Toolkits for Transdisciplinarity

EIGHT TOOLKITS FOR TRANSDISCIPLINARITY

What can transdisciplinarians learn from each other and from other communities of practice about methods for transdisciplinary research?

The *Toolkits for Transdisciplinarity* series – published between mid-2015 and mid-2017 in the scientific journal *GAIA – Ecological Perspectives in Science and Society* – highlights existing compilations of methods useful for transdisciplinary research. This popular series expands the repertoire of methods available to transdisciplinary researchers by introducing them to previously unfamiliar methods. It is also a boon to transdisciplinary education providing students with easy access to an overview of relevant tools.

Of the eight toolkits, two (toolkit #1 on *knowledge co-production*, toolkit #8 on *integration*) were developed by transdisciplinary researchers. The others were developed in different contexts but still include many methods that transdisciplinarians will find useful.

One toolkit provides concepts and methods relevant to the *full range of transdisciplinary research,* while the others cover four key aspects of transdisciplinary investigations: 1. *collaboration,* 2. *synthesis of knowledge from relevant disciplines and stakeholders,* 3. *thinking systemically,* and 4. *making change happen.*

More specifically, the eight toolkits can be categorized as follows:

Full range of transdisciplinary research
- *Research Integration and Implementation (toolkit #6)*

Collaboration:
- *Collaboration (toolkit #4)*

Synthesis of knowledge from relevant disciplines and stakeholders:
- *Co-producing Knowledge (toolkit #1)*
- *Dialogue Methods for Knowledge Synthesis (toolkit #3)*
- *Integration Methods (toolkit #8)*

Thinking systemically:
- *(Dynamic) Systems Thinking (toolkit #7)*

Making change happen:
- *Engaging and Influencing Policy (toolkit #2)*
- *Change (toolkit #5)*

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TOOLKITS FOR TRANSDISCIPLINARITY*

TOOLKIT #1

Co-producing Knowledge

The eight methods in the *td-net toolbox for co-producing knowledge* compiled by Christian Pohl and Gabriela Wülser are useful for bringing together different perspectives on a problem, recognising that not only individuals but also social groups have different ways of thinking about issues. One method (soft systems methodology) covers the whole process, while the others cover specific aspects. The aim is to provide researchers with an array of methods from which they can choose those most appropriate for their particular research problem.

The methods in brief (and in approximate order of use in the process of co-producing knowledge):

- *Soft systems methodology* leads a heterogeneous group through the process of structuring a complex problem to deciding on the most desirable and feasible change while keeping worldviews explicit throughout.
- *Toolbox approach* allows disciplinary experts to understand how their own and other disciplines approach research.
- *Three types of knowledge tool* examines what is, what should be and how we come from where we are to where we should be thereby allowing explicit deliberation and decisions on the research question.
- *Actor constellation method* uncovers implicit assumptions that disciplinary experts and stakeholders have about each other's relevance for and potential contributions to addressing the research question.

- *Delphi method* allows a group of experts to anonymously develop a considered position demonstrating the substance and degree of consensus and dissent.
- *Emancipatory boundary critique* allows stakeholders to uncover normative assumptions underlying solutions to complex problems proposed by disciplinary experts.
- *Most significant change technique* provides a way for researchers and practitioners to compare values and priorities in monitoring and evaluating social change projects.
- *Storywall method* enables reflection on the process of co-producing knowledge with each participant explaining how they perceived and experienced the joint process.

The *td-net toolbox for co-producing knowledge* provides a description of each method, is collecting examples of their use, and is updated with new methods from time to time. It can be found at www.naturalsciences.ch/topics/co-producing_knowledge.
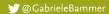
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TOOLKIT #2

Engaging and Influencing Policy

ROMA: A Guide to Policy Engagement and Influence compiled by John Young and colleagues provides a general approach and specific methods addressing how researchers can effectively interact with policy makers. This is based on the extensive experience of the *Research in Policy and Development (RAPID)* programme of the UK Overseas Development Institute. *ROMA* stands for *RAPID Outcome Mapping Approach*.

The toolkit provides guidance in three areas:

- *Diagnosing the problem:* understanding root causes rather than symptoms, understanding why the problem persists, diagnosing complexity and uncertainty, and identifying stakeholders.
- *Developing an engagement strategy to influence policy:* identifying realistic outcomes, identifying who or what is to be influenced, developing a theory of change, developing and implementing a communications strategy, and assessing the available capacity and resources.
- *Developing a monitoring and learning plan:* defining information requirements, collecting and managing data, and making sense of data to improve decision-making.

The tools described below provide a flavour of *ROMA*.

Five-whys technique: This starts with the initial problem, asking why it is a problem, why that explanation is a problem and so on five times. By the fifth "why" there should be a depth of understanding that goes beyond the immediately apparent issues.

