Transdisciplinarity as a method of science-practice collaboration: Definition(s), prerequisites and challenges in the start-up phase

Roland W. Scholz

- Prof. em. Dr. phil habil. Dipl. Math., former Chair of Natural and Social Science Interface, Dept. Env. Systems Sciences,, ETH Zürich (Switzerland)
- Adj. Prof. (PD), Department of Psychology, University of Zurich (Switzerland)
- Prof. Extraordinaire, Faculty of Economic and Management Sciences, School of Public Leadership, Institute for Environmental Decisions, University of Stellenbosch (South Africa)
- Senior Advisor Phosphorus Cycle Management: Fraunhofer Institute for Interface Engineering and Biotechnology, Stuttgart (Germany)

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Structure of my talk

PART 1 (15 minutes) – Definitions, conceptions, functions and outcomes of Td and some other forms of theory-practice collaboration

INTERMEZZO (3 minutes) – What role may the science system take? – “Normative research” or being “a public good that supports all-stakeholders’ democratic process of norm-finding”

PART 2 (ca. 7 minutes) – Some questions which may help you to become a transdisciplinarian
Clarifying concepts: Disciplinarity, interdisciplinarity, transdisciplinarity

Disciplines are characterized (defined) by (i) objects and (ii) (core) methods.

- Mathematics: (i) Numbers, symbols (ii) proof (thought)
- Psychology: (i) Mental processing and behavior, (ii) experiment (observation)
- Pharmacy: (i) chemical impacts on diseases, (ii) natural science experiments, (iii) approval studies (impacts of chemical matter)
Interdisciplinarity

• Interdisciplinarity is established by the **fusion** of concepts or methods from different disciplines (bringing wind and brass together; how the saxophone emerged from clarinet and trumpet)

• Examples
  – Game theory: Mathematics (*proofs; optimal solution*), economy (*concepts such as ‚rational player‘, *strategy, utility*); behavioral sciences (*experiment, behavioral observations*)
  – Social-psychology: Psychological mechanisms in social settings
  – Bio-chemistry: Chemical processes in living organisms
  – Didactics of mathematics: The study of learning (psychology) and teaching (educational sciences) of mathematics ... under certain constraints/cultural settings (economy/sociology, anthropology)

• Interdisciplinarity only functions (well) among “related sciences” which use the same mode of causation (even binary propositional logic fails as integrating layer)

⇒ **Mode 1 transdisciplinarity** (Piaget, 1972) may provide a proper epistemological meta-level for relating different types of causation


Transdisciplinarity (according to the Zurich 2000 definition) in a nutshell

Transdisciplinarity

1. Means going beyond sciences (not only beyond disciplines)
3. Asks for integrating knowledge and values from practice in science (from a science perspective; Scholz, 2000)
4. Means doing applied research in theory-practice discourses with equal rights (no contract research, only sponsoring), co-leadership is the ideal. Includes certain elements of participatory research (but goes much further; co-leadership = authentic equal eye level, mutual learning by knowledge integration)
5. Is an appropriate “research paradigm that better reflects the complexity and multidimensionality of sustainability” (Martens, 2005)
6. Has been declared as the appropriate methodology by which a sustainable development should be investigated and promoted (Scholz & Marks 2001)
7. It is a 21st century variant of the „traditional engineer mission“ (building energy systems ≠ anticipating impacts of energy systems)
Knowledge integration is the core of transdisciplinarity: The architecture of knowledge

Experiencing (Erfahren) of the real world allows for formulating relevant Guiding Q...

Leads to understanding

Allows to conceptualizing

Prepares explaining

There are different types of **epistemics** involved in knowledge integration.

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**Practitioners** are the experts for understanding/the epistemics of intuition; concrete systems.

- 'Erfahren'/Experience of the real world allows for formulating relevant...
- Leads to 'verstehen'/understanding
- Allows to 'begreifen'/conceptualizing
- Prepares 'erklären'/explaining

**Scientists** are the experts for (causal) explanation; abstracted systems.

Scholz & Tietje, 2002
Five major variants and perspectives of ‘knowledge integration’

1. Disciplines
2. Modes of thought
3. (Sub-)systems
4. Interests/perspectives
5. Cultures/Religions

Variants and perspectives of ‘knowledge integration’
What makes transdisciplinary processes? There are the main ‘domains.’

1. Interdisciplinary research a the basic layer of td-research

2. A multi-stakeholder discourse (which benefits from ❶)

3. A facilitation process linking ❶ and ❷

Disciplines, e.g.
- Soil sciences
- Plant sciences
- Chemical engineering
- Economics
- etc.

