

EVALUATING TRANSDISCIPLINARY APPROACHES

Hosted by the

BELMONT
F O R U M

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WHAT IS THE PURPOSE OF THIS DOCUMENT?

Transdisciplinary (TD) approaches to research and innovation can transform policy, perspectives, and behavior to directly address or build capacity towards meeting global challenges. The number of science-based organizations investing in TD research is growing. Sustained support for this work requires clear and effective communication about its potential impact to a variety of stakeholders, including funders and policymakers. Capturing and communicating the full impact of these projects requires a new approach to evaluating them. This document compiles the results of a workshop that was convened to develop such an approach. The recommendations generated, including approaches and indicators for evaluation, are summarized on pages 9–10.

WHY USE TRANSDISCIPLINARY RESEARCH?

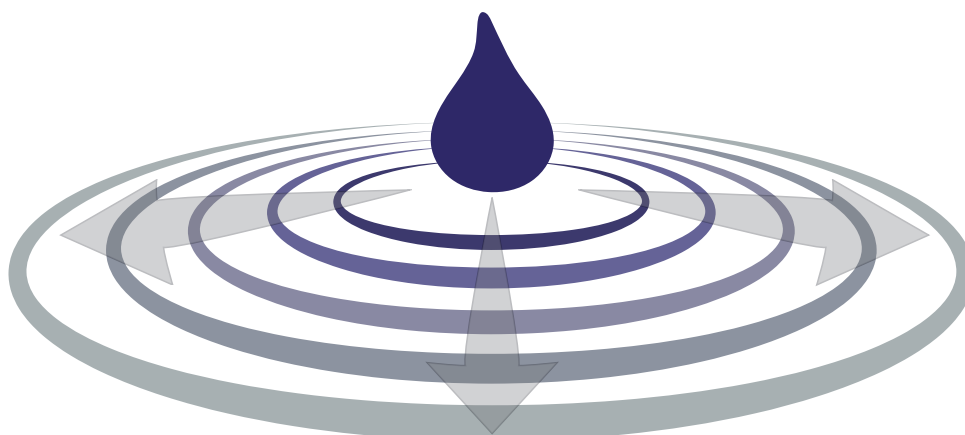
Transdisciplinary research involves trans-sector participation of stakeholders in both research on complex problems and implementation of solutions. This typically involves multiple disciplines, fields, and professions in teams that co-design research, co-produce solution-oriented knowledge, and integrate that knowledge into strategies for problem-solving and the development of new scientific insights.

Definition based on: Bammer et al., Expertise in research integration and implementation for tackling complex problems: when is it needed, where can it be found and how can it be strengthened? Palgrave Communications 2020, 6, 5. doi:10.1057/s41599-019-0380-0.

Transdisciplinary research addresses local and global problems by bringing together knowledge from different disciplines and stakeholders—both those affected by the problem and those in a position to influence action on the problem. The aim of TD research is to develop innovative approaches, assisting the development of effective policy and practice changes.

An effective transdisciplinary project acts like a water droplet that creates a ripple effect in a body of water. The project legacy that ripples out from a transdisciplinary project includes:

- **learning** achieved at both individual and project levels,
- **practices** employed and skills developed by project participants,
- **policies** that are generated from the project,
- **products** from the project, and ultimately,
- societal **transformations** that result from the transdisciplinary project.



**TRANSDISCIPLINARY
PROJECT**

LEARNING

PRACTICES

POLICIES

PRODUCTS

TRANSFORMATIONS

COMMON GOALS FOR TRANSDISCIPLINARY RESEARCH

The TD research process generates actionable knowledge that can help **address problems** at local and global levels. It generates diverse, collaborative strategies on these challenges by helping individuals, policy-makers, and communities make **informed decisions**. This can lead to **positive change** in multiple ways, including by **transformed governance**.

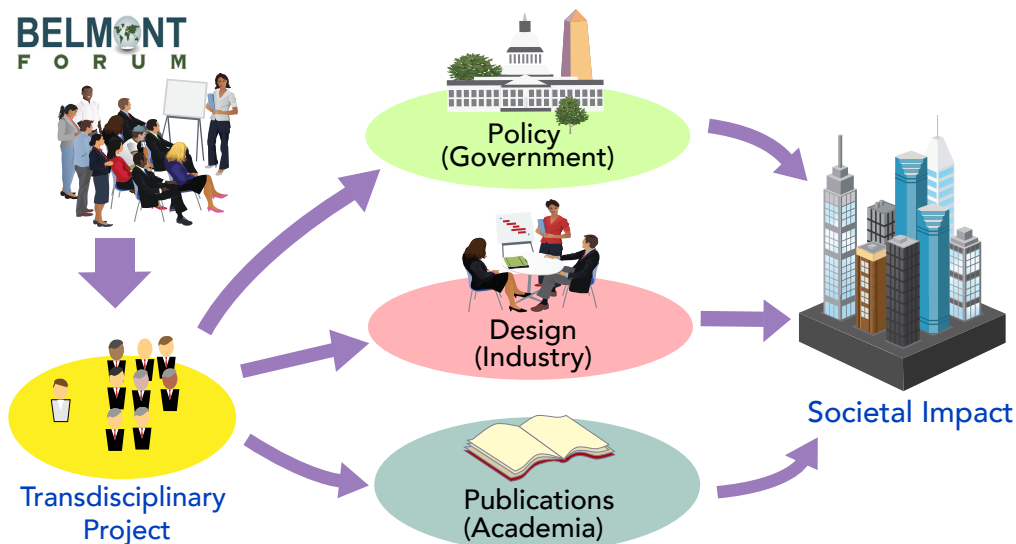
Within the realm of science, TD research aims for **inclusivity**, engaging stakeholders in all parts of the process. This encourages **new paradigms** in the way science is approached and practiced. Additionally, TD practitioners strive to follow **F.A.I.R. data practices**: they ensure that the data they generate is **F**indable and **A**ccessible by others, that it is **I**nteroperable, and **R**eusable by multiple researchers.