Influence and interest matrix: This maps stakeholders according to 1. their ability to influence the problem, 2. their interest or engagement with the problem. The matrix has four quadrants: stakeholders with high in-

fluence and high interest, stakeholders with high influence and low interest, stakeholders with low influence and high interest, and stakeholders with low influence and low interest. Location of stakeholders in the matrix helps identify with whom it is most productive to work and how.

Five questions for identifying systemic factors: 1. Which branch of government holds the key to change?, 2. Where and how does political debate occur?, 3. What role do informal politics play?, 4. Is there really capacity to make change happen?, 5. How do external forces influence change?

Four options for communicating: This differentiates between formal and informal engagement as well as between working cooperatively with the decision-making system ("inside" track) and staying apart, which makes a more confrontational approach possible ("outside" track). Four communication strategies result: advising (formal, inside), advocacy (formal, outside), activism (informal, outside) and lobbying (informal, inside).

ROMA is flexible in how the tools are combined and used, and open to constant reflection and learning. *ROMA* is available as

- pdf: www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9011.pdf and
- on-line workbook: www.roma.odi.org.

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TOOLKITS FOR TRANSDISCIPLINARITY – TOOLKIT #3

Dialogue Methods for Knowledge Synthesis

Fourteen dialogue methods for groups are described, along with case studies of applications in four research areas: environment, population health, security and technological innovation. Unless otherwise specified, the dialogue usually involves disciplinary experts plus stakeholders. There is considerable flexibility in how each method can be used.

The first ten methods are useful for integrating judgments about a problem, providing a broad understanding.

- **Citizens' Jury** and **Consensus Conference:** in both, provide information from subject matter experts, advocates and stakeholders to a panel of non-expert, non-partisan citizens.
- **Consensus Development Panel:** use scientific evidence to develop a statement on a research question or controversial issue by a panel of independent experts.
- **Delphi Technique:** use sequential questionnaires interspersed with summaries of previous responses to systematically solicit and collate expert judgments.
- **Future Search Conference:** consider the whole system to develop ideal future scenarios, then identify common ground and make implementation action plans.
- **Most Significant Change Technique:** generate and analyse stories for monitoring and evaluating complex interventions.
- **Nominal Group Technique:** ensure equal participation in generating, recording, discussing, and voting on ideas for action.
- **Open Space Technology:** guide self-organisation to set the agenda, organise discussions and decide on follow-up action.
- **Scenario Planning:** identify likely futures and their implications to assist present-day planning under conditions of uncertainty.
- **Soft Systems Methodology:** develop a visual representation focusing on key players, world views, transformation process and environmental constraints to produce and implement action plans.

Four additional methods concentrate on understanding particular aspects of a problem.

- **Appreciative Inquiry:** clarify, develop and synthesise visions by identifying what is good and how to move to a higher level of goal attainment.
- **Strategic Assumption Surfacing and Testing:** bring to the surface and challenge assumptions that underlie participants' preferred approaches to a problem.
- **Principled Negotiation:** find a fair, objective way to accommodate different interests.
- **Ethical Matrix:** bring to the surface, weigh and take into account conflicting values.

Reference: McDonald, D., G. Bammer, P. Deane. 2009. *Research integration using dialogue methods.* Canberra, Australia: ANU Press. Open access online at *http://press.anu.edu.au?p=60381*.

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This semi-regular column aims to alert GAIA readers to useful toolkits of methods for conducting transdisciplinary research. If you would like to contribute a toolkit description, please contact sehy@oekom.ch.

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TOOLKITS FOR TRANSDISCIPLINARITY – TOOLKIT #4

Collaboration

Practical guidance is provided on collaboration in research teams, including those which strive for high levels of integration.

The toolkit is divided into nine sections, each covering the following:

- **How to …** (e.g., how to foster trust).
- **Ask yourself: is it working?** (Under this question tips are provided for identifying successes and failures, illustrated by case studies, along with take-away messages.)

Preparing to Collaborate: This introductory section reviews issues relevant both to participating in and leading a research team; describes the importance of mentorship; lays out the value of self-reflection, understanding personality types, and recognising the impact of emotions; and provides tips for resolving conflict and receiving feedback from others. Links are provided to three specific tools: *Myers-Briggs Type Indicator* to understand personality types, *Thomas-Kilmann Conflict Mode Instrument,* and *360-degree evaluations* for receiving feedback from others.

Building a Research Team: Provides tips for interviewing new team members to ascertain their approach to collaborations though assessment of values, performance, and behaviour. A link is provided to the *Model of Group Development,* which lays out five stages of group evolution.

Fostering Trust: Provides information about two types of trust (calculus-based and identification-based) and creating the foundation for trust, including a template for developing a collaborative agreement.