Interdisciplinarity by merging concepts and methods from different sciences

Unsustainable P-management today

Transdisciplinary processes

Sustainable P-management tomorrow

Practice

Multi-stakeholder discourse among key agents from practice

Groups, e.g.
- Farmers
- Mining industry
- Fertilizer trades
- Environmental organizations
- etc.
**Organizational Chart of the SMAP 2016 Project**

<table>
<thead>
<tr>
<th>Key stakeholder groups of the smallholder's value chain</th>
<th>Td-Facilitator of the Project</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallholder farmers’ spokesperson Other representatives</td>
<td>Margaret Osundwa Uasin Gishi County</td>
<td>Dr. Abigael Otinga Ruth Njorge University of Eldoret</td>
</tr>
<tr>
<td>• County • NCPB • Wholesale Traders and fertilizer importers • Seed companies • Financial Institutions • Farmers organizations CGA • *Farmers • Marketors • Agrodealers • Others • (Extension officers)</td>
<td>Various extension officers who are facilitating/leading the project</td>
<td>University of Eldoret Department of Soil Science Department of economics University of Egerton Department of soil and plants (Prof. Birech) Social science department Fraunhofer Society, Germany (Transdisciplinarity) University of Waterloo, Canada, Prof. Weber (Sustainable finance) Others</td>
</tr>
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</table>
Science—practice co-leadership on all levels

Organizational Chart (of a Transdisciplinarity Lab)
The Global TraPs project (2011-2014) included Td-moderators on all subsystems/facets.
## Organizational Chart of the SMAP 2016 Project

### Practice

- Smallholder farmers’ spokesperson
- Other representatives

### Td-Facilitator of the Project

- Margaret Osundwa
  - Uasin Gishi County

### Science

- Dr. Abigael Otinga
- Ruth Njorge
- University of Eldoret

### Key stakeholder groups of the smallholder's value chain

- County
- NCPB
- Wholesale Traders and fertilizer importers
- Seed companies
- Financial Institutions
- Farmers organizations CGA
- *Farmers*
- Marketors
- Agrodealers
- Others

- (Extension officers)

- Various extension officers who are facilitating/leading the project

- University of Eldoret
  - Department of Soil Science
  - Department of economics

- University of Egerton
  - Department of soil and plants (Prof. Birech)
  - Social science department

- Fraunhofer Society, Germany (Transdisciplinarity)

- Univesity of Waterloo, Canada, Prof. Weber (Sustainable finance)

- Others
What are transdisciplinary processes?

- They differ from other types of theory practice cooperation?
- They have functions and outcomes
- Please distinguish between td-research and td-processes!
When we are facing a sustainable transition—depending on the guiding question/focus, you can distinguish between three types of actors with own agendas.
**Illustrating Consultancy**

- Contract-based research
- Scientists lose control about research and data
Illustrating Participatory Research of Public at Large

- Science keeps control
- Benefit of practitioners unimportant/secondary
- Scientist become value driven political actors
- Groundbreaking research of a normal science type becomes secondary
• Governmental representatives keep control
• When process is stopped and how results are needed is often unclear
• Co-leadership among science and practice
• Mutual learning/knowledge integr. for socially robust solutions and groundbreaking research
Products and functions

Td-Processes (according to the Zurich 2000 definition)

• Organize processes of mutual learning between theory and practice

• Serve for

  ① Capacity building
  ② Consensus building
  ③ Mediation
  ④ Legitimization

• Provide socially robust orientations ("socially robust solutions")

What are „socially robust solutions“ (robust orientations)?

A ‘socially robust orientation’

i. Meets science *state of the art scientific knowledge*

ii. Has the potential to *attract consensus*, and thus must be understandable by all stakeholder groups

iii. Acknowledges the *uncertainties and incompleteness* inherent in any type of *knowledge* about processes of the universe

iv. Generates processes of *knowledge integration of different types of epistemics* (e.g. scientific and experiential knowledge, utilizing and relating disciplinary knowledge from the social, natural, and engineering sciences)

v. *Considers the constraints* given by the context both of *generating and utilizing knowledge*
From 1993–2014 I have co-lead/participated in 25+ large scale transdisciplinary case studies in **Switzerland, Sweden, Germany, Austria, Seychelles, Bhutan, Kenya, Vietnam, Guatemala**

There are more genuine Td case studies ... A special feature of Sustainability Science 8/15 will provide conclusions from 40 studies of the ITd-Net
Intermezzo

What Role may the Science system take?
Normative research/transformations: Who is developing and defining the norms of society in a democratic setting
Practitioners build a Multi-Stakeholder Forum

Scientist have to organize disciplined (discipline-based) interdisciplinarity for transdisciplinary processes

Science community

Public at large (Stakeholders)

Legitimized decision maker

Public discourse (Stakeholder activities)
Scientists build an interdisciplinary process. Scientists become one party in a multi-stakeholder forum.
Practitioners + scientists build a Multi-Stakeholder Forum
Science is a public good that has to be efficiently organized/prepared to serve sustainable transformations.
Two roles of science in theory practice discourses:
(A) Science as a **public good** which serves all stakeholders; which needs an internal ID process; mutual learning goes beyond “knowledge transfer”