Why and when would you use transdisciplinary approaches?

- Complex problems that involve contentious issues benefit from TD approaches
- When stakeholder engagement is crucial for reaching consensus, a TD co-design, co-production approach is useful
- Issues that affect people from multiple disciplines and life experiences with different values and knowledge types are best addressed with TD approaches

When would you not use transdisciplinary approaches?

- Simple problems that are not contentious can be addressed with single disciplinary expertise without significant stakeholder engagement
- Co-development with researchers and stakeholders requires significant resources (e.g., time and money), and should only be used when needed
- The inability to form trusted relationships between researchers and stakeholders may preclude successful TD approaches



The Belmont Forum provides funding for transdisciplinary research in which researchers and stakeholders co-design and co-produce various projects that have societal impacts. Outputs can include a) policy documents and recommendations for government agencies and elected officials, b) designs for commercial or industrial use, and c) journal publications and book chapters for academic dissemination.

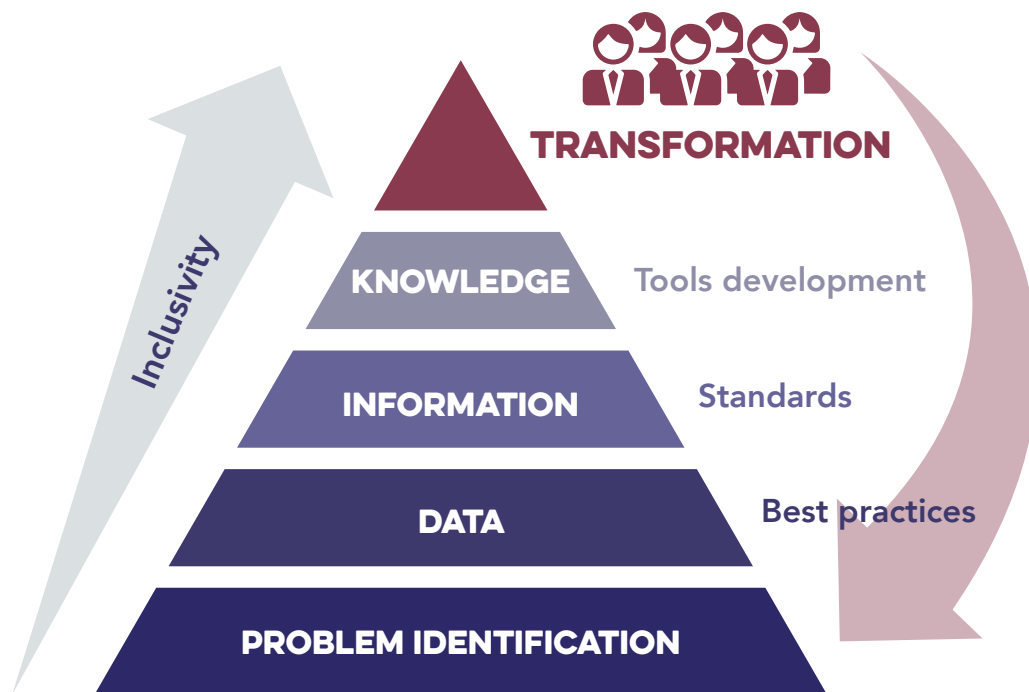
CHALLENGES TO THE TRANSDISCIPLINARY RESEARCH PROCESS

Decision-making must recognize the geographic and social context in which the decisions are made. But research, data, and information for decision-making are often driven by funding mechanisms that support single-disciplinary approaches. These siloed approaches may not allow for consideration of the full context of decision making environments, and are inadequate for the non-linear changes associated with the complex problems of the 21st century that have not been solved by traditional approaches. To make systematic transdisciplinary decision-making a reality, a new cadre of researchers, as well as officials, executives and other decision-makers, will need to be schooled in systems-based modes of inquiry and work, underpinned by transdisciplinary research.