Developing a Shared Vision: Provides four key questions.

Communicating about Science: Compares dialogue with debate in discussing data, interpreting results, and other aspects of research communication.

Sharing Recognition and Credit: Criteria for evaluating contributions are provided.

Handling Conflict: Provides tips about listening, principled negotiation, and "adversarial scientific collaboration".

Strengthening Team Dynamics: Reviews factors that prevent the development of a strong team, evaluation of relationships and performance, tips for keeping a positive mood.

Navigating and Leveraging Networks and Systems: Includes suggestions for understanding a team as a social system.

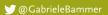*Reference:* Bennett, L. M., H. Gadlin, S. Levine-Finley. 2010. *Collaboration & team science: A field guide.* National Institutes of Health Publication 10-7660. Bethesda, MD: National Institutes of Health. Open access online at *http://teamscience.nih.gov*.

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Change

More than 120 techniques aimed at achieving change are presented, many of which can be adapted for transdisciplinary research. The *Change Management Toolbook* has three major sections covering personal, team and larger systems change.

Personal Change Tools that may be useful for transdisciplinarity are those that help people "think outside the box" and those that help people understand their own vision and goals. Tools include:

- *Walt Disney Circle* to develop and assess ideas through the roles of dreamer, realist and critic.
- *Assessment and Change of Limiting Beliefs* to examine the achievability of a goal, especially identifying and exploring limiting beliefs and motivation to change them using a series of structured questions.

Team Change Tools that may be useful for transdisciplinarity are those that deal with different perceptions of reality and those that make possible learning within teams. Tools include:

- *Wheel of Multiple Perspectives* to capture the perspectives of each team member about the relevant stakeholders for a problem.
- *Art of Dividing a Pumpkin* to deal with the needs of all stakeholders in a way that respects equal rights.
- *After Action Review* to make learning conscious and explicit using four questions: What was supposed to happen? What actually happened? What were the positive and negative factors? What have we learned?

Larger Systems Change Tools that may be useful for transdisciplinarity are those that 1. help understand the core principles and resources at play, 2. identify vision, values and goals, 3. help understand stakeholders, 4. help find leverage for change within a system, 5. work with whole systems. Tools include:

- *Scoping* to delineate the systemic context of the problem. This is a nine-phase process using 28 provocative questions.
- *Ralph Stacey's Agreement and Certainty Matrix* to assess which decision making processes should be used. This is based on the degree of agreement on what should be done among the people directly involved and the level of certainty in the information base.
- *Stakeholder Analysis* to categorise stakeholders in terms of ability to influence process or outcomes, extent of change (of stakeholders) required and change effort required.

Reference: Nauheimer, H. 1997. *The change management toolbook. A collection of tools, methods and strategies.* Open access pdf at *http://www.change-management-toolbook.com*. Online version with additional more recent tools added by community members *http://www.change-management-toolbook.com/tools*.

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Research Integration and Implementation

The *Integration and Implementation Sciences (I2S)* website provides more than 100 tools, approaches and cases relevant to research integration and implementation. They deal with 1. synthesis of knowledge from different disciplines and stakeholders, 2. understanding and managing unknowns, and 3. providing integrated research support for policy and practice change.

Knowledge synthesis tools that may be useful for transdisciplinarity include:

- *Dialogue: nine key dynamics* which describe best practice conditions for dialogue, specifically 1. building a safe space, 2. openness, 3. respect, 4. storytelling, 5. listening, 6. suspending automatic response, judgment, and certainty, 7. collaborative inquiry, 8. finding common ground and exploring differences, and 9. balancing advocacy and inquiry.
- *Stakeholder participation: Arnstein's ladder* which presents eight kinds of participation, distinguished by how much power stakeholders have in determining the final product.
- *Trading zones and interactional expertise* which provides useful ways of thinking about and improving collaborations across very different disciplinary communities.

Tools for understanding and managing unknowns that may be useful for transdisciplinarity include:

- *Quantitative risk matrices* to quantify consequences and likelihoods of risks, as well as to combine these assessments.
- *Unknowns taxonomy* which distinguishes between passive and active ignorance and different kinds of unknowns in each of these categories.
- *Unknowns matrix* which provides a useful way of distinguishing between three primary categories of unknowns – known unknowns, unknown knowns and unknown unknowns.

Tools to provide integrated research support for policy and practice change that may be useful for transdisciplinarity include:

- *ADOPT (Adoption and Diffusion Outcome Prediction Tool)* to increase understanding of factors influencing adoption of non-contentious mainstream agricultural innovations in developed countries.
- *Framing: a quick guide* which provides an introduction to how to create powerful messages.
- *Powercube* which is a conceptual tool for understanding and analysing how power works in processes of governance, in organizations, and in social relationships.
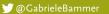
MORE INFORMATION:
http://i2s.anu.edu.au/resources: The *Integration and Implementation Sciences* website is regularly updated, with new additions advised via the bi-monthly *I2S News*. The website and the news also provide information about journals which publish research integration and implementation methods, as well as relevant professional associations and networks, and conferences.

