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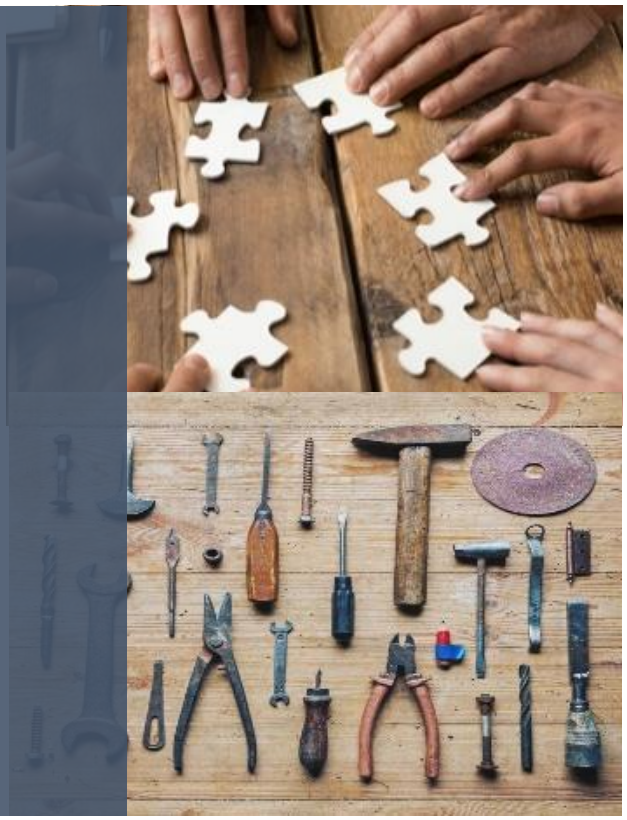
# TRANSDISCIPLINARY RESEARCH PROJECTS APPROACH IN GFE: CONCEPTS AND TOOLS.



May 2023.

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The **Research Centre for Global Food Security and Ecosystems** act as platform for the development and implementation of research projects on global food security and ecosystems within the University of Hohenheim.

In cooperation with the Research Support Department, we support scientists in developing and implementing research initiatives. More information on: https://gfe.uni-hohenheim.de/en

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## Glosary

GFE: Research Centre for Global Food Security and Ecosystems

TDR: Transdisciplinary Research

CoP: Community of Practice

EIP: European Innovation Partnerships

PRA: Participatory Rural Appraisal

ENoLL: European Network of Living Labs (ENoLL)

# Introduction

In recent decades, scientists have involved different stakeholders in the generation of knowledge to address problems of societal interest. It is generally accepted that impactful science requires a constant dialogue between science and practitioners. Many scientific fora and funding calls are increasingly calling for the deliberate inclusion of nonscientific stakeholders in applied research.

The Global Food Security and Ecosystem Research Centre (GFE) aims to support researchers in the development and implementation of research projects with high levels of relevance and societal impact. Since its inception, the GFE has been dedicated to facilitating dialogue and cooperation between Hohenheim researchers and stakeholders outside academia. As a further step in improving the service offering, the GFE aims to improve the way transdisciplinarity is addressed in the GFE's core activities. To this end, the GFE presents in this document a concept note that includes a strategy to be followed in the next five years to deepen the transdisciplinary approach. This is supported by a compilation of basic concepts and methods that can be applied during the development, management and evaluation of research projects that seek to increase the involvement of stakeholders and nonscientific actors throughout the entire project lifecycle.

This guideline is primarily targeted at GFE project managers and officials who aim to design, develop and manage research projects that integrate knowledge between scientists from different disciplines and nonscientist actors in the search for solutions to complex problems. As such, the guide does not pretend to be exhaustive, and its main intention is to present starting points and practical hints to apply concepts to help navigate the many possibilities, crossroads, and resources of transdisciplinary research.

The guideline is divided into six sections. The first two sections explain the rationale of the concepts most commonly used in the literature. In these two sections, we want to answer the main theoretical questions of *What is transdisciplinary research*? *How does knowledge integration occur*?

The third and fourth sections present a compilation of available methods, tools and instruments. These can be combined, adapted and used depending on the purpose, the different types of knowledge integration sought and the different phases of the project life cycle. In these sections, we address the following topics: *Which methods, tools, and techniques for knowledge integration exist? How can transdisciplinary research projects be managed according to the project life cycle?*

Finally, the last section describes a suggested roadmap for the GFE in the following years to include the concepts and tools of transdisciplinary research on daily activities. As support for officers, the annexes include a brief description of 46 identified tools with available sources and examples of selected cases that provide insights into the benefits and challenges of implementation of the tools in the field.

# 1. What is transdisciplinary research?

## 1.1 Transdisciplinarity

The core idea of transdisciplinarity is that **different academic disciplines work jointly with practitioners to solve a real-world problem**. (Klein et al. 2001). In the literature, transdisciplinarity is defined as a *"reflexive, integrative, method driven scientific principle aiming at the solution or transition of societal problems and concurrently of related scientific problems by differentiating and integrating knowledge from various scientific and societal bodies of knowledge"* (Lang et al. 2012, S. 26–27)

The reflexive characteristic aims to enable mutual learning processes. New knowledge is generated by integrating different scientific and nonscientific insights through a recognition of the equal value of different knowledge systems and frameworks and an appreciation of how the interplay of those systems can create new ways of thinking and understanding (West et al. 2021).

The concept of transdisciplinarity is related to other research approaches, such as multidisciplinarity and interdisciplinarity, but differs from them in terms of the actors involved and the collaboration that takes place between them (Figure 1).

*Interdisciplinarity* integrates data, methods, concepts and theories from two or more scientific disciplines to better understand problems whose solutions go beyond the scope of individual disciplines. In contrast, *multidisciplinarity* means that different disciplines work in parallel on a specific research question without integration (Figure 1).

*Transdisciplinarity* integrates nonacademic knowledge and knowledge from different scientific disciplines into a mutual, problem-oriented learning and research process. Transdisciplinarity is based on interdisciplinarity in most cases. This means that several scientific disciplines or stakeholders are needed to analyse and solve the problem (Figure 1).

## 1.2 Sustainability science and Transdisciplinary Research

Sustainability science entails the analysis of complex global issues such as climate change, growing urbanization, food security and biodiversity loss. Such complex problems require research on common issues from the point of view of the natural, man-made and/or social systems in which they are embedded (Vasbinder et al. 2010). Transdisciplinary research (TDR) offers a practical way to address contested, high-stakes societal problems where knowledge is uncertain, the specific nature of the problem may be disputed and the potential impacts on stakeholders are significant (OECD 2020).

The discourse on transdisciplinarity dates back to the 1950s (Jahn et al. 2012). In 1970, the OECD raised the debate on the need for interdisciplinary collaboration to address socioecological issues as a set of axioms to be shared across academic disciplines (Jahn et al. 2012). In 2000, the Zurich Conference on Transdisciplinarity adopted and popularized a more problem-oriented approach, emphasizing its links to the context ("real-world" problem setting), shifting the discourse from science-theory driven deliberations to the question of what this new way of doing science means in practice (Jahn et al. 2012). Many authors describe transdisciplinarity as a research approach (Jahn et al. 2012), a practice (Russel, 2008), an attitude or a form of action (Klein 2004). These descriptions are more related to a *way to do things* instead of a set of specific tools, theories or institutions developed for that purpose (Jahn et al. 2012).

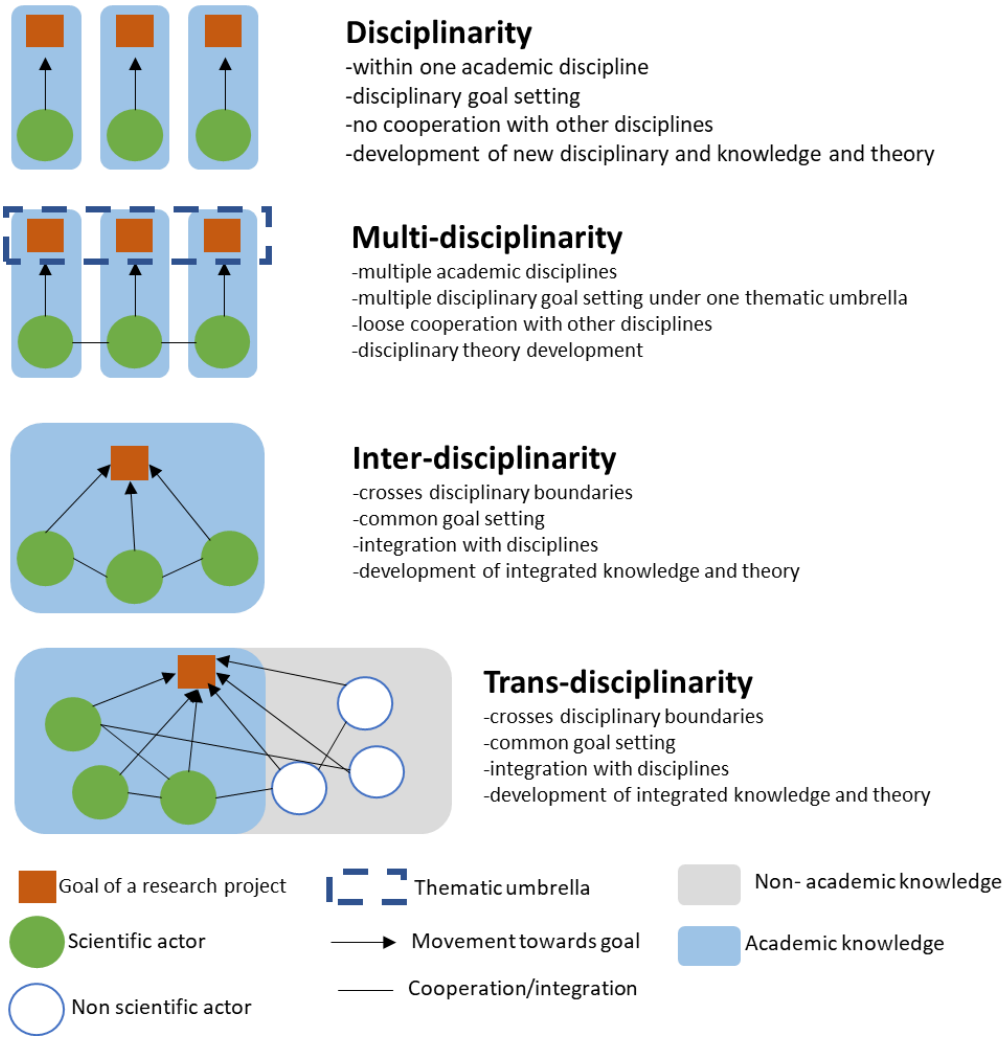


***Figure 1. Overview of research concepts: disciplinarity, multidisciplinarity, interdisciplinarity and transdisciplinarity***

*Source: Adapted from Tress* et al*. 2005 p.484*

As an approach, TDR promises a better understanding of the nuanced context, action, and decisions that determine socioecological systems and the development of organizational, social, and technological innovations that fit a given situation (Knierim und Callenius, 2018).

## 1.3 Phases, knowledge types, intensity of involvement and modes of TDR

The current body of literature conceptualizes an ideal transdisciplinary research process in *three phases*, integrating *three types of knowledge*, with varying *intensity of involvement of nonscientific actors*, and in different *modes of coproduction*.

### 1.3.1 *Phases of the conceptual model of transdisciplinary research*

Ideal transdisciplinary research occurs in three phases (Figure 2) (Brandt et al. 2013):

i. problem framing
ii. production of new knowledge (analysis of the problem)
iii. integration and application of knowledge (exploring the impact)

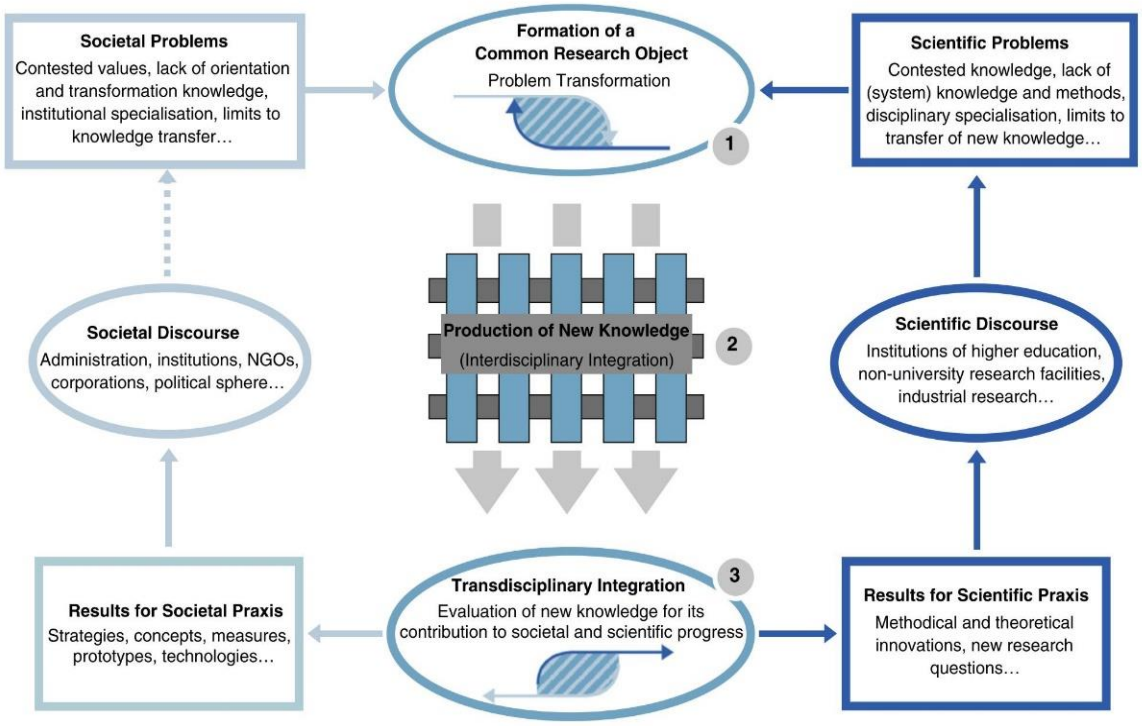


***Figure 2. Conceptual model of transdisciplinarity.***
*The numbers indicate the three phases of the ideal transdisciplinary research process.*
*Source: Jahn* et al *2012, p.5*

In the *first phase,* a societal problem is transformed into a boundary object, a team is formed, and the research process is designed together with all parties, transforming diverging expectations into desired manageable outcomes of the research (Jahn et al. 2012).