Transdisciplinary research can inform decision-making using systems thinking, collective problem identification, and the development of ways forward that recognize direct and indirect consequences, trade-offs, and broader return on investment. Similarly, decision-making must be crafted so that it includes co-design, co-production, co-leadership, and is able to adapt to changing conditions and interim research outcomes. Effective partnerships require a) clear communication, b) appropriate scaling, c) trusted relationships, and d) receptive audiences.

Transdisciplinary research is underpinned by FAIR and open data (see previous page). This policy was adopted by the Belmont Forum to: widen access to data and promote its long-term preservation in global change research; help improve data management, use and reuse, and foster new data literacy; coordinate and integrate disparate organizational and technical elements; fill e-infrastructure gaps; and share best practices.

Wilkinson, M. D. et al. *The FAIR Guiding Principles for scientific data management and stewardship*. *Sci. Data* 3:160018 doi: 10.1038/sdata.2016.18 (2016).



Transformation— affecting change—is realized through the use of transdisciplinary approaches. Those impacted by the successful implementation of such a process can replicate this approach in other (new) problems.

EVALUATING TRANSDISCIPLINARY RESEARCH

Transdisciplinary research and action can transform governance and create substantial positive change. However, transformational change can often take a long time to manifest and can be hard to attribute to any one research effort, making it difficult to evaluate transdisciplinary processes. To address these evaluation challenges, evaluators can use mixed methods and longitudinal analysis, and analyze case studies of past transformations. Projecting outcomes across time requires new evaluation techniques to measure the added value of transdisciplinary research and contribution to social learning. Evaluating transdisciplinary efforts has additional challenges because constituent disciplines have specific sets of metrics, and because it is difficult to develop indicators that can attribute synergistic impacts to transdisciplinary. Three broad approaches are highlighted to address these issues:

1. A selective approach that applies to themes that are evaluated, such as looking at the effectiveness of mentoring approaches in facilitating the next generation of TD research professionals.
2. Developing indicators for particular TD efforts on an ad hoc basis, such as through an expert panel to collectively define the relevant indicators.
3. Ensure funding for TD project evaluation, either programmatically, such as where there is a grant that develops the overarching evaluation of the other projects, or at the project level, with a predetermined percentage of the project budget set aside for evaluation.

Advantages to evaluation

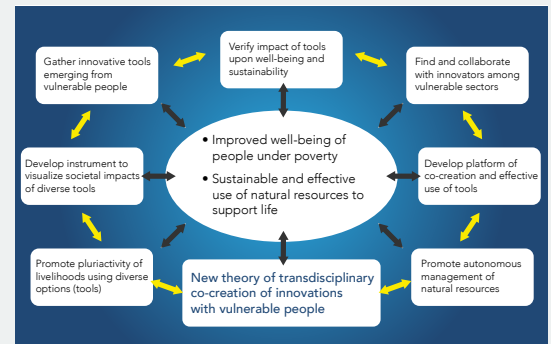
A critical imperative is to design a deliberative framework for monitoring and evaluating impacts of transdisciplinary research, and to distill best practices that can be integrated into TD efforts to optimize societal impact goals. Well-designed operating, monitoring, and evaluation procedures in transdisciplinary research can be used to:

- Help funders allocate resources in ways that maximize returns on investments
- Ensure project quality from inception and provide continuous systematic feedback on progress toward goals
- Confirm relevance of research activities to global sustainable development
- Increase research visibility and bolster impact
- Strengthen stakeholder engagement and collaboration, fostering effective innovation and program delivery
- Inform decisions and actions to optimize stakeholder ownership and engagement
- Enhance exchange of knowledge among local, regional, and global communities

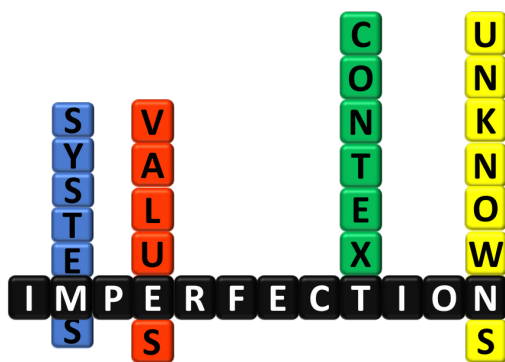
DEVELOPING METRICS FOR TRANSDISCIPLINARY RESEARCH

Realizing a globally sustainable society through R&D in tackling global environmental changes

The Research Institute for Science and Technology for Society (RISTEX) conducts research and development (R&D) programs with the aim to produce and promote innovative solutions to issues confronting society. Such issues include global warming, aging populations and declining birthrates, and the need for improvements to safety and security. To gain practical knowledge and methods that will bring solutions to these social issues, RISTEX promotes transdisciplinary research among researchers from diverse fields, practitioners and other stakeholders. In addition to R&D programs, RISTEX runs programs to support the application and dissemination of R&D results in society. **Learn more:** <https://www.jst.go.jp/ristex/en/>.