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TOOLKITS FOR TRANSDISCIPLINARITY – TOOLKIT #7

(Dynamic) Systems Thinking

Transdisciplinary research often requires systems thinking, especially understanding how the inter-related elements of a problem form a complex and unified whole, and how those interdependencies influence the actions that can be taken. Seven how-to guides provide an introduction to systems thinking tools, especially for understanding dynamic systems.

Guide 1: Introduction to systems thinking includes:
- what is systems thinking?,
- what is a system?,
- putting systems in context,
- what do systems do?

Guide 2: Systems thinking tools: a user's reference guide includes:
- dynamic thinking tools, such as reinforcing and balancing loops and guidelines for drawing causal loop diagrams,
- structural thinking tools, such as graphical functions,
- computer-based tools, such as learning laboratories.

Guide 3: System archetypes basics: from story to structure describes recurring generic systems structures (distinctive combinations of reinforcing and balancing processes) found in many kinds of organisations, under many circumstances, and at many levels and scales. These system archetypes teach how to diagnose recurring problems and to design effective interventions. Eight common archetypes are analysed: *fixes that fail, shifting the burden, limits to success, drifting goals, growth and underinvestment, success to the successful, escalation,* and *tragedy of the commons*.

Guides 4 to 6:
- *Systems archetypes I: diagnosing systemic issues and designing interventions*
- *Systems archetypes II: using systems archetypes to take effective action*
- *Systems archetypes III: understanding patterns of behaviour and delay*

These guides work through each archetype in more detail. For the *tragedy of the commons* archetype, for example, this involves diagnosing the commons, identifying the incentives that need to be managed and relevant timeframes, and analysing issues that may interfere in successful action.

Guide 7: Applying systems archetypes includes using systems archetypes as lenses, structural pattern templates, dynamic theories and tools for predicting behaviour.

Reference: The guides can be found on *The Systems Thinker* website at **https://thesystemsthinker.com/category/how-to-guides**. They were written by Daniel H. Kim, with two guides co-authored by Virginia Anderson and Colleen Lannon, respectively. While designed for use in a business context, they are also relevant to transdisciplinary research.

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TOOLKITS FOR TRANSDISCIPLINARITY – TOOLKIT #8

Integration Methods

Integration is essential in transdisciplinary research. In their book ***Methods for Transdisciplinary Research: A Primer for Practice*** Matthias Bergmann and colleagues describe the importance of integration, provide a range of integration methods, and illustrate the use of these methods in a series of case studies. The seven groups of integration methods are described here.

1. Integration through conceptual clarification and theoretical framing
The process is, through purposeful discussion, to agree on common use of concepts and technical terms, as well as the theoretical framework/s that will be used.

2. Integration through research questions and hypothesis formulation
This involves agreeing on project content and goals, again through purposeful discussion. For example, formulating problem-oriented, rather than discipline-oriented, research questions is key.

3. Screening, using, refining, and further developing effective integrative scientific methods
This involves identifying methodological needs for integration, developing and testing innovative methods, and adopting established methods.

4. Integrative assessment procedures
These methods include multi-criteria assessment, developing guiding principles or a vision, assessment through Bayesian probability networks, and formative evaluation.

5. Integration through development and application of models
Included here are conceptual models to reduce complexity, system models to examine interconnections, forecasting models to outline possible future states, and computer simulations to pool information from different scientific fields.

6. Integration through artifacts, services and products as boundary objects
Potential boundary objects are 1. artifacts, which are material focal points, such as an avatar or a robot, 2. a catalogue of questions, 3. a normative integrative key question, and 4. a product such as a publication, a market analysis or a prototype.

7. Integrative procedures and instruments of research organisation
Processes for cooperation within a research project include 1. ways of forming interdisciplinary teams and institutions, 2. stakeholder involvement and participation, 3. iteration or recursiveness, which involves mutual adjustment between contributions from the sciences and from societal practice and 4. key question procedure at end of project, which involves consolidation of results across all phases of a project.

Reference: Bergmann, M., T. Jahn, T. Knobloch, W. Krohn, C. Pohl, E. Schramm. 2012. *Methods for transdisciplinary research: A primer for practice.* Frankfurt am Main: Campus. // German version: *Methoden transdisziplinärer Forschung: Ein Überblick mit Anwendungsbeispielen.* Published in 2010.

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This is the last column in this series which aims to alert GAIA readers to useful toolkits of methods for conducting transdisciplinary research. A new column on frameworks for transdisciplinary research will start in the next issue of GAIA.

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