During the *second phase,* there is an interplay of specialized work in subteams and a generation and integration of knowledge from different disciplines (Jahn et al. 2012). Achieving this integration requires negotiation between the different forms of knowledge (equally valid) according to the question and the composition of the research team (Miller et al. 2008).

The *third phase* is concerned with evaluating the results of the research process in terms of their potential contribution to society (validity and relevance to the original real-world problem) and to scientific progress (new knowledge within and outside the disciplines) (Jahn et al. 2012).

These phases are interrelated and immersed in a specific context, and in each phase, the team, the activities and the outcomes change (Table 1).

*Table 1. Team composition, activities and outcomes according to the phases of Transdisciplinary Research projects*

| *Phases* | *In a TDR project* |
|---|---|
| *1. Problem framing* | ○ *the team include all relevant expertise, experience, and other relevant ''stakes''*<br>○ *the project team reach a common understanding of the problem*<br>○ *there is a common research object or guiding question, with subsequent specified research object and questions, formulated, and the partners agree on common success criteria*<br>○ *the project team agree upon a jointly developed methodological framework that defines how the research target will be pursued* |
| *2. Knowledge production (analysis of problem)* | ○ *the tasks and roles of the actors from science and practice involved in the research process are clearly defined*<br>○ *the research team use methods and settings suitable to generate solution and options for the problem addressed and for the inter- and transdisciplinary cooperation and knowledge integration* |
| *3. Integration and application (exploring impact)* | ○ *the project results implemented resolve or mitigate the problem addressed*<br>○ *the results are integrated into the existing scientific body of knowledge for transfer and scaling-up efforts*<br>○ *the research team provide practice partners and scientists with products, publications, services, in an appropriate form and language*<br>○ *the societal goals are being achieved. Additional (unanticipated) positive effects are being accomplished.* |

*Source: adapted from Lange* et al*. 2012*

In an ideal setting, the three phases are expected to occur in chronological sequence. In reality, the duration of each phase depends on the purpose of the project and other factors: in many projects, problem framing occurs at a different time and with a different team. For example, a call for funding for a collaborative research project already preestablishes many assumptions that preframe the problem and the actors to be involved. In addition, the type of discipline predefines the methodologies to be used, and these, in turn, determine the type of involvement required from nonscientific actors.

### *1.3.2 Knowledge types*

To solve societal problems, transdisciplinarity aims to produce three types of knowledge (Becker, 2002): (i) the knowledge involved in the understanding of an issue (system knowledge), (ii) the knowledge required for determining the possibilities and boundaries of decision-making (orientation knowledge), and (iii) knowledge of the ways and means of practically realizing such decisions (transformation knowledge) (Jahn et al. 2012)

(i) System knowledge refers to the observation of the context of a given system and interpretation of the underlying drivers and buffers that cause and determine the extent of change. System knowledge refers to the current state of a system and its ability to change. Understanding and interpreting the natural factors and social actors within the investigated system entities in order to produce target knowledge in the next step (Hirsch Hadorn et al., 2006).

(ii) Target knowledge refers to the scope of action, and problem-solving measures lead to better practices (technology, management, institutions). Target knowledge focuses on

desired target states, potential risks and benefits under prevailing uncertainties (Hirsch Hadorn et al., 2006).

(iii) Transformation knowledge refers to the practical implications that can be derived from target knowledge to change existing habits, practices and institutional objectives. Transformation knowledge enables practitioners to evaluate different problem-solving strategies and to achieve the competence to foster, implement, and monitor progress and to adapt and change behavioural attitudes (Hirsch Hardorn et al., 2006).

Effective transdisciplinary research relies on all knowledge types due to their mutual interdependencies (Hirsch Hardorn et al., 2006). For this reason, there are no clear relations between the *phase* of the transdisciplinary research process and the *type of knowledge produced* or *the type of involvement of* nonscientific actors (Brandt et al. 2013). However, it can be argued that the transformation knowledge seems to be more related to the *mode* of a cocreation project.

### *1.3.3 Intensity of involvement of nonscientist actors*

The intensity of the collaboration between scientific and nonscientific actors can be classified into five types: information (i), consultation (ii), collaboration (iii), cooperation (iv) and empowerment (iv) (Stauffacher, 2008; Kruetli et al., 2010, Brandt et al. 2013)

(i) Information is restricted to participation, which contains a limited degree of commitments and potential influencing power for the public.

(ii) Consultation describes a one-directional information flow from the practice actor to academia mainly retained by questionnaires, interviews, and focus groups.

(iii) Cooperation, two-way communication and a hierarchical relation between those involved and those being involved exist.

(iii) Collaboration is used to describe higher levels of involvement in which the participants are responsible on equal footing for the progress of process and output.

(iv) Empowerment presents the highest level of involvement in which the authority to decide has been given to the nonscientific stakeholders, giving them full power over content and process.

Boundaries between the levels are blurry and changing; however, differences are discernible and serve planning purposes (Stauffacher, 2008). It is recognized that participation requires reflection on the *right form* at the *right time*, rather than "*the more participation, the better" (*Kruetli et al., 2010).

Research projects often engage stakeholders at more than one level. Most research projects require at least the first level of involvement (i.e., 'information'), and many projects will include a mix of all four levels of engagement (Biodiversa 2021). Not all TDR projects have *empowerment* as an ultimate goal, although a high level of practitioner involvement is recommended for most sustainability science projects (Brandt et al. 2013).

Given the different resource requirements (in terms of skills and time) at each level of involvement, many authors stress the importance of defining the optimal level of intensity of collaboration needed, depending on the purpose of the research and the desired mode of coproduction. Jahn et al. (2012) argue that the higher the level of uncertainty of the problem to be solved, the more *collaboration* and *empowerment* is needed. Most TDR projects focus on *collaboration* and *cooperation*, while other research approaches (multi, inter and disciplinarity research) involve stakeholders at the level of *information* and *consultation*. In general, all the approaches make some kind of *information* and *dissemination* activities inside or outside the scientific community. In most of the projects, the levels of intensity of involvement change along with the type of desired integration (Figure 3).

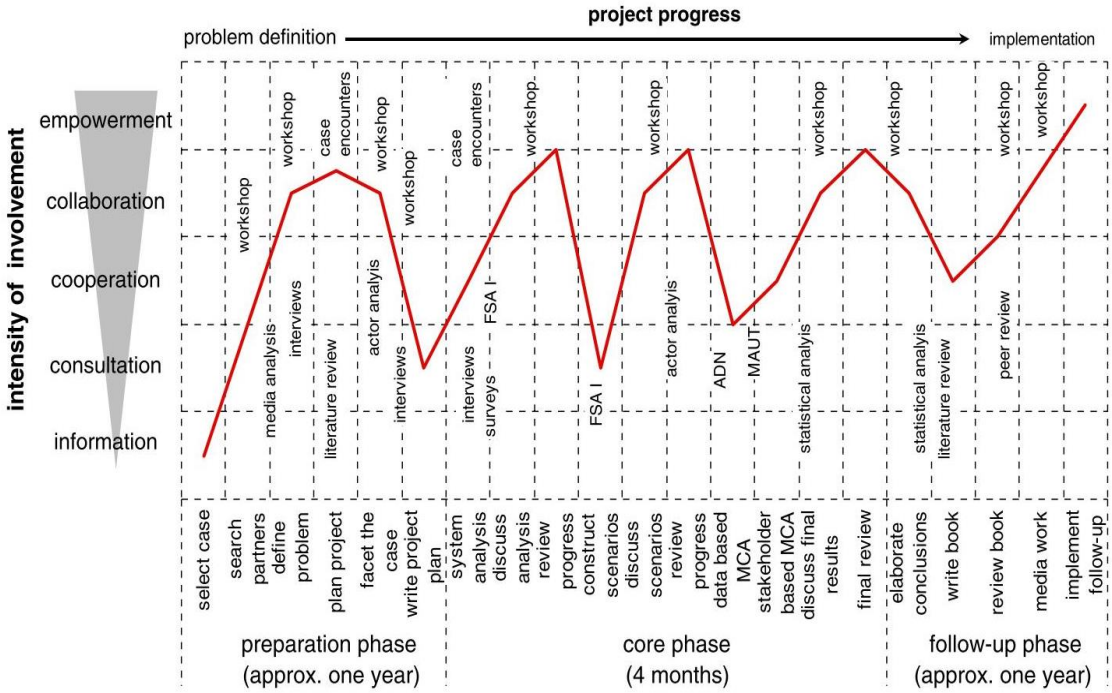


***Figure 3. Variation in the intensity of involvement of stakeholders at different phases of one TDR project***

*Source: Stauffacher, F.* et al*, 2008, p. 6*

### 1.3.4 Cocreation modes: setting the purpose of TDR project

Although the concept of the transdisciplinarity process in an ideal context is usually presented as a single model, empirical research shows that TDR implementation may follow different *modes* of execution (Chambers et al 2020). Those *modes* or archetypes are determined by underlying assumptions held during the conceptualization or the design of TDR projects: (i) purpose; ii) understanding of power; iii) approach to decision making and iv) expected pathway to impact (Figure 4).

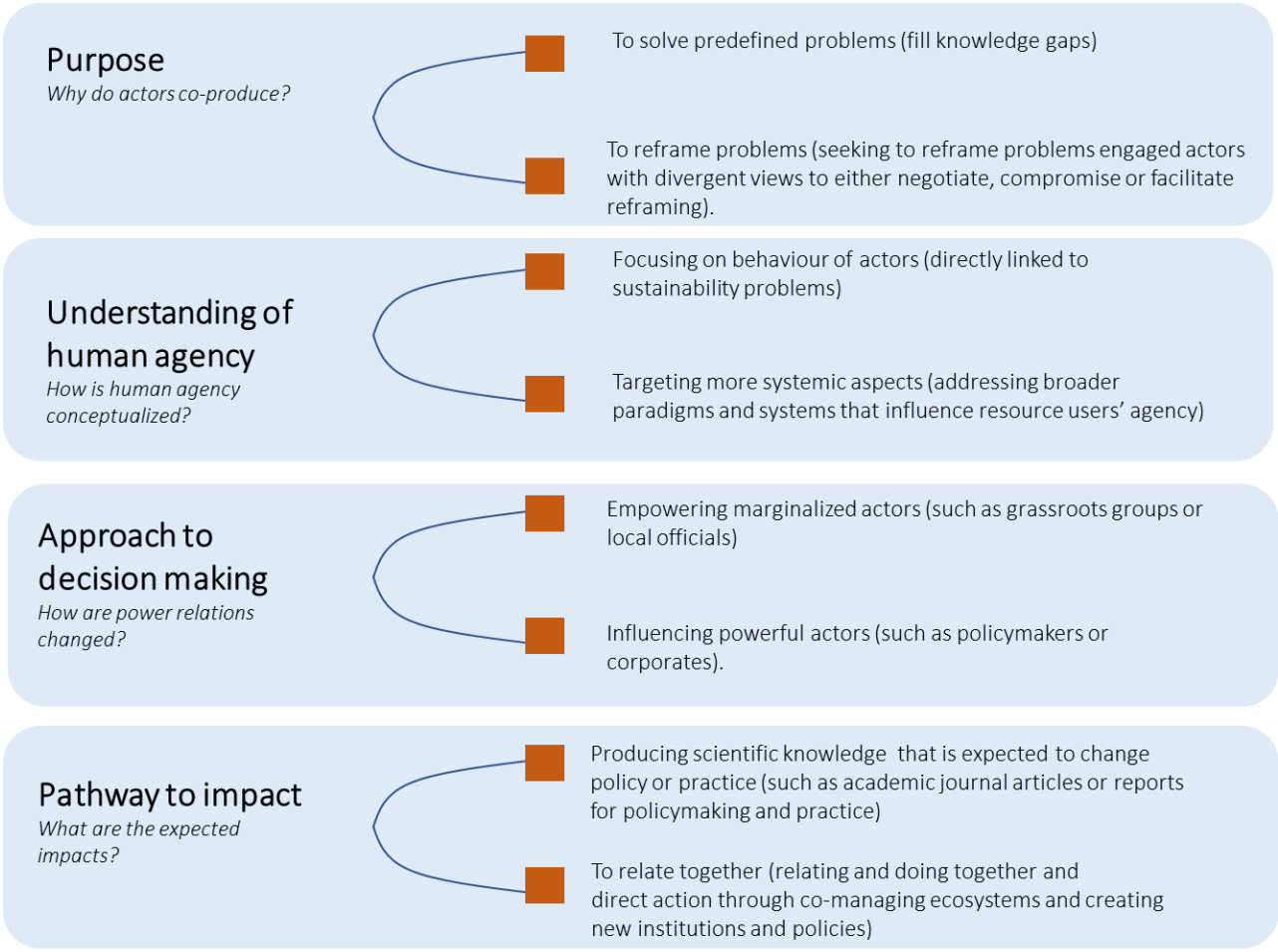


***Figure 4.*** *Six modes of cocreation projects.*

*Source: adapted from Chambers 2021*

## 1.4 Impact of TDR projects

The relatively high degree of effort involved in transdisciplinary research can be justified only if a greater gain in knowledge can be expected than with disciplinary, multidisciplinary or interdisciplinary approaches or if collaboration with practitioners is likely to transform a reality (Bergmann et al 2005). Because the main premise of TDR is to solve problems through cooperation between science and society, the impact of TDR is evaluated at two levels: i) scientific criteria and ii) extrascientific criteria, namely, change as an outcome of TDR (Jahn et al. 2012).