(B) **Science becomes one out of a set of stakeholders** (often linked to the post-normal conception of science) – this is a variant of “action research”
A vision: We need disciplined interdisciplinarity in transdisciplinary processes.
PART II

Some questions to you
The startup (1-2) is the most important phase

| 1. INITIATION         | 1.1 Initial idea  
|                       | 1.2 Building partnership |
| 2. PREPARATION        | 2.1 Problem definition  
|                       | 2.2 Project planning  
|                       | 2.3 Organization  
<p>|                       | 2.4 Resources |
| 3. CORE PHASE         | 3.1 Stakeholder (public at large) involvement |
|                       | 3.2 Methods |
|                       | 3.3 Communications |
| 4. POST-PROCECESSING  | 4.1 Outcomes |
|                       | 4.2 Dissemination |
|                       | 4.3 Evaluation |</p>
<table>
<thead>
<tr>
<th>1. INITIATION</th>
<th>Checkup questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1 Initial idea</strong></td>
<td><strong>1.1.1 Choice of system and topic</strong> ✓ (done)</td>
</tr>
<tr>
<td><strong>1.2 Building partnership</strong></td>
<td><strong>1.2.1 Co-leadership</strong></td>
</tr>
<tr>
<td></td>
<td>Is there someone who could take this role?</td>
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<td></td>
<td><strong>1.2.2 Added values</strong></td>
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<tr>
<td></td>
<td>What added values may you offer to practice that the invest time &amp; money?</td>
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<td></td>
<td><strong>1.2.3 Accepting the otherness of the other</strong></td>
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<td>How would you approach Swiss Oil company which promotes “Heat with oil” as partner?</td>
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<td><strong>1.2.4 Including unconventional thinkers</strong></td>
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<td>...</td>
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<td></td>
<td><strong>1.2.5 Contract on rights, responsibility and data</strong></td>
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<tr>
<td></td>
<td>What rights would you offer practitioners to take control ver scientific publications?</td>
</tr>
<tr>
<td>2. PREPARATION</td>
<td>2.1 Problem definition</td>
</tr>
<tr>
<td>----------------</td>
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<tr>
<td>2.1.1 Joint system/problem discovery</td>
<td>2.2.1 Start with the synthesis</td>
</tr>
<tr>
<td>Are you planning a side change (Living in the system?)?</td>
<td>Backward planning</td>
</tr>
<tr>
<td>2.1.2 Guiding question</td>
<td>2.2.2 Define a project end:</td>
</tr>
<tr>
<td>Is there such a Q? Is it negotiated with practice partners?</td>
<td>...</td>
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<tr>
<td>2.1.3 Faceting the case/problem (i.e. structuring)</td>
<td>2.2.3 Methods of knowledge integration</td>
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<tr>
<td>...</td>
<td>These methods are your backbone. Which one do you use</td>
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<td>2.1.4 System boundaries</td>
<td>2.1.5 System model</td>
</tr>
<tr>
<td>Have you crisply defined the system boundaries</td>
<td>Is there a system representation which is accepted and understood by all?</td>
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<tr>
<td>2.1.6 Communication/shared language</td>
<td>...</td>
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<tr>
<td>2. PREPARATION</td>
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<tr>
<td><strong>2.3 Organization</strong></td>
<td><strong>2.3.1 Organizational chart</strong></td>
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<tr>
<td><strong>2.3.1 Stakeholder pre-selection</strong></td>
<td></td>
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<tr>
<td><strong>2.3.3 Physical separation</strong></td>
<td></td>
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<tr>
<td>2.4 Resources</td>
<td><strong>2.4.1 Financial resources planning</strong></td>
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<tr>
<td></td>
<td><strong>2.4.2 Personal Fluctuation</strong></td>
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<td><strong>2.4.3 Career constraints</strong></td>
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<td><strong>2.4.4 Confidentiality and trustworthiness</strong></td>
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Transdisciplinarity is of interest for adaptation and mitigation with respect to climate change

- Envisaged Societal Relevance and Impact is a most important evaluation criterion – But Transdisciplinarity asks for benefits for science knowledge as well

- Example 1: JPI Climate policy paper, S.1 ....there is a need to make a distinction between ‘scientific analyses of societal transformations under climate change’ (the analytical perspective; trying to understand societal changes) and ‘scientific analyses for societal transformations under climate change’ (the normative perspective; trying to contribute to successful societal changes). In practice, however, these two roles will be very much interconnected.

- But, there is a third mode: ... there is a need to do science with society to find socially robust solutions, to efficiently relate experiential wisdom with scientific rigorness – It’s possible: The scientific board of JPI was co-chaired by science and Greenpeace
Two major sources of transdisciplinarity
A method book and a theory book


**Ontology:** The ontology of (transdisciplinary) sustainability transitions is that

(a) of an “ill-defined problem type”

(b) which includes normative issues