Developing a new theory of transdisciplinary co-creation of innovations.



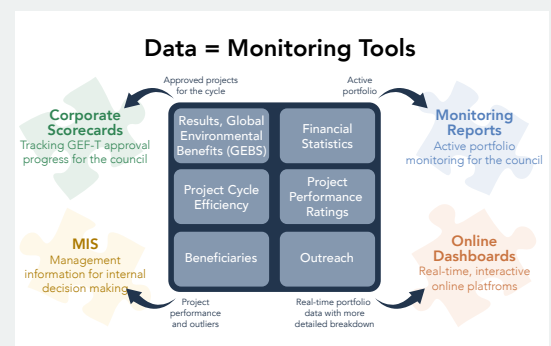
Transdisciplinary research requires expertise to address each of the above five elements.

Metrics based on the integration and implementation sciences (i2S) framework

There are many complex societal and environmental problems that require a more comprehensive level of understanding to underpin effective action. But they can be difficult to get "handles" on. Therefore, it is useful to consider them as having the following five elements: 1) they are systems problems with no clearly defined limits, 2) how they are defined is contested, because values, for example, frame how a problem is seen, 3) context matters and places real-world constraints on understanding and action, 4) many unknowns about the problem are unresolvable, 5) there are no perfect solutions and any solution can only ever be partial and temporary. **Learn more:** <https://i2s.anu.edu.au/>.

The Global Environment Facility: metrics and measurement

The Global Environment Facility (GEF) is one of the world's largest public funders of projects and programs that benefit the global environment. GEF projects generate data through periodic reporting at defined stages of their project cycles. Such data then provide the basis for a number of dynamic monitoring tools. GEF programming is moving in the direction of "integrated" and "impact" programming, with a drivers-based approach to reversing the course of environmental degradation. In addition to impact as measured by current indicators, these investments have the potential of "transformative change". However, the measurement system is not yet structured to capture the full benefits of these new types of programs. The development of more complex indicators that can measure synergies, transformative change, and systemic impact that will result from this drivers-based and integrated approach, is a pressing measurement challenge to which GEF is devoting effort. **Learn more:** <https://www.thegef.org/>.



GEF project data provide the basis for various monitoring tools.

DEVELOPING METRICS FOR TRANSDISCIPLINARY RESEARCH

Transdisciplinary measures for (conceptual) design

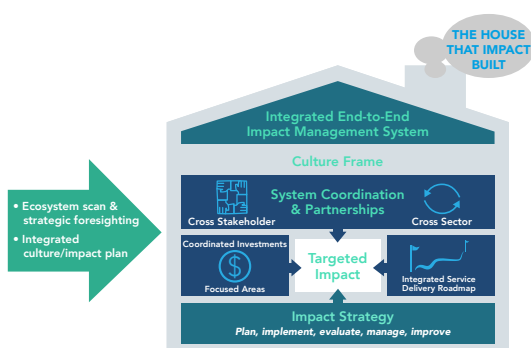
Science and technology are built out of constant capturing and harnessing of additional natural phenomena and the novel combination of existing technologies. Innovation is a broader concept than invention that refers to the entire process by which technological change is deployed in products, services, and systems to address human needs. But, as technologies and social challenges grow in scope and scale, the number and complexity of interacting elements can become unmanageable. Therefore, transdisciplinary approaches are needed to understand stakeholders and techno-social interactions, complemented with design methods that are used to identify, decouple, and resolve conflicts using the knowledge of diverse disciplines that yield designs with a higher level of invention. **Learn more:** <https://www.researchgate.net/publication/256712862>.

Development of New Technology

1. Novel technologies arise by combination of existing technologies
2. The cumulation of earlier technologies begets further cumulation. New technologies in time become possible components for the construction of further new technologies
3. Technology builds out of both combination of existing technologies and the constant capturing and harnessing of additional natural phenomena

One need for potential inventors and innovators are tools to facilitate searching for potential design solutions from among existing technologies

Arthur W.B., *The Nature of Technology*. New York, NY, Free Press. 2009.



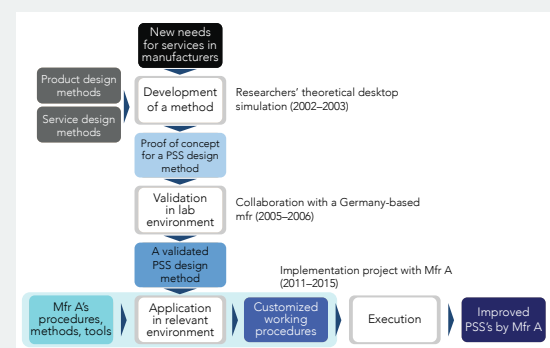
Building blocks of the Targeted Impact house.

Assessing and measuring the impact of transdisciplinary research

Alberta Innovates is an organization striving for 21st century solutions to many sustainability and economic challenges facing Alberta today. These are achieved through transdisciplinary work through investments in research, innovation, and entrepreneurship, but the impact of this work is often hard to reach and then quantify. Therefore Alberta Innovations has created several methods for achieving these goals through the use of some simple systems. “The house that impact built” system demonstrates how many different aspects are required in order to support successful impact. **Learn more:** <https://albertainnovates.ca/>.

Transdisciplinary—a definition, a best practice, and thoughts for impact pathways

In the late 1990s, a strong need was observed in manufacturing companies in developed countries to address services in a better manner for economic and environmental reasons. However, design methods available from academia then were either for products or services: none for products and services in an integrated manner. Therefore, Sakao, with colleagues, found an opportunity to develop a new method to effectively help manufacturers design Product/Service Systems (PSS). A series of research works were successfully carried out for sustainable consumption and production—developing and disseminating a design method for PSSs. **Learn more:** <https://www.sciencedirect.com/science/article/pii/S2212827115001687>.



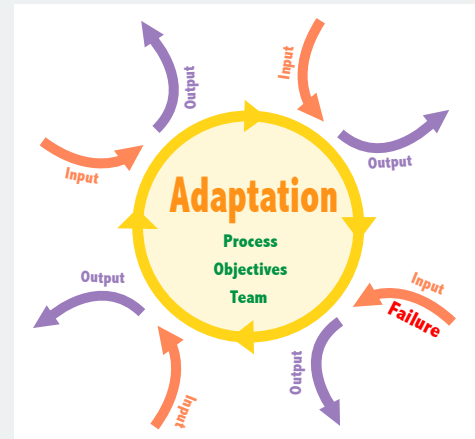
PSS: Product/Service System;
Mfr: Manufacturer; Env: Environment.

TRANSDISCIPLINARY METRICS

The two major forms of evaluation are 1) ongoing (formative) evaluation used for providing feedback to participants, and 2) end of project (summative) evaluation used to assess the effectiveness of a project or program. The formative evaluation is for the project team and is termed the "process" evaluation. The summative evaluation is of the project and is termed the "outcome" evaluation.

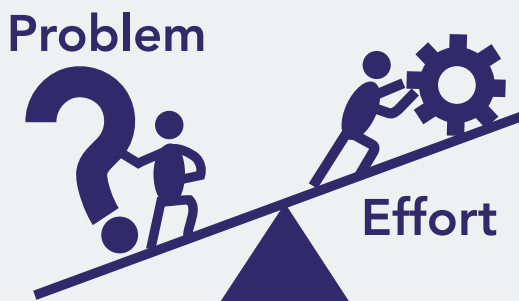
Transdisciplinary process metrics

- Stakeholder engagement: Was stakeholder mapping done, and were the right stakeholders involved? Were stakeholders true partners in co-design of the research?
- Was a theory of change and/or research framework used to project expected outcomes, and did the project follow the path outlined by the theory of change? Was the theory of change adaptive to changing contexts?
- Was an adaptive framework built into the project design to allow fundamental change throughout the project based on interim outcomes and feedback?
- Are researchers, stakeholders, funders, reviewers, and institutions fully committed to providing the resources, time, and capacity necessary to fulfill an adaptive transdisciplinary process?



Projects should allow adaptability for processes, project objectives, and even the make up of the project team, based on an iterative process that receives interim input and output feedback.

Transdisciplinary outcomes metrics



The balance between the problem solving and effort expended is a key tradeoff for transdisciplinary approaches. Pervasive problems, in particular, require considerable effort, but are worth tackling if they can be effectively addressed.

- Were the metrics used for evaluation of project outcomes identified at the beginning of the project?
- What are legacies of the project in terms of a) changed behaviors, b) lasting networks, or c) changed perceptions?
- Are there unique transdisciplinary indicators or metrics that can complement traditional disciplinary metrics to evaluate project outcomes?
- Can a mixed methods approach of quantitative and qualitative indicators be employed to evaluate project outcomes?

LESSONS LEARNED FROM IMPLEMENTING TRANSDISCIPLINARY APPROACHES

Transdisciplinary research requires significant inputs of time and resources, in addition to extensive collaboration. This introduces unique challenges in transdisciplinary efforts, as well as to the common hurdles faced in disciplinary research.

- As in most research, there is an initial time lag between the completion of transdisciplinary endeavors and the dissemination of results, and further delays before those results are considered in a decision-making context. Funding sources must provide support for the calibration of these time frames appropriately.
- The level of collaboration inherent in TD research necessitates a cross-sectoral, systems-wide perspective, cross-cultural competencies, and significant communication skills. In order for TD research to be successful, training in these skills must be available for researchers, stakeholders, and funders. This may require considerable revision of current institutional models, culture change, or new educational paradigms altogether.
- TD research must be adaptable; progress toward goals should be continuously evaluated during the iterative process. Indicators for evaluation should be carefully designed to align with the time frame of the project process.
- Results from post-project evaluation (at both the project and program level) should be compiled to create a shared knowledge framework so that best practices can be compared against replicable standards.

Lessons learned have four components:

1. Context

Context is crucial for framing lessons learned from implementing transdisciplinary approaches.

2. What we did

What we did are the decisions made regarding the problem that were useful, as well as decisions made that were not useful.

3. What happened

What happened is the result of “what we did” given the context of the problem at hand.

4. Recommendations

Recommendations can be made after evaluating components 1–3. These recommendations should be made in easy to understand language, which tells the story. Lessons learned should be specific, rather than generalized.

RECOMMENDATIONS FOR TRANSDISCIPLINARY RESEARCH

The following are recommendations provided by the participants of this workshop on how to use, improve, or modify existing transdisciplinary research approaches. Recommendations are ordered by when to use them during the TD research process (planning, implementing, or evaluating).

Planning transdisciplinary research

- 1. Know when to use transdisciplinary research approaches.** What is your ultimate goal for implementing transdisciplinary research projects? Determining the behaviors and outcomes you want to see at the end of your TD research project will help you plan your project and incentivize participants. Transdisciplinary research is not a linear process. Employ an array of different methods in order to solve your problem. Be aware that you must be comfortable with uncertainty if you are to use transdisciplinary research methods.
- 2. Acquire sufficient support, both funding and training, for all project partners.** Explore new funding streams that can be leveraged to improve upon transdisciplinary projects and research, and consider non-traditional funding sources. Develop networks among institutions for the pursuit of non-governmental funding opportunities.
- 3. Increase inclusivity by ensuring multiple relevant knowledge streams are involved in the transdisciplinary research project.** Solidify commitment and buy-in from funders, stakeholders, researchers, institutions, and reviewers. Engage with industry and the private sector throughout the TD research process—these are two valuable perspectives that are often underrepresented in TD research.
- 4. Foster a network of support.** Secure the support of NGOs, agencies, and institutions dedicated to TD research. It is important to establish a level of commitment among the partners and stakeholders involved in a TD research project. Encourage students to engage in TD research approaches.
- 5. Incentivization is key.** Transdisciplinary research is hampered by the incentive structure of institutions that reward researchers for traditional academic outputs, including peer-reviewed papers and large grants from prestigious funding sources, which are not often results of transdisciplinary processes from non-traditional funding sources. A fundamental change is needed within institutional processes for tenure and promotion that reward researchers for addressing societal problems without prioritizing traditional measures. Transdisciplinary research methods should be valued by institutions and researchers, and actively included in their work.

Implementing transdisciplinary approaches

- 1. Begin the evaluation process at the beginning of your transdisciplinary project.** It is crucial to learn from ongoing and completed TD research projects. A great way to ensure project evaluation is to set aside a percentage of the project budget for the sole purpose of evaluation. Utilize a spectrum of tools for project evaluation. The use of surveys is a great way in which to evaluate stakeholder perceptions before, during, and after the TD research project. Provide clear reasoning for implementing evaluation tools, especially those that are expensive and time-consuming.

RECOMMENDATIONS FOR TRANSDISCIPLINARY RESEARCH

- 2. Use qualitative, not just quantitative, indicators.** Transdisciplinary research is about people, not about quantifiable outcomes. Qualitative indicators will provide a richer understanding of the changes that occur during the TD research process, as well as highlight important culture shifts among communities involved.
- 3. Develop aspirational indicators to address in the future.** Projects are often constrained by inadequate budgets, short timelines, and lack of personnel. You may need to implement your TD research project in steps or phases in order to reach your ultimate goal. Developing aspirational indicators is a great way to show future intent of your project and maintain momentum, while enabling you to focus your efforts on accomplishing outcomes within the current scope of work.
- 4. The transdisciplinary research process should be transparent and accountable.** Transparency allows outside parties to understand your transdisciplinary research more thoroughly. These audiences can appreciate your methods, contribute to or build upon your research in the future, or potentially even replicate your efforts in other communities. Transparency in transdisciplinary research strengthens innovation.

Evaluating TD research and sharing knowledge learned

- 1. Develop a transdisciplinary evaluation framework.** The evaluation of a transdisciplinary research project is crucial to its overall success—and the success of other projects. Currently there exists no streamlined evaluation framework for transdisciplinary research. A unique suite of transdisciplinary research indicators and metrics needs to be developed for such an evaluation framework.
- 2. Be adaptable in your transdisciplinary research methods.** All TD research projects are unique and multi-faceted and cannot be implemented or evaluated identically to other TD research projects. So, when our assumptions about TD research evaluation do not hold, how do we adjust our metrics to reach our goal? Acknowledging that method adaptations are part of the TD research evaluation process, and being receptive to change are great places to start.
- 3. Learn from each other and other transdisciplinary research projects.** Many institutions have been implementing transdisciplinary research long before the term “transdisciplinary” became commonplace. These institutions, and all others employing TD research methods, should share what they've learned thusfar. Adequate project evaluation and transparency in methods enables organizations to learn from each other.
- 4. Motivate research investors to stay involved in transdisciplinary research projects.** Providing adequate return on investment—money, knowledge, societal improvements—will keep investors engaged in your research. Communicate regularly with investors throughout the duration of your project and not just at the project's conclusion.