On the first level, scientific quality is a precondition of societal benefit (Wolf et al. 2015). TDR is normally evaluated with the quality criteria usually used to evaluate disciplinary science (Brandt et al 2013). Until now, TDR has not been fully recognized in the dominant stream of research evaluation due to the lack of coherent framing and the reproducibility of the methods (Brandt et al 2013). In addition, TDR emphasizes the quality of *the research process,* which is not sufficiently acknowledged in the metrics used to evaluate scientific quality. New frames such as Responsible Research Innovation (RRI), **Research Quality Plus (RQ+)** (Lebel and McLean, 2018), standardization of Current Research Information Systems (CRIS) (Wolf et al. 2015), and OECD guidelines (OECD 2020) are developing more comprehensive criteria

to judge and recognize the role that the process of research has on their societal relevance beyond traditional indicators (and incentives) to evaluate research and researchers' performance. Excellence and rigor are equally important for TDR, but there is a need to redefine how we evaluate and measure these qualities (OECD 2020).

On the second level, empirical analysis shows that different approaches of TDR contribute to different societal changes, from informed policies and shifted narratives to reshaped relations and institutions (Chambers et al. 2021) More importantly, there might be synergies and trade-offs between the objectives of TDR (Chambers et al. 2021) and tensions between crucial outcomes expected from TDR projects, e.g., *impact* vrs *process* and *control* vrs *inclusion* (Chambers et al. 2022). For example, projects reframing perspectives did not demonstrate shifts in policies or practices, or successful production of scientific knowledge was negatively associated with attaining other outcomes. The tendency of researchers to direct coproduction resources to fill knowledge gaps may actually hinder the attainment of other types of outcomes that inspire collective action (Chambers et al. 2021), echoing authors' claims that funding paradigms and policies predefining problems and impact pathways can constrain the full range of possible outcomes of coproduction.

In summary, the design choices of TDR projects will determine how researchers and actors will navigate the trade-offs and risks associated with different approaches to weaving knowledge, action and change (Chambers et al. 2022). Therefore, a well-designed combination of phases helps projects meet both research and societal demands (Newig et al. 2019).

## 1.5 Main challenges for TDR implementation

Based on the brief description of the previous sections and quoting Brandt et al. (2013), we can summarize that TDR has been evolving during the last decades, receiving more attention and relevance and moving towards more commonly accepted frameworks. Funding agencies and universities are adapting to better accommodate the requirements of transdisciplinary research (OECD 2020). Nevertheless, TDR faces several challenges:

- Lack of coherent framing: The use of transdisciplinary research in sustainability science is increasing, but under diverse terms, there is no common glossary, no focused communication platform and no commonly shared research. Overlaps with other concepts (action research, citizen science, triple or quadruple Helix, interactive innovation, coinnovation, cocreation) pose a problem for studies interested in following the approach. The overlap between different terminology and concepts can be a major obstacle to effective communication and collaboration between different communities (OECD, 2020).

- Integration of methods. The study of empirical cases shows that there are no clear relations between the theoretical concepts (phases and type of knowledge) and the methods. In Brandt et al. (2013), "*It is futile to use concepts such as process phases and knowledge types if these concepts cannot be clearly communicated to, and used by, practitioners and scientists seeking to engage in concrete transdisciplinary research"* (Brandt et al. 2013, p 6). The openness and diversity of methods has the advantage of adaptability to different contexts but affects the reproducibility of results and therefore the use for standardized frameworks. (Brandt et al. 2013).

- Practitioners' engagement: Although knowledge sharing and collaboration are happening, empowerment is still rare (Brandt et al. 2013). This could be caused by the design of the project or its conflict management implementation (Chambers 2022), the lack of familiarity of the actors with engagement (Lange et al 2012), or the vagueness and ambiguity of the expected

results (Lange et al 2012). Lange et al. (2012) mention the "fear of failure" as an important factor limiting actors' participation, either because of the offering of prepackaged (technical) solutions without involving practice partners or endless collaborative research continuously postponing the solutions (*knowledge-first trap*). New approaches, such as financing the development of the proposal or the notion of "researching-by-doing" (such as learning-by-doing), can create space for reflection and iterative cycles (Lange et al. 2012).

- Generating and measuring impact: Generating transdisciplinary research with high scientific impact remains challenging mostly because of the reproducibility of the methods. Although there are formative evaluations (criteria to assess the principles of transdisciplinarity) and scientific outcome assessments (bibliometrics), it is more challenging to track the societal impacts of transdisciplinary research because such impacts occur with significant delays, the causal links are often difficult to establish and the complexity level of the problems and the solutions adopted (Lange et al 2012). As more empirical studies become available, the analysis of impacts will be further studied.

***Box 1. Recommendations to Universities to address societal challenges using transdisciplinary research***

Based on a report of case studies and consultation of experts, OECD (2020) suggest the following recommendations to universities and public research institutes:

- introduction of challenge-based approaches in research strategies and organizational structures
- development of institutional structures and mechanisms to foster cooperation across disciplines and to support TDR
- establishment of structures and mechanisms to build long-term trusted relations with external stakeholder communities, including creation of formal, high-profile interfaces with civil society and private and public sector entities
- allocation of core resources, including personnel, to build long-term expertise in TDR methodologies and practice
- introduction of TDR learning modules into science education and postgraduate training courses;
- support for early career researchers to engage in TDR projects,
- changes to evaluation and promotion criteria for individuals who engage in TDR, so that they are judged not only on scientific publications and citations but also on their contribution to collective research outputs

# 2. Knowledge integration

## 2.1 How does knowledge integration occur?

Integration of knowledge is the main cognitive challenge of transdisciplinarity (Jahn et al. 2012) Jahn et al 2012 defines integration as the "*cognitive operation that establishes a novel, hitherto nonexistent connection between distinct entities of a given context"* (Jahn et al. 2012, p 3). Integration is an interactive process of coconstructing knowledge that is organized during all stages of a TDR process. (Pohl et al. 2021). The degree of integration can be relatively more superficial or profound and varies according to the epistemic distance between the disciplines involved, the timeframe of the investigation, or the complexity of the problem to be solved (OECD, 2020).

Knowledge integration occurs in several *dimensions:* communication, social and organizational or cognitive-epistemological (Bergmann et al, 2010). At the same time, there are different *types* of integration: symmetric integration, natural-social science integration, formal and informal knowledge integration and conceptual integration (Bergmann et al, 2010). The type of integration required depends on the uncertainty of the problem to solve: for the so-called '*wicked problems*', the integration of knowledge is extremely high in all phases, and the participation of external stakeholders is mandatory throughout the course of research. (Jahn et al. 2012).

Pohl et al. (2021) describe knowledge integration as "*an open-ended learning process without predetermined outcomes. It designates relations established throughout a TDR process between elements that were not previously related. Those elements are participants in a TDR process […]and more specifically pieces of knowledge, ideas, or practices from different thought-collectives as well as views of individual researchers and practitioners*." (Pohl et al. 2021, S. 23)

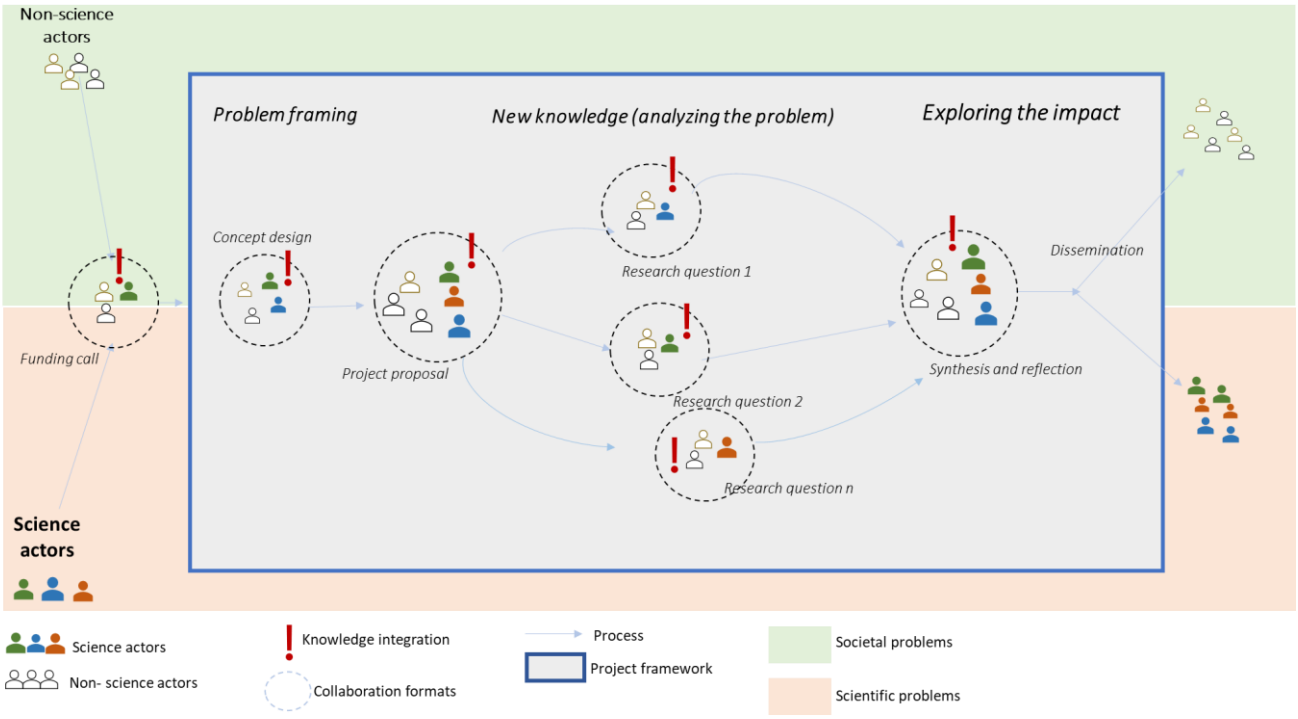


***Figure 5. Representation of how and where knowledge integration occurs in different structures and phases of a TDR project***

*Source: Adapted from Pohl* et al*. 2021*

The methods[1] used to integrate konwledge in TDR can be differentiated according to their function during the research project phases: (1) definition of concepts and theoretical frameworks, in which a shared understanding is created across disciplinary boundaries; (2) formulation of research questions and hypotheses, in which societal problems are translated into research objects; (3) development of integrative methods, in which existing inter, trans-, and intradisciplinary research methods are reviewed and adapted; (4) design of assessment procedures, in which multiple criteria from different perspectives are merged into new procedures; (5) model development and application, in which theoretical and empirical descriptions of a particular part of reality are linked; and (6) creation of boundary objects, in which mutual understanding across cognitive and normative boundaries is enhanced. A seventh area is the organization of the research itself, which is the basis of the previous six (Bergmann et al. 2012).

*Table 2. Areas and methods to integrate knowledge in the three phases of a TDR project.*

| | | | Phases of TDR projects | | |
|---|---|---|---|---|---|
| Areas in which integration can occur | | Methods of integration of knowledge | Phase 1 | Phase 2 | Phase 3 |
| A Integration through definition and theoretical framing | | ***Interdisciplinary conceptual work*** | | | |
| | 1.1 | Interdisciplinary and subject-related clarification of important terms from the problem area | ● | ● | |
| | 1.2 | Subject-specific connectivity through conceptualization of central terms with reference to the problem area | ● | ● | |
| | 1.3 | Interdisciplinary analytical conceptual work and concept formation | ● | ● | |
| | 1.4 | Categories for interdisciplinary description | ● | ● | |
| | | ***Theoretical framing*** | | | |
| | 2.1 | Heuristic for interdisciplinary problem solving | ● | ● | |
| | 2.2 | Conceptualizing integrative epistemic objects | ● | | |
| | 2.3 | Integrative theoretical framework | ● | | |
| | 2.4 | Double-sided critique of naturalistic and cultural research approaches | ● | | ● |
| B Integration through research questions and hypothesis generation | | ***Research questions*** | | | |
| | 1.1 | Reformulation of the problem description/research question related to the actors | ● | ● | ● |
| | 1.2 | Development of a common research scenario/learning model | ● | | |
| | | ***Hypothesis generation*** | | | |
| | 1.1 | Integrative hypothesis generation | ● | ● | |
| C Integratively effective scientific methods | 1 | Reviewing existing interdisciplinary methods and identifying the need for methods | ● | ● | |
| | 2 | Interdisciplinary method development | | ● | |
| | 3 | Application of proven transdisciplinary methods | ● | ● | ● |
| D Integrative assessment procedures | 1 | Multicriteria interdisciplinary evaluation procedures | ● | ● | |
| | 2 | Vision | ● | ● | |
| | 3 | Evaluation via a bayesian probability network | | ● | |
| | 4 | Formative evaluation | ● | ● | ● |

[1] We make a distinction between *integration methods* and *research methods*. The former refer to mechanisms normally used for knowledge integration at different stages of a research project. The latter are the methods used during the research process in data collection, analysis and interpretation.

| Areas in which integration can occur | Methods of integration of knowledge | Phases of TDR projects | | |
|---|---|---|---|---|
| | | Phase 1 | Phase 2 | Phase 3 |
| E. Integration through the development and application of models | 1 Models development | ● | ● | ● |
| | 2 System models | ● | ● | ● |
| | 3 Prognosis models | | ● | |
| | 4 Simulation | ● | | |
| F. Integration through artefacts, services and products as boundary objects | ***Artifacts, services, and products*** | | | |
| | 1.1 Products | ● | ● | ● |
| | 1.2 Artifacts | | ● | ● |
| | 1.3 Catalog of questions | ● | ● | |
| | 1.4 Normative questions as boundary object | ● | | |
| | ***Publications*** | | | |
| | 2.1 Guidelines for praxis partners | | | ● |
| | 2.2 Educational texts | | | ● |
| | 2.3 Scientific publications and similars | | | ● |
| G. Integrative procedures in the research organization | ***Design of multidisciplinary teams*** | | | |
| | 1.1 Interinstitutional cooperation | ● | ● | |
| | 1.2 Teambuilding | ● | ● | ● |
| | 1.3 Equality of core subjects-and aspects-the advocate principle | ● | ● | ● |
| | 1.4 Interdisciplinary and intermodule understanding - the sponsorship principle | | ● | |
| | 1.5 Founding new interdisciplinary institutions | | | ● |
| | ***Stakeholder participation*** | | | |
| | 2.1 Development of discursive products between science and Praxis | ● | ● | ● |
| | 2.2 Permanent integration with the practice partner via an intermediary | ● | ● | ● |
| | **Iteration and recursivity** | | | |
| | 3.1 Iteration for the appropriate integration of professional contributions | ● | ● | |
| | 3.2 Iterative/recursive procedures of knowledge integration | ● | ● | ● |
| | **Guiding questions at the end of the project** | | | |
| | 4.1 Final integration on guiding questions | | ● | ● |

*Source: Adapted from Bergmann* et al*, 2010.*

## 2.2 In which multistakeholder collaboration (formats) does this knowledge integration occur?

The integration of knowledge is the result of the interaction of different actors at a certain point of the project timeline in a specific format (Lam et al. 2021). Those multistakeholder actions (either consultation, collaboration or empowerment) are spaces, platforms or structures or "formats" (Lam et al. 2021)) where different actors meet and interact together. In those spaces, actors *"define problems to study, exchange expertise, build personal relations, project and maintain academic self-concepts, and yoke for status; … they create together …a basis that shapes how they collaborate with each other—such as shared language, key concepts, tacit rules of interaction, group culture and identity, and collective mission"* (Boix Mansilla et al. 2016). Successful collaborations (e.g., those that have substantive impact on subsequent research, participants' excitement, and interaction styles for mutual

learning) are related to the presence of cognitive, emotional, and interactional factors (Boix Mansilla et al. 2016, Pohl et al. 2021).

There are many possible multistakeholder structures to implement TDR; in this section, we present those that are most currently present in the literature as formal collaborations (Figure 6).

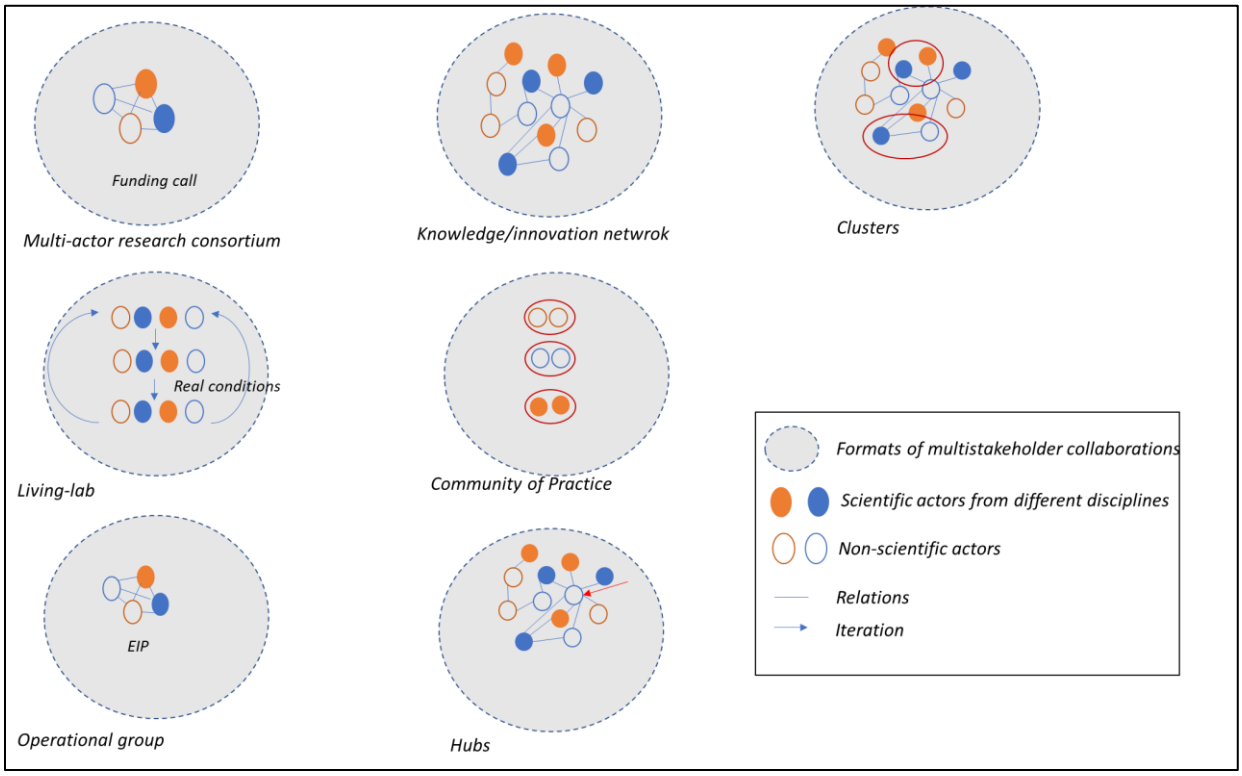


***Figure 6.*** *Examples of formal formats for multistakeholder collaboration currently used*

### 2.2.1 Multiactor research projects

Multiactor projects are projects in which end users and multipliers of research results (such as farmers and farmers' groups, advisers, enterprises and others) are closely cooperating throughout the whole research project period (EU 2021). Stakeholder engagement does not necessarily imply the involvement of end users or those subjects of study (Biodiversa 2021). In some multiactor projects, there exists the requirement that the project consortium is composed of several actors and works closely together. In many others, actors are involved as part of the *"stakeholder engagement* strategy", in which concrete activities are defined according to the objectives, the required level of engagement, the timing of engagement activities, and the expected role of stakeholders (Biodiversa 2021). Not all multiactor projects are designed as TDR projects, but many of them include *collaborations*, *involvement* and *empowerment* at some point, and many of them realize activities to generate knowledge integration between scientists and nonscientific actors.

### 2.2.2 Living labs

Living labs are defined as user-centered, open innovation ecosystems based on a systematic user cocreation approach, integrating research and innovation processes in real-life communities and settings (ENOLL,? According to the ENOLL, five key elements must be present in a living lab, regardless of their application domain: 1) active user involvement, 2) real-life setting, 3) multistakeholder, 4)

multimethod approach, 5) cocreation (i.e., iterations of design cycles with different sets of stakeholders).
According to the objective of the research and the expected level of involvement, in living labs, end users are involved in the process as an active actor, more than a subject of the research. Wanner et al. 2018 conceptualize a Living Lab or "Real Labor" as a space where TDR takes place and in which codesign, coproduction and coevaluation exist (Figure 7).

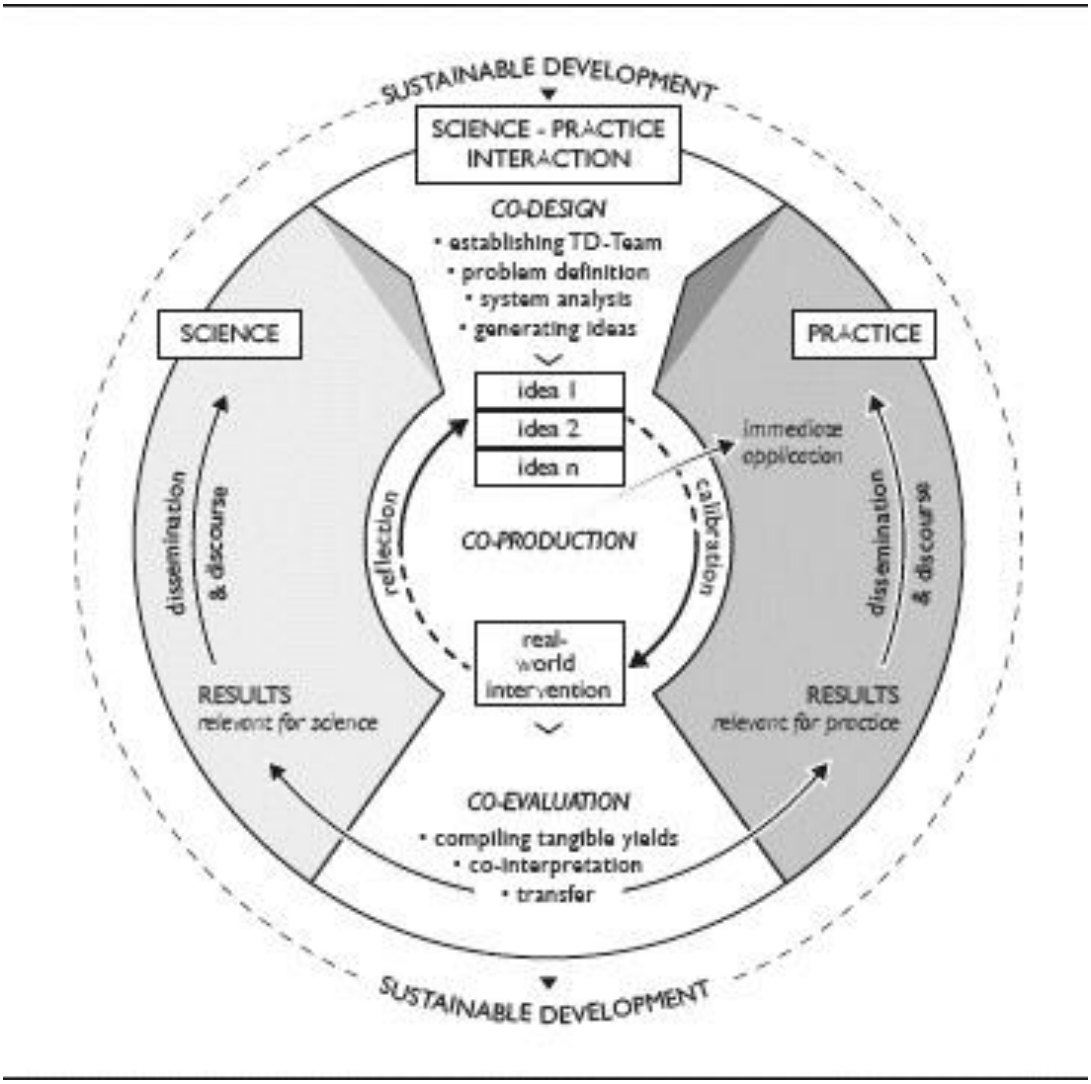


*Figure 7. Cyclical concept for Wuppertal's Real-World Laboratories.*

*Source: Wanner et al. 2018*

The model of living labs could be applied in several instances, for example, *agro-ecology living labs*, *city labs* and *policy labs*. In the case of agriculture, living labs are initiatives in which experimentation is conducted on real farms in specific territorial and community contexts, with farmers and other actors involved from the beginning as equal partners in proposing ideas, testing them, improving them and promoting them further. Agroecosystem living labs (ALL) have been defined as "*transdisciplinary approaches which involve farmers, scientists and other interested partners in the codesign, monitoring and evaluation of new and existing agricultural practices and technologies on working landscapes to improve their effectiveness and early adoption".* (MACS-G20, 2019*).*

One example of the steps of the process under this type of research is the so-called *on-farm research experimentation* that follows an iterative procedure during which practical information is generated and farmers can easily understand, assess and readily convert the research to farm practices. In such a process, actors' main interests are integrated: researchers obtain data, farmers experiment with the costs/benefits of solutions, and private developers have the ground to test innovative solutions (Lacoste et al 2020). On-farm experimentation involves changing a management variable, observing and then discussing the outcome with the main actors, with the primary objective of stimulating evidence-based learning and decisions (Lacoste et al 2020). On-farm experimentation could also be designed to allow aggregation of data and the development of models, valuable for the research process.

### 2.2.3 Operational groups

Operational groups is a term coined by EIP Agri to define groups that bring together a mix of specific actors (e.g., farmers, advisors, researchers, businesses, etc.) to work together in multiactor projects to build upon and test new ideas, find focused solutions for specific issues or develop concrete opportunities that need the creative combination of scientific, practical and entrepreneurial skills.

The difference with Living labs is that operational groups are focused on innovations, are time-bound, are subject to funding under the Rural Development Programmes, and hence are not suited to deliver long-term transition efforts and data management over a long period of time. An EIP operational group builds itself around a single innovation project, targeted towards finding a solution for a specific issue. Project implementation is limited to a few years, the time it takes to develop the innovative solution/opportunity. The operational group is not bound to a specific territory or an upfront fixed strategy and exists only to carry out that project (EIP-AGRI Service Point, 2014).

### 2.2.4 Communities of practice

A community of practice (CoP) is a group of people who are practitioners in a certain field, who share an interest or a passion for something that they practice, and who learn how to do it better through regular interaction (Catana et al. 2021). Community of Practice refers to the social dimension of learning, including the dimensions of community, identity, meaning and practice, which are all closely connected (Wenger 2000). A CoP can be created at the beginning or as a part of a larger network (Gerster-Bentaya and Knierim, 2017). There are three essential aspects in a community of practice: i) a shared domain of interest, ii) COP members engage in joint activities, helping each other and sharing information and iii) COP members are practitioners and not mere spectators (Cundil et al 2015).

### 2.2.5 Innovation and learning networks

Generally, a network refers to a group of agencies, organizations or individuals who agree to work collaboratively or in partnership to achieve a common goal (Powell 1990). *Knowledge networks* connect people across disciplinary or occupational boundaries by providing close, continuous communication and information dissemination among sectors engaged in technical as well as policy innovations for solving problems (Feldman 2012). *Innovation networks* are multiactor collaborations that are usually initiated by research institutes and formed around a particular real-life problem aiming at joint development, testing, and implementation of adaptation measures. It differentiates from knowledge networks because it focuses on innovation, has an external driving force of network development, and science actors have a specific role (Schmid et al 2016).

Networks are recognized as models for innovation promotion, where an emphasis is placed on knowledge accumulation in external linkages, system integration and extensive networking (Preez &Louw, 2008). In contrast with classical "organization", networks are based on voluntary contributions and navigate in unknown areas, and therefore, classical management methods usually used for

organizations might not be applicable: *"Instead of starting with a mission and targets and ending up with instructing people, we start with people, and look for their ambitions for which they feel energy. Then, we try to connect these people so that they can share this energy for creating movement. The targets will become clear over time. A shared mission is not the start of a good process, but the result of* it" (Wielinga and Vrolijk, 2008). In this uncertain dynamic, to reach the objectives, the so-called *"cold"* factors (instruments, indicators, competences) are as important as "warm" factors (energy, networks, ambitions) (Wielinga and Vrolijk, 2008). Therefore, a facilitator of such a process must address cognitive and emotional factors (Boix Mansilla et al. 2016, Pohl et al. 2021).

### 2.2.6 Hubs

A hub is a node in a network where the number of links greatly exceeds the average. The term has been used in several instances to depict a conglomerate of coordinative forms that aim at remodelling the productive, distributive and redistributive mechanisms for products, services and economic value (Berti and Mulligan, 2016). For example, a digital innovation hub helps companies in a region become more competitive by improving their business/production processes and products (and services) through digital technology (Fraunhofer, 2020, Smart Agri-Hubs, 2022). In comparison, a Food Hub is an intermediary organization or business that works as the supply chain manager and provides a logistical and organizational platform for the aggregation and distribution of source-identified food products from local and regional producers to wholesale buyers and end consumers (Berti and Mulligan, 2016).

### 2.2.7 Clusters

A cluster is a group of actors, organizations and/or structures according to shared or similar characteristics or interests. Clustering might respond to the distance between geographical characteristics or thematic areas, and it is assumed that its uniqueness facilitates the comparison of cases, the identification of factors affecting a process or the adoption of measures or policies at the regional level.

# 3. Which methods, tools, and techniques for knowledge integration exist?

Transdisciplinary sustainability research utilizes a broad range of different methods for knowledge integration and production. There is no clear set of tools required for different process phases or integration of different types of knowledge (Brandt et al. 2013). This is mainly because a restricted set of methodological tools may not allow adequate access to frame the problem from the point of view of various actors or disciplines (Jahn et al., 2012). The plurality of methods used does, however, potentially compromise the notion of the reproducibility that is demanded by science, increasing the "costs" of method integration and hampering communication within and outside the transdisciplinary research community (Jahn et al., 2012). (Brandt et al. 2013) For that reason, it may be helpful to develop a broad suite of accepted methodological tools. This may increase the efficiency and effectiveness of transdisciplinary research in sustainability science and help to communicate its findings to other scientists and the wider public (Brandt et al. 2013).

The methods and procedures to be applied along a TDR project are diverse and should be selected according to the joint vision for knowledge integration (Hoffmann 2016) In this chapter, we present some methods of integration in the areas mentioned in Chapter 2. We make a difference in *methods of integration* and *research methods*. The former refers to mechanisms normally used to generate knowledge integration at different stages of a research project. The latter are the methods used during the research process in data collection, analysis and interpretation.

## 3.1 Collaborative methods to work with multistakeholder groups

The use of participatory approaches to reach consensus and promote action in teams has been widely studied and used in academia, industry and civil society as a way to promote creative and critical processes of change. Many diverse schools of thought have created, refined and disseminated practical facilitation methods, tools, and skill sets to be able to design processes around the underlying dynamics of human systems, power relations, conflict, and teamwork (Brouwer et al 2016).

In this section, we compile notions and principles of the most frequently mentioned concepts in the literature on TDR: participatory tools, design thinking and social science research. Those three "lenses" are not mutually exclusive and are nourished by each other.

### 3.1.1 Participatory tools

Participatory methods are tools for dialogic communications among planners, facilitators, administrators and their partners to help them solve acute problems and to increase problem-solving capacities for those involved (Hoffman et al 2011). Participation is not only about the tools; rather, they have to be embedded in attitudes and behaviours favourable to dialogue. Without a supportive attitude, the tools could be counterproductive and may lead to disappointment (Hoffman et al 2011). The outcomes of participatory activities are usually unpredictable because of their open and flexible character and therefore need organizational and planning structures that can deal with surprises and changes (Hoffman et al 2011). Participatory rural appraisal (PRA) is a process structured in nine steps (see Annex 1. Tool number 10).

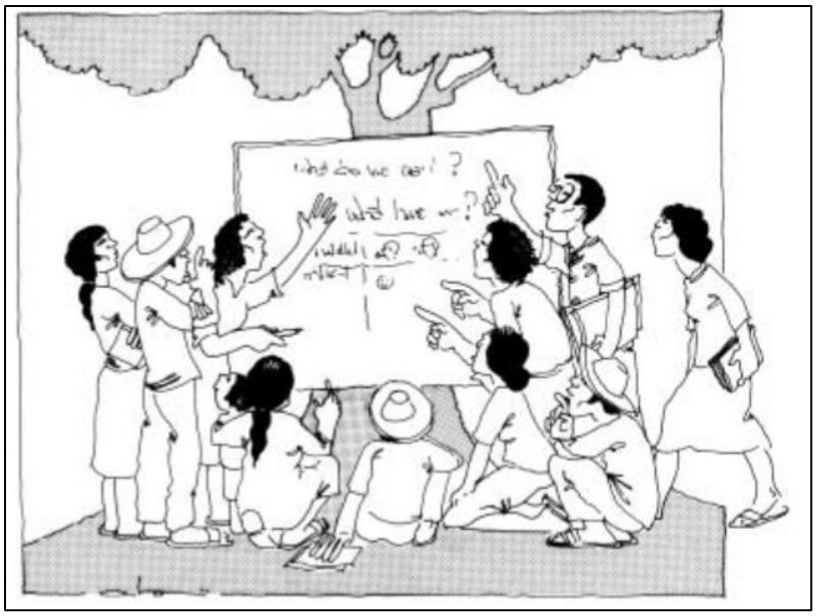

*Figure 8. Collaboration setting of participatory methods.*

*Source: Germann and Gohl, 1996*

What initially started as a pioneering method to enable communities to solve their own problems inspired work at other scales, such as regional and global value chains, and the facilitation of what is called multistakeholder partnerships (Browel et al 2019). Currently, multiple guides are available. A list of sources is exemplified in Annex 2.

### 3.1.2 Design thinking

Design thinking is a set of methods and tools to solve problems and promote innovations, popularized from 2005 in business schools and design instances to create ideas that better meet consumers' needs and desires. Brown 2008 defines design thinking as a set of spaces rather than steps. In those spaces (either end-user problem or solution), an iterative and nonlinear process of inspiration, ideation and the process of generating, developing and testing the ideas leads to the way to market new products, services or strategies (Brown 2008).

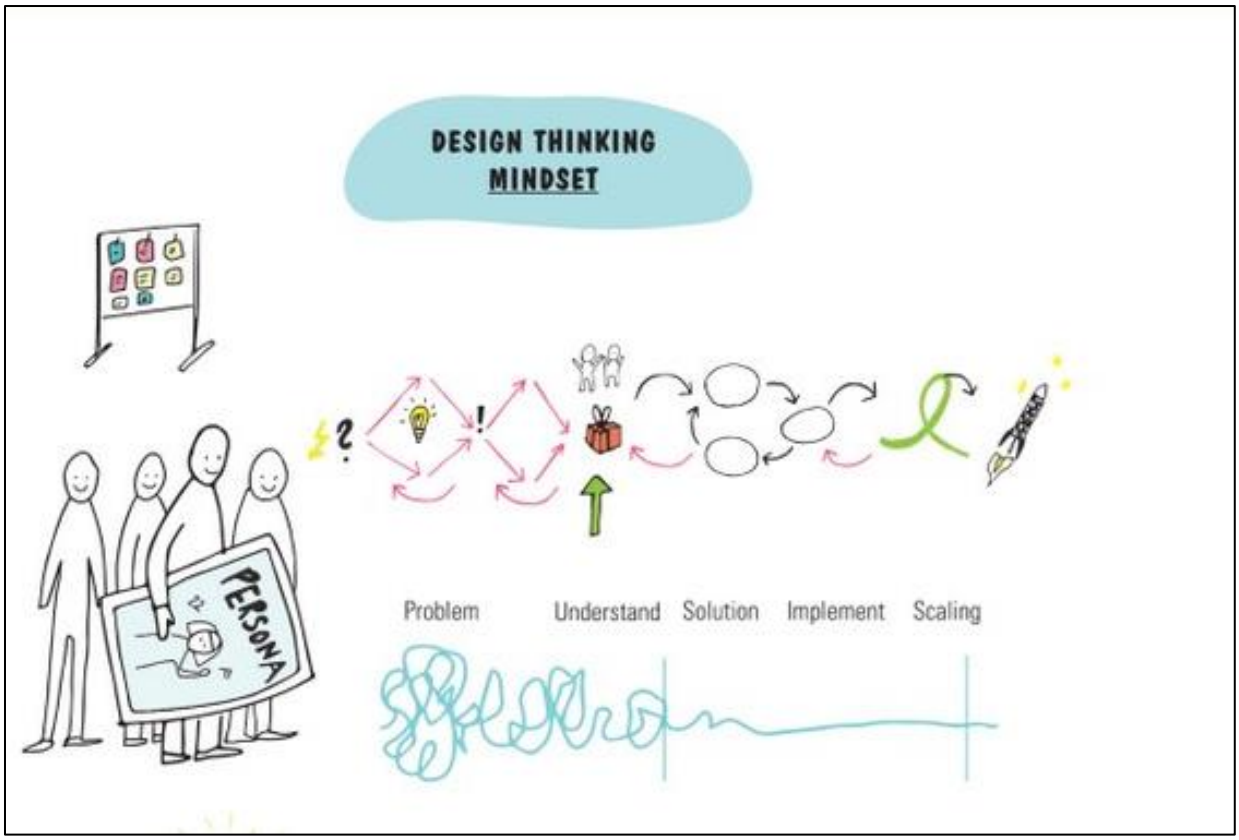


***Figure 9. The process of human-centered design thinking***

*Source: Lewrick* et al *2018*

Because of the end-user centered approach, design thinking tools are considered potential instruments of transdisciplinary dialogues and multistakeholder collaborations (Browel et al 2019, Gonera and Pabst,2019). Enablers and barriers of the use of design thinking are very similar in business, academia and TDR projects (Gonera and Pabst, 2019).

### 3.1.3 Social science research tools

Traditionally, social science research uses instruments to capture data and obtain insight from the *subjects of research*. Surveys, semistructured interviews, interviews, and focus groups are instruments used to collect empirical data using quantitative or qualitative data and/or analysis. Mixed-methods approaches make use of a mixture of qualitative and qualitative tools to answer research questions requiring both types of research (Creswell, 2018). More recent research approaches have developed tools related to TDR, such as *action research* and *citizen science*. Participatory action research emphasizes the connection of research with action in a real-world setting, resulting in the cogeneration of knowledge between researchers and participants (Fletcher et al. 2015). Citizen science is defined as "public participation in scientific research", which means "*intentional collaborations in which members of the public engage in the process of research to generate new science-based knowledge*" (Shrik et al 2012 p 3). Citizen science involves a broad spectrum of involvement and outputs: citizens support certain phases of the research process (e.g., data collection) or projects where citizens have real potential for social change (Schäfer and Kieslinger 2016). Citizen science can include but does not necessarily involve either interdisciplinarity or cocreation (OECD 2020).

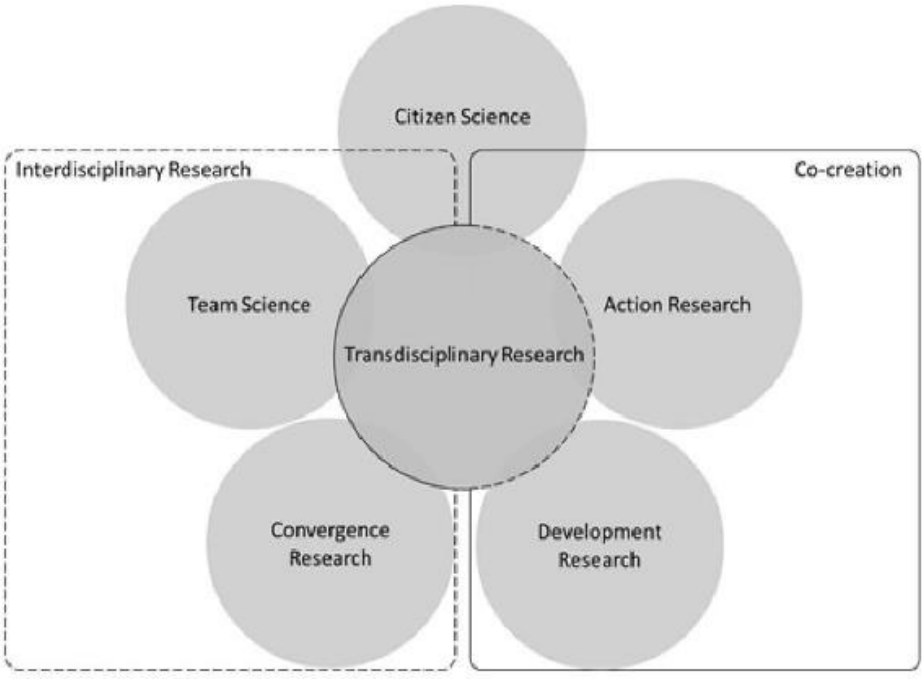


*Figure 10. Social science research approaches and their relationship with transdisciplinary research*

*Source: OECD 2020*

## 3.2 Tools by phase of transdisciplinary research and integration

In this section, we list the tools that exist and have been used and documented before. The definition of what is a *tool* is in general very broad, and therefore, the classification of tools is challenging. We used the term tool as an activity that has an *expected purpose and outcome and can be applied in a determined period of time, involving several actors and using a predefined procedure.* Some are small exercises of short duration (1-2 hours), some others are a sequence of steps to achieve a broader objective, and some others can be classified as a "mindset" or a "battery" of tools. The purpose of using a specific tool is given by the type of integration of knowledge desired (Table 2), and this is based on the general purpose and expected impact pathway of the project (section 1.3.4).

We identify the potential tools to be used by areas of knowledge integration and project life management cycles (Figure 11).

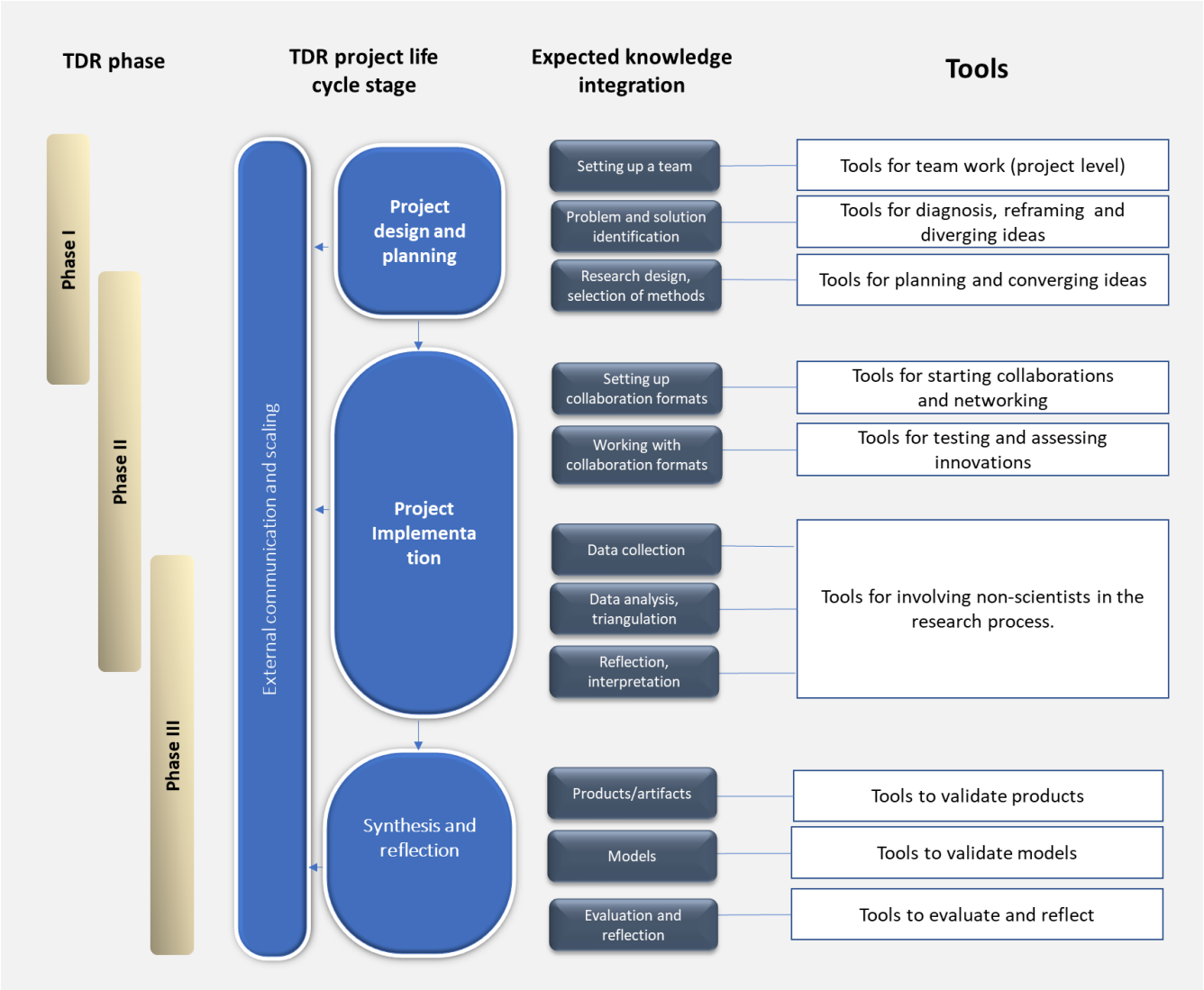


*Figure 11. Overview of the tools according to the phase, the management cycle and the integration of knowledge.*

*Source: Authors*

Each tool has a purpose and a different procedure. As seen in Figure 11, the phases of TDR could overlap according to the type of research, and therefore, it is difficult to relate a specific tool to each phase. Therefore, to operationalize TDR, it is more useful to first determine the type of integration desired and then proceed to select the more suitable tool(s) to apply according to the project life cycle management stage (Table 3).

*Table 3. List of tools that can be applied in different integration areas, according to project life cycle and TDR phase*

| Phase TDR | If you are in (project cycle) | …and want to integrate knowledge in | …then you can use | …with the purpose of … |
|---|---|---|---|---|
| I | 1 Project design and planning | Setting up the team | ***Tools for team work (project level)*** | |
| | | | 1 Discussion group | Team setup<br>Rules set up |
| | | | 2 Brain storming/brain writing | Get divergent ideas about the problem |
| | | | 3 Card collection | Get similar ideas together |
| | | Identify problems/and or solutions | ***Tools for Problem diagnosis and exploring solutions*** | |
| | | | 4 Venn Diagram/stakeholder identification | Identify main actors, institutions, influence and interests |
| | | | 5 Stakeholder analysis, prioritization and understanding | Identify main stakeholders, interests, potential roles, and potential barriers in the project |
| | | | 6 Rich picture/mind maps | Gain new perspectives of the problem/solution |
| | | | 7 Problem tree | Identify/characterize the problem (could be part of the Theory of Change procedure) |
| | | | 8 Framing and reframing | Gain new perspectives of the problem |
| | | | 9 Soft system analysis | Gain new perspectives of the problem and the system |
| | | | 10 SWOT analysis | Identify weakness and strenghts of the team |
| | | | 11 Constellation analysis | Identify the main actors interest and their relation to the research questions |
| | | | 12 Interviews (experts, actors) | Get insight of the individual perception oft he main actors |
| | | | 13 Persona | Identify problems according tot he perspective oft he end-user to define the problem |
| | | | 14 Empathy map | Identify problems and potential solutions for specific target groups |
| | | | 15 Concept canvas | Analyse influencing factors in a problem |
| | | | 16 Rural Rapid Appraisal tools (livelihood strategies, social map, seasonal maps, calendars, production analysis) | Tools to identify problematic at field or community level, usually rural areas |
| | | | 17 Timeline analysis | Promote reflection on trends and developments and to link events with strategic planning, with the end-users |
| | | | 18 Transect analysis | Identify the (spatial) situation with the end-users, frequently in rural ares |
| | | | 19 Participatory mapping | Identify actors, interest, process and power relationships |
| | | | 20 Field visits, excursion, cross-visits | Have an in depth examination of perspectives and experiences of main stakeholders about a problem or a potential innovation |
| | | | 21 Delphi method | Converge stakeholders opinions |
| | | Develop research questions or hypotheses | ***Tools for Converging/structuring ideas, strategies and research questions*** | |
| | | | 22 Scenario development | Identify (forecasting or backasting) future scenarios |
| | | | 23 Project objective hierarchy | Converge in the solution to the problem |
| | | | 24 Theory of change | Develop and visualize a strategy of action that links activities with expectations of stakeholders |
| | | | 25 Stakeholder involvement strategy | Develop and visualize the strategy of involvment of stakeholders during the project |
| | | | 26 Project Canvas | Identify and visualize the main components of the project |

| | | | | |
|---|---|---|---|---|
| | | | 27 Give and take matrix | Identify collaborations between subgroups in a project |
| | 2. Conducting research activities (cocreation) | | | |
| | | Set up collaboration formats(e.g. networks, living labs) | ***Tools for Setting up and facilitating formats for collaboration (livinglabs, innovation networks, platforms)*** | |
| | | | 1 Discussion groups | Team setup<br>Rules set up |
| | | | 2 Brain storming/brain writing | Get divergent ideas about the problem |
| | | | 28 Coherence tool | To expand insights in the functioning of a vital network; to clarify the participants' positions in the network and to clarify the (power) differences and similarities between the participants. |
| | | | 29 Network analysis | Create a map that can be used to priorize the relationships that need to be worked on to implement the initiative. |
| | | | 30 Initiative spiral | Plan or monitor different stages of the development of an initiative considering cold or warm factors |
| | | Work with collaboration formats(e.g. networks, living labs) | ***Tools for generation of ideas, diverging*** | |
| | | | 2 Brainstorming, brainwriting | Generate ideas |
| | | | 6 Rich picture/Mindmaps | Generate new ideas based on others ideas |
| | | | 15 Concept canvas | Analyse influencing factors in a problem |
| | | | 14 Empathy map | Identify problems and potential solutions for specific target groups |
| | | | 31 Six thinking huts | Generate ideas considering mutliple midnsets |
| | | | 20 Field trips/crossvisits/in field observations | Generate data/validate results and perceptions of solutions implemented in the field |
| | | | 32 Worldcafe | Generate new ideas based on others ideas |
| | | | 33 Caroussel | Generate new ideas based on others ideas |
| | | | 16 Rural Rapid Appraisal tools (livelihood strategies, social map, seasonal maps, calendars, production analysis) | Tools to identify problematic at field or community level, usually rural areas |
| | | | ***Tools for converging ideas*** | |
| | | | 3 Card collection | Order multiple ideas in similar clusters to identify trends a faciltiate agreements |
| | | | 34 Voting, ranking and prioitisation | Reaching consensus accridng to criteria |
| III | | | 35 Story telling | Sketch potential solutions identifying barriers, opportunities and points of improvement |
| | | | 36 Prototyping | Sketch potential solutions identifying barriers, opportunities and points of improvement |
| | | | | |
| | | | ***Tools to get/provide feedback*** | |
| | | | 37 I like, I wish, what if | Provide feedback |
| | | | 38 Feeback capture grid | Provide feedback |
| | | | 39 Usability tests | Test a solution under a scpecific context |
| | | | 35 Story telling | Sketch potential solutions identifying barriers, opportunities and points of improvement |
| | | Data collection, analysis or interpretation | ***Tools for participating in research steps (collect, analyse and interpret data)*** | |
| | | | 40 On- farm (on site) experimentation | Identify the benefits and costs of a solution; generate data for research |
| | | | 41 Citizen science tools | Generate data (big volumes) and get feedback form cititzens |
| | | | 42 Triadic comparison of technology options (tricot) methodology | Farmers lead the research by planting trials of 3 varieties under their normal practices and conditions |

| | | | | |
|---|---|---|---|---|
| | | | 20 Field trips/crossvisits/in field observations | Generate data/validate results and perceptions of solutions implemented in the field |
| | | | 21 Delphi method | Converge stakeholders opinions |
| | | | 43 Development and validation of models | Get feedback on models and results form key stakeholders and experts |
| | 3. Synthesis and reflection | Products, artifacts, models and evaluation | ***Products/artifacts, models evaluation*** | |
| | | | 21 Delphi method | Converge stakeholders opinions |
| | | | 43 Development and validation of models | Get feedback on models and results form key stakeholders and experts |
| | | | ***Evaluation*** | |
| | | | 46 Multicriteria assessment | Assess the results of the changes in terms of relevant criteria for researchers and stakeholders |
| | | | 44 Most significant change | Determine the more salient impact of the project |
| | | | 17 Trendlime/timeline | Identify milestones and external aspects that influenced the project |
| | | | 45 Reflection tools (lessons learned) | Identify lessons learned oft he project |
| | | | 35 Story telling | Sketch the process identifying barriers, opportunities and points of improvement |
| | | | 18 Transects | Identify the situation after the project |

As a basic and first rule, the selection of which tool to use depends mostly on the expected result, the expected number of participants and the contextual conditions. The rationale, purposes, steps and examples are described in Annex 1. The use of the tools requires the presence and collaboration of several actors, and effective integration involves an emotional and a social-interactional dimension, beyond the cognitive dimension (Pohl et al. 2021). Therefore, skills to facilitate human interactions are an essential part of collaboration formats. Particularly important for TDR is the handling of the ethical issues that arise from the application of the integration methods.

### 3.2.1 Facilitation

Facilitation of collaborative events and groups requires specific knowledge, skills and behaviour (Bolliger and Zellweger, 2007). The function of the facilitator is to lead a group towards attainment of a goal upon the group has previously agreed upon.

Competences for facilitation include *interaction competence* (effective communication and problem solving), *visualization competence* (external memory of topics developed), *participation competence* (bringing out the best in a group by cumulative learning) and *dramaturgic competence* (arranging an event alternating between suspense and thrill, group and plenary sessions, experience and cognition) (Oepen, 2003).

*Box 2. Basic rules of facilitation*

- First be clear about the expected result, then choose the appropiate methods.
- Make agreements with participants for every event, every sequence, and every step.
- Successful facilitation begins with preparation.
- Limit yourself to what is feasible.

Source: (Bolliger and Zellweger, 2007)

According to Gerster-Bentaya and Knierim (2018), facilitators should take care of:

- Continuous visualization: supporting an open documentation of relevant contents and group decisions taken. A common way of visualization makes use of moveable cards, sticky notes, or flipcharts of different forms, colours and shapes that are disclosed among participants and documented on the minutes.

- Well-selected questions: they are key to activating participants' knowledge and inviting them to contribute. Depending on the stage of a process, questions can enlarge or narrow a topic. To be functional, they need to be perceived as relevant and answerable for the participants. Idea collections normally start with quite open questions, while in a situation analysis to identify cause-effect relations, questions can be rather specific. If possible, pretest the questions to ensure their adequacy and potential answers.

- Make everybody speak: that includes politeness and respect for everybody's constributions. Several methods and techniques help to ensure that all participants are able to contribute.

- Create a dramaturgy according to the group dynamic. The design of an event needs to consider personal relationships and the energy levels of participants. The level of intensities needs to be combined: working units in which contents are elaborated in subgroups and later presented and discussed in the plenary, presentations in plenary, listening and contributing. Breaks are of tremendous importance, and the change in methods whenever the energy level of participants starts declining.

### 3.2.2 Ethical considerations

Traditional research, specifically qualitative research, requires a strong emphasis on dealing with ethical issues. Similarly, TDR should consider ethical aspects from the matters that can arise during the design or implementation. OECD (2020) mentions the following points that should be part of a priori ethical approval and periodical revision of a TDR project:

- Diversity and inclusivity of partners: project stakeholders should be chosen based on technical and disciplinary factors and represented by the groups that will be impacted by the research and any implemented solutions.
- Asymmetries of power There is a need to identify and mitigate power differentials between scientist and nonscientist actors. That includes transparency in dealings with end users, as well as meaningful engagement of all stakeholders.
- Cultural equity and/or language issues can also be important in local-scale projects. Because effective communication is critical in TDR, ensuring sufficient language proficiency on the project team is needed.
- Equitable distribution of risks and benefits: Well-designed TDR projects proactively identify potential winners and losers, especially with respect to vulnerable groups, and take measures to balance risks and benefits.
- The potential for unintended consequences that can extend to groups that are not directly involved in a project and hence have 'no voice'. Outreach and consultation activities that extend beyond project partners are one way to explore unintended consequences.
- Data access and who controls access can be particularly sensitive issues. This relates to personal data and other forms of sensitive data, which cannot be openly shared.

# 4. Managing transdisciplinary research projects

The project life management cycle is usually defined in four steps: analysis of situation, planning, implementation and evaluation. In contrast, traditional research projects follow a logic starting with the identification of research gaps, development of a research question, data collection, analysis of data, reaching a conclusion and finalizing with publications and dissemination of scientific outputs. TDR follow the flow of research projects involving science and nonscience actors, where knowledge integration occurs (Figure 12).

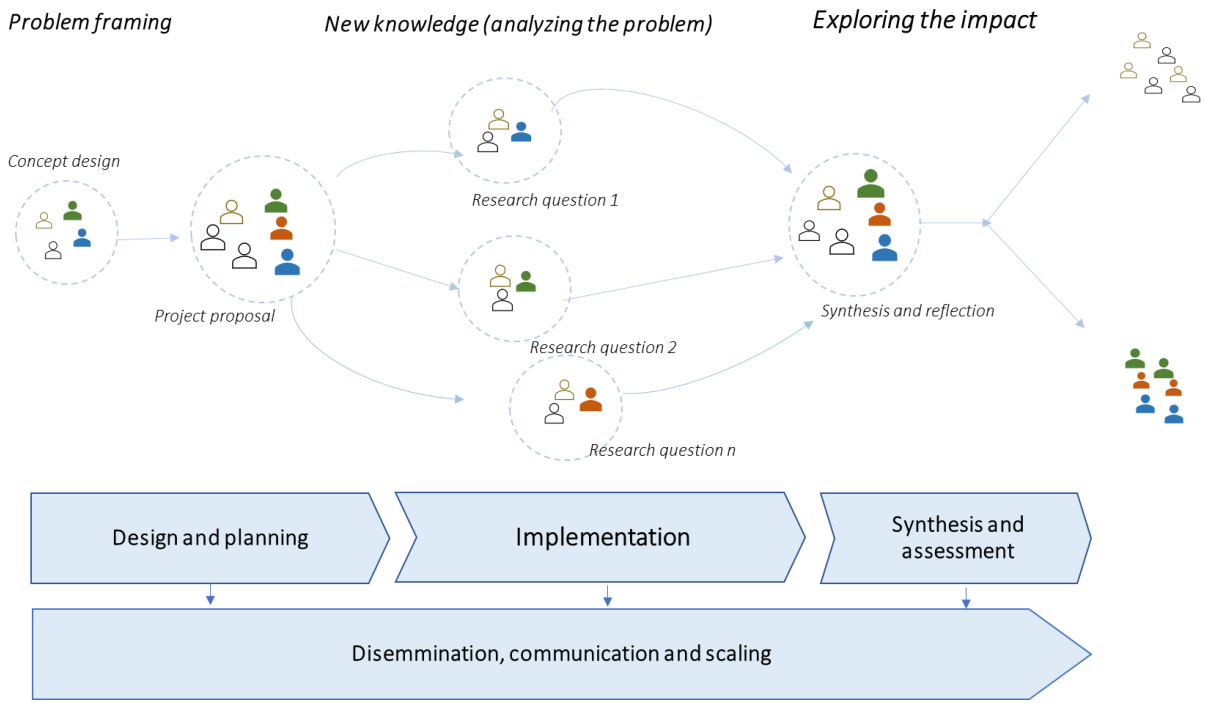


*Figure 12. Project life management stages in TDR projects*

***Source: authors adapted from** Hoffman* et al*. (2017)*

Beyond context, the most important factors associated with success or failure are those associated with process design and participant selection, in particular i) systematic representation of stakeholders prior to initiating a participatory process; ii) professional facilitation, including structured methods for eliciting and aggregating information from participants and balancing power dynamics among participants; and iii) provision of information and decision-making power to participants (de Vente et al. 2013).

## 4.1 Designing and planning TDR projects

The design of TDR projects is likely to pose the greatest difficulties during the management of a TDR project. This is due to the difficulties experienced during the selection of project partners and establishing mutual trust, understanding and coordination (OECD 2020). It is also the stage where the structural mechanisms, goals and expectations are most likely to evolve. The way TDR projects are designed largely depends on the conditions and requirements of the funding call. In general, we can identify several potential steps in the design of TDR projects:

- Identifying the frame conditions of the project
  - Get to know the funding call
  - Identify key and interested actors

- Engage key partners
  - Set up a core team
  - Define the desired involvement of stakeholders in the design of the proposal
  - Define the expected mode of coproduction and desired impact pathway of the project

- Develop a concept proposal
  - Agreement on the problem and key actors
  - Understanding and reframing the problem from key actors' point of view
  - Agreement on the strategic approach of the research gaps
  - Define the desired involvement of stakeholders along the project
  - Check the ethical considerations of the foreseen project
  - Agreement on the research questions
  - Agreement on a plan for developing the project proposal

- Develop a full proposal
  - Describe the problem
  - Describe the objectives, research gaps and state of the art
  - Describe the research questions and methods to answer them, identifying and deciding the expected level of knowledge of integration between stakeholders and disciplines
  - Describe and quantify tasks and resources necessary, including those to organize opportunities for knowledge integration
  - Visualize assumptions and establish casual relationships: revise and refine the strategic approaches, ensuring that the main activities, actors, and project logic are sound and adequate to contribute effectively to the main outcomes and impacts
  - Revise the knowledge integration expected from stakeholders in the stages of the project and in the subgroups
  - Identify criteria of success (from science and practice perspectives) and develop a monitoring plan

- Develop a communication and exploitation plan

*Box 3. Questions to assess in a TDR project proposal*

- Do the disciplinary composition and the competence in the team permit the treatment of the essential aspects of the problem?
- Is the competence of the practice partners appropiate to the everyday life problem and its solution (relevant knowledge, role in the project, possibilities to implementing results)?

- Does the project take up an everyday life problem, and how is this problem relevant?
- Is the everyday life problem adequately translated into scientific questions? Is the current state of knowledge taken in to consideration and can the research questions be regarded as innovative in relation to this state of knowledge?
- Is there a common research object formulated that covers the whole research team, and can it serve in the research process as a basis for knowledge integration?
- Has the project team formulated plausible criteria of success for the project?
- Is a distinction made between goals of scientific knowledge and goals for practice? Are reasons given for the focus?
- Are suitable methods planned to conjoin contributions of knowledge from participating scientific fields and from practice?
- In the research project, is flexibility ensured by permiting research with as few normative goals as possible (the desired goal situation in the realm of practice; not anticipating the result)?

- Do the methods envisioned, the interfaces of transdisciplinary collaboration, the form of integration of practice, and the form of results and products fit the solution strategy sought for the project goal?
- Does the structuring of the project (work steps, connection between modules, integration steps) correspond to process of generating and integrating knowledge in the research process and to the requirements of the participating actors?
- Have means and opportunities for the specific tasks of coordinating, integrating and organizing a transdisciplinary research project been planned?
- Did the research team plan the work jointly?
- Are the kind of project management and decision-making structures described and do they seem to promise success under the conditions of the project?
- Is there regular reflection planned on the cooperation in the team and on the implementation of plans of knowledge integration?
- Are procedures of self-reflection and quality assurance planned?

*Source: Bergmann* et al*, 2005*

## 4.2 Implementing the project activities

During the implementation of the plan, the strategies designed during the planning phase will be conducted to achieve the goals (Blanckenburg et al 2005). The implementation of TDR projects

requires including nonscientist actors in those stages where they contribute differently (Enengel et al 2012). Coordination, leadership and communication have a large relevance together with the management of potential challenges and conflicts (Figure 7).

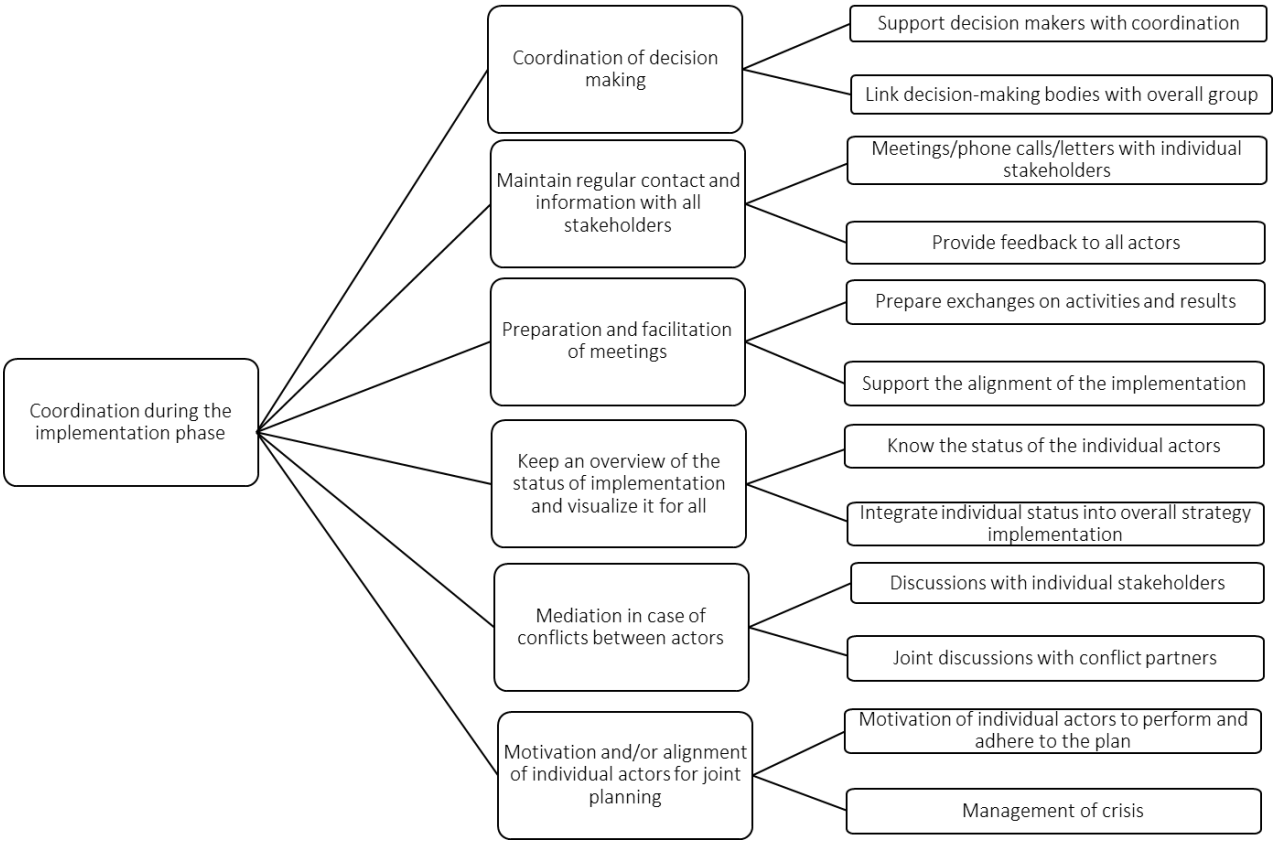


*Figure 13. Role of coordination in TDR research projects*

*Source: adapted from Blanckenburg* et al *2005.*

TDR requires explicit and continual negotiation about values, goals, ways of working, definitions, criteria for success, division of labour and other issues (OECD, 2020). Project actors usually navigate tensions and power dynamics differently (Chambers et al 2021). Those pathways or "agility" levels driven by facilitative leadership influence the coproduction of knowledge, action, and change by diverse actors with apparently different agendas (Chambers et al 2021).

Two major tensions influence the choices made during the implementation of a cocreation research project: 1) the relevance of *impact* vs. the relevance of the *process* and 2) the tension between having *control* of actors vs*. inclusion* of actors (Chambers et al 2021). When dealing with those tensions, conflicts and trade-offs, OECD (2020) highlights the importance of four management aspects:

- Structural mechanisms to manage complexity. TDR project management requires significant resources and management of multilevel and cross-disciplinary governance structures that need to be supported by formal agreements on issues such as dispute resolution, changes to project goals or advisory arrangements and budgetary management.

- Effective, regular and consistent communication with different stakeholders, different standards, expectations, and incentives for communication; in some cases, it is essential to have a designated and skilled facilitator to manage relationships and communication.

- Leadership across academic disciplines and other stakeholders in the project team can be delicate, especially where mandates and/or lines of authority are unclear. Coleadership with academic and nonacademic leaders is often desirable. In any case, projects should explicitly establish equivalent standing (or justifiable hierarchies) among members of the project team and procedures to resolve conflicts.

- Managing expectations and loss of enthusiasm among partners who do not see particular elements as related to their personal or professional objectives (expectations about publications, language barriers, ownership of intellectual property). Because TDR generally involves pressing societal problems, expectations and pressures can be greater than in traditional research, with failures resulting in a loss of confidence on the part of project partners. In general, proactive, a priori negotiation and an equitable balancing of transdisciplinary elements with more focused research can help manage expectations across the wider set of project stakeholders.

*Box 4. Questions to assess during the implementation of TDR project*

- Are execution, collaboration, and time management in the production and integration of knowledge succesful?
- Is the collaboration in the research team and with representatives from the realm of practice (social integration) succesful?
- Are the tasks and roles of the actors from science and practice involved in the research process are clearly defined?
- Are management and decision-making structures functional?
- The research team use methods and settings suitable to generate solution and options for the problem addressed and for the inter- and transdisciplinary cooperation and knowledge integration?
- Are suitable methods applied or developed to combine all bodies of knowledge coming from the participating disciplines and from the realm of practice?
- Are there specific working tools supporting the methods of the transdisiciplinaryity knowledge integration and is their use succcesful?
- Is there congruence between the project focus (science and/or practice) and the type of knowledge gained?
- In the course of the project, can a shift between parts of the research with scientific focus and parts with a practical focus be observed?

*Source: Bergmann* et al.*, 2005*

## 4.3 Synthesis and assessment of TDR projects

The synthesis of results in a large TDR project is defined as bringing together, integrating and summarizing the individual research results of the subgroups in such a way that the intended audiences can make effective use of them (Hoffman 2017).

In large TDR projects, a synthesis of the results is normally produced at the end of the program. The synthesis responds to the overarching research question and facilitates the subsequent step of disseminating and communicating with external stakeholders. The synthesis of results should be planned from the beginning of the project and varies depending on the project complexity. Hoffman et al. (2017) identify nine steps in the synthesis process: 1) identify synthesis topics, formulate key messages and define target audiences; 2) define objectives, questions and responsibilities; 3) define methods and procedures; 4) approve proposal; 5) collect and screen results; 6) process, analyse and integrate data and results; 7) prioritize and synthetize data and results; 8) validate synthesis and results; and 9) diffuse synthesis results. The process of prioritization, validation and discussion of results is recommended to be conducted in consultation or collaboration with experts from science and practice.

While the synthesis is a summary of the project results to be disseminated, the evaluation is a reflection on the process and results.

There are many ways to perform the evaluation, according to the objectives of the assessment. We can identify frameworks for assessing the process (Bergmann et al 2005), frameworks for assessing societal outcomes (Chambers et al 2020, Belcher et al. 2019) and framework for assessing scientific outcomes (Wolf et al 2015).

In addition to these external evaluations, internal reflection is usually done in project meetings such as General Assemblies. Reflection tools are used to assess the achievement of the objectives and derive lessons learned.

*Box 5. To check during the synthesis and assessment of TDR project*

- Are the planned procedures for self-reflection and quality assurance used?
- Did the project follow the rules of communication that were laid down?
- Were strategies for coping with conflicts or crises in the project implemented?
- Is the research goal achieved?
- Has there been scientific innovation/progress? Have new scientific methods concepts, or instruments resulted?
- Are the planned disciplinary results achieved?
- Is a contribution made to solving a societal/practical problem?
- Are the practice partners or practice representatives criteria of success fullfilled?
- Are the strategies for transfer from science to practice that were laid down in the project concept and proposal succesful?
- Are there unintended direct effects in the scientific sphere and in the realm of everyday life, and how are they assessed?
- Are there unintended indirect effects in the scientific sphere and in the realm of everyday life, and how are they assessed?
- How does the planned budget compare with the actual needs for funds?
- What products are there? Is the relation to target groups successful?
- What publications are there? Is the relation to target groups successful?
- Is there a description of the transdisciplinary research methodology?
- Is there a description of the methods and procedures of the transdisciplinary knowledge integration?
- Is there a description of the generalizability of the context-related results?
- Does the preparation of the research results for implementation in practice adequately consider the societal and institutional framework conditions?
- How can the additional use of results that justifies the transdisciplinary approach be described?

## 4.4 External communication and scaling

EU defines communication, dissemination and exploitation to those activities that will bring the research results to the attention of as many relevant people as possible (EU 2014). The strategic planning and implementation of those activities can help to actively involve partners, establish partnerships with similar projects and partners, inform stakeholders about the different steps and amplify scientific messages to broader audiences.

The dissemination and communication strategy should be established from the start of the project. A model to design this strategy is provided by the EU where communication activities are directly related to the expected impact pathway, open data access and management of intellectual property (IP) (Figure 13).

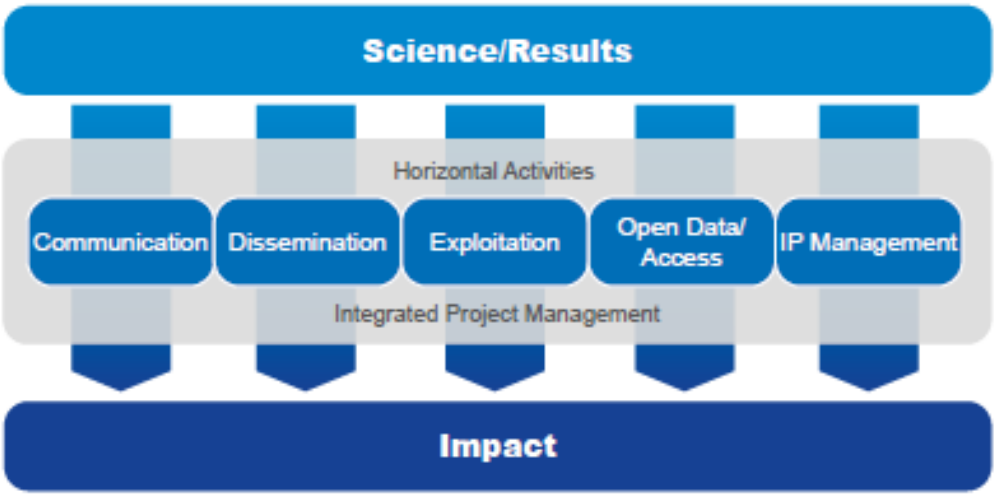


***Figure 14.** Components of a dissemination and communication strategy in a research project*

*Source: European IP Help Desk 2022*

Communication has the objective of reaching out to society and showing the impact and benefits of research activities. The focus is to inform and promote the project and ist results in a nontechnical manner and through strategically planned actions possibly engaging in a two-way exchange. The target audiences are multiple audiences beyond the projects' own community, including media and the broad public.

The dissemination objective is to transfer knowledge and results with the aim of enabling others to use or reuse and take up the results, thus maximizing the impact of the research. The focus is on describing and ensuring that the results are available for others to use or reuse. The dissemination strategy is targeted to audiences that may take an interes in the potential use and reuse of the results (scientific community, industrial partners, policy makers)

Exploitation has as an objective to use and reuse the project results through scientific, economic, political or societal exploitation, aiming to turn the research actions into concrete

value and impact for society. The focus is on making concrete use/reuse of the project results. The targeted audiences are people or organizations (including project partners or oder user groups) that make concrete use of the project results.

The practical steps recommended to develop a communication, dissemination and exploitation strategy are as follows:

1. Make a situation analysis and develop the ojectives (Why)
2. Map the targeted audiences for communication, dissemination and exploitation (Who). For each audience, you should work on a distinct strategy using targeted messages, means and language.
3. Build the main messages to be transmitted (What)
4. Define the tools, channels and timing (How)
5. Monitoring and evaluation according to the Key Performance Indicators (KPI)

### *Box 6. Checklist to build a communication strategy*

A. Ensure good management

- ☐ Have resources been allocated (time and money)?
- ☐ Are professional communicators involved?
- ☐ Is continuity ensured?

B. Define your goals and objectives

- ☐ Are there any goals and objectives?
- ☐ Are your goals and objectives neither too ambitious nor too weak?

C. Pick your audience

- ☐ Is your audience well defined?
- ☐ Does it include all relevant target groups?

D. Choose your message

- ☐ Is it news?
- ☐ Are you connecting to what your audience wants to know?
- ☐ Are you connecting to your own communication objectives?

E. Use the right medium and means

- ☐ Do they reach the audience?
- ☐ Do they go beyond the obvious?

F. Evaluate your efforts

- ☐ Go back to your goals and objectives. Have they been reached? What lessons have you learned?

*Source: EC 2014*

# 5. GFE strategy for supporting TDR research projects

## 5.1 GFE objectives and TDR support strategy

The GFE supports researchers from different university departments in the preparation and carrying out of national and international cooperation projