multiple disciplines and non-academic actors, as well as the potential societal impact.

Diversify assessment panels

Evaluation committees may not be diverse enough to represent the differing epistemologies, ontologies and research methods used in transdisciplinary research projects. This results in confusion among researchers over terminologies and concepts and in inconsistencies between what is required by local funding agencies and what researchers can deliver. Hence, panels assessing transdisciplinary research proposals need to include academic and non-academic members with experience in this type of research and ensure that the members reflect the multicultural society that researchers will influence and work with.

Address power imbalances

Transdisciplinary research in Brazil is usually funded by international agencies, with very little funding from local agencies. Despite the well-intended efforts of those agencies to promote transdisciplinary research in the global South, their impact on the ground is still limited and tends to

favour well-established research institutions. For example, two large-scale programs (Large-Scale Biosphere and Atmosphere Experiment in Amazonia (LBA) and La Plata River Basin Experiment (LPB)) promoted international collaboration among the Amazon and La Plata basin countries to further develop research related to the natural sciences and human dimensions of global change. While many publications and some policies were produced by these programs, they mostly benefited research communities in Brazil (LBA) and Brazil–Argentina (LPB). In Brazil, most of the research groups involved in the LBA were from universities and research centres outside Amazonia, with only a few from Amazon-based institutions in the states of Pará, Amazonas and Acre. Institutions from other countries comprising the Amazon region had even less representation. The impact of these programs on local research capacity was also limited, with many post-graduate students completing their studies in universities in São Paulo, the USA and Europe and often not returning to work in their places of origin. International research funding schemes supporting this type of research therefore need to pay greater attention to local and regional power imbalances²³ to contribute to the creation of future opportunities for less established research institutions and actors.

Support early career researchers

Transdisciplinary research work is not part of the curriculum in most universities in Brazil and is often seen as a skill to be developed later in life. To address this gap in research skills, especially in earth system science, early and consistent opportunities for students to conduct transdisciplinary research (for example in research methods courses) is required. This is important both for students who will pursue an academic career and for those who will go on to become practitioners in the public and private sectors.

There is also a need to invest in training for future professionals to develop their communication skills so that the environmental agenda can involve and be effectively translated and disseminated to society. Universities and research institutions can support this by providing suitable physical, financial and organizational infrastructure for dissemination and by promoting more activities that bring scientists and society closer together.

Learn from past experiences

While they are rare, there have been transdisciplinary research initiatives in Brazil focused on climate change

adaptation that could inspire future work. For example, the METROPOLE project²⁴ involved collaboration between scientists from various institutions and stakeholders from the coastal city of Santos. The project was ‘adopted’ by the city’s practitioners (for example municipal managers and policy makers from the environment and civil defence departments) and provided a platform for knowledge co-production. This collaboration remained active for years after the project ended and enabled the city to advance its adaptation agenda to include sea level rise.

Another example is Adapta Sertão^{25,26} — a community-based adaptation initiative that supported small scale farmers in the semiarid region of northeast Brazil. Created in 2006, the initiative targeted small-scale farmers in the State of Bahia and aimed to identify technologies and strategies that could make family farming more resilient and better prepared to respond to droughts. It involved directly engaging the local communities to disseminate and replicate technologies and strategies. While METROPOLE and Adapta Sertão may be local-scale initiatives, they are inspirational because they broke with traditional research approaches and created participatory processes that continued beyond the project’s lifespan. They thus provide useful frameworks for designing successful transdisciplinary projects.

In summary, climate change adaptation requires greater interaction between actors from science, policy-making and civil society to address specific local issues and to avoid entrenching social inequalities and disempowering less-resourced, disadvantaged communities. To enable this, many academic communities in the global South must acknowledge and overturn their colonial legacy by developing their own form of transdisciplinary research that accounts for the intrinsic local political and cultural context. Such practices need to be supported by national and international funding agencies to make transdisciplinary research opportunities more widely available. □

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Competing interests

The authors declare no competing interests.