CASE STUDIES: BELMONT FORUM TRANSDISCIPLINARY RESEARCH PROJECTS

Supplementing research with case studies provides a more complete vision for how transdisciplinary approaches can be implemented in real world settings. The following are two Belmont Forum funded transdisciplinary research projects that are excellent examples of utilizing various transdisciplinary research techniques.

Arctic Sustainability: A synthesis of knowledge (ASUS)

ASUS, a Belmont Forum Arctic Observing and Research of Sustainability granted project, brought together a diverse, multi-national team to develop a framework highlighting the state of currently understanding best practices, and metrics for achieving sustainability in the Arctic. An inclusive, stakeholder engagement driven process highlighted the social, demographic, economic, and environmental aspects of resilience across a range of scales. The team identified eight crosscutting themes from patterns and trends of sustainability concerns in the Arctic: natural resource development and management, climate change, biogeophysical transformations, human wellbeing, education and health, gender and socio-environmental justice, and Indigenous communities, and globalization. Synthesis relied on monitoring data and information associated with trends and drivers of change that manifest themselves within dynamic, coupled, human-environmental Arctic systems. **Learn more:** <https://arctic.uni.edu/asus>.



Arctic mountains. Duncan C. CC BY-NC-2.0.

TSUNAGARI



Fishing on Dal Lake, Kashmir, India. Matthew Savage. CC BY-NC 2.0.

TSUNAGARI, meaning connectivity and relationship in Japanese, aims to build an international network of researchers to link knowledge to action for the sustainable use of biodiversity and ecosystem services in Asia. A transdisciplinary approach was used to integrate different disciplines of environmental research across multiple spatial scales, and evaluate the importance of ecosystem connectivity between land and ocean for biodiversity and ecosystem services. **Learn more:** <https://www.belmontforum.org/projects/>.

CASE STUDIES: NON-BELMONT FORUM TRANSDISCIPLINARY RESEARCH PROJECTS

Many organizations outside the Belmont Forum are making strides implementing transdisciplinary research approaches. The following are two non-Belmont Forum funded transdisciplinary research projects worth noting for their use of transdisciplinary techniques.

Climate Change & Coastal Māori Communities

The goal of this project was to address climate change impacts on two Māori coastal communities in New Zealand and aid in the implementation of preferred adaptation strategies to mitigate these impacts. Māori landowners, scientists, and architecture students worked together to design solutions for communities that consider local cultural, economic, and environmental implications. This project was successful in creating opportunities for these communities to consider how to adapt their land management practices in line with climate change, and in co-developing Integrative Transition Action Plans with Māori coastal land block owners that include pathways for implementation. The outcomes of this project were shared at various exhibitions in New Zealand. **Learn more:** <https://www.deepsouthchallenge.co.nz/projects/climate-change-coastal-maori-communities>.



*Māori kumara garden. Michal Klajban.
CC BY-SA-4.0.*

SIRen: Sustainable Integrated Renovation



*Stockholm, Sweden skyline. Alex Nordstrom.
CC BY-SA-2.5.*

Based in Sweden, SIRen takes a holistic approach to sharing knowledge and innovation in sustainable renovation. This project successfully connects various disciplines, research institutions, government agencies, NGOs, and private property owners with the collective goal of improving sustainable renovation projects. However, a limitation to this project is maintaining active participation among all parties. The replacement of participants during the TD research process proved to hinder project progress. **Learn more:** <http://www.reoveringscentrum.lth.se/siren/>.

Good practices for integrating transdisciplinary research

- Ensure that applicable knowledge streams are considered and appropriate stakeholders are engaged. Identify stakeholder roles and ensure that stakeholders have the capacity to participate.
- Collaborate on development of research questions, process, and project management.
- Account for power and gender dynamics.
- Set attainable, measurable goals regarding timelines, objectives, and stakeholder engagement. Recognize and plan for multiple goals.
- Plan for and execute an iterative process of dynamic validation through feedback exchange and evaluation of intermediate and long-term products.
- Exercise reflexive practice: put aside time for reflection, relationship-building, identification of unexpected opportunities, and conflict resolution.
- Ensure availability of support for capacity building.

Evaluating Transdisciplinary Approaches workshop

The aforementioned recommendations and priority actions were developed during the Evaluating Transdisciplinary Approaches workshop that took place 26–28 June 2019. This workshop, hosted by the Belmont Forum at the National Science Foundation in Alexandria, VA, USA, brought together over 30 transdisciplinary research practitioners to discuss and evaluate transdisciplinary research approaches, and generate recommendations to improve and expand future transdisciplinary research efforts.

Workshop participants represented a diverse collection of organizations committed to transdisciplinary research. Refer to the back page for a complete list of participants and affiliations.

Photos: Workshop participants engaged in various activities to produce the recommendations listed in this document. Sky Swanson.



PRIORITY ACTIONS MOVING FORWARD

Discussions during the workshop identified the following four recommendations as priority actions following the meeting:

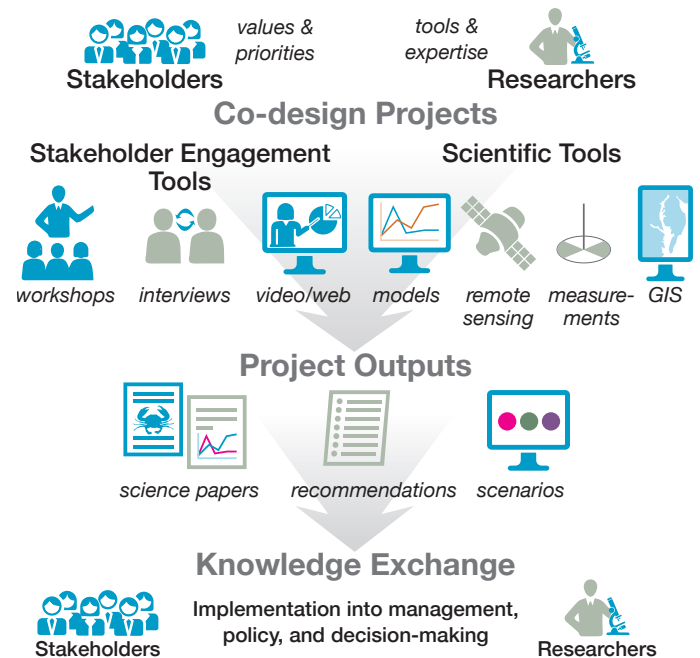
- 1. Perform an analysis on past transdisciplinary research projects.** Use the transdisciplinary evaluation framework to determine what worked and what didn't work for previously implemented TD research projects. The learning journey from previous projects will inform both policy and future TD research projects.
- 2. Develop a transdisciplinary evaluation framework.** It is crucial to learn from ongoing and completed transdisciplinary research projects. Currently there exists no streamlined evaluation framework for transdisciplinary research. A unique suite of transdisciplinary research indicators and metrics need to be developed for such an evaluation framework. Developing specific transdisciplinary process and outcome metrics will contribute to this framework. Project evaluation needs to be recognized as an important part of the TD research process, and accounted for in the TD research project budget and timeline.
- 3. Foster a network of support among transdisciplinary research practitioners.** Secure the support of NGOs, agencies, and institutions dedicated to TD research. It is important to establish a level of commitment among the partners and stakeholders involved in a TD research project. Be prepared to invest adequate funding and training for all involved, and incentivization—monetary, or otherwise—to ensure the support and commitment of all parties.
- 4. Ensure stakeholders are adequately integrated throughout the transdisciplinary process.** Transdisciplinary teams with diverse perspectives will respond better to key community issues and values, and will lead to faster, more effective change. Involve stakeholders throughout the entire TD research project process, rather than for specified steps along the way.



Participants at the Evaluating Transdisciplinary Approaches workshop. Sky Swanson.

WHAT IS THE BELMONT FORUM?

The Belmont Forum is a multinational organization that strives to bring together multicultural and multi-ethnic teams to collaborate on creating paths forward to address some of our toughest sustainability questions. Through the process of transdisciplinary research, the Belmont Forum combines social sciences, natural sciences, and humanities, and works with stakeholders directly to create ideas for the future of sustainability policy creation, management, and decision making. The Belmont Forum works constantly toward the goal of improving the planet and a creating a brighter future through collaboration and partnership with funding organizations from over 50 countries, international science councils, and regional consortia.



RESOURCES FOR MORE INFORMATION

Belcher, B., Claus, R., Davel, R., Ramirez, L. Linking transdisciplinary research characteristics and quality to effectiveness: A comparative analysis of five research-for-development projects. *Environmental Science & Policy*, Volume 101, November 2019, pages 192–203. <https://doi.org/10.1016/j.envsci.2019.08.013>.

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Klein, Julie Thompson & Falk-Krzesinski, Holly J. (2017). "Interdisciplinary and collaborative work: Framing promotion and tenure practices and policies," *Research Policy*, Elsevier, vol. 46, pages 1055–1061. DOI: 10.1016/j.respol.2017.03.001.

Schramm, Engelbert & Bergmann, Matthias & Brohmann, Bettina & Hofmann, Esther & Loibl, Celine & Rehaag, Regine & Voss, Jan-Peter. (2005). *Quality Criteria of Transdisciplinary Research: A Guide for the Formative Evaluation of Research Projects*. Questions to evaluate inter- and transdisciplinary research proposals. Institute for Social-Ecological Research ISOE-Studientexte No.13. https://www.researchgate.net/publication/256437773_Quality_Criteria_of_Transdisciplinary_Research_A_Guide_for_the_Formative_Evaluation_of_Research_Projects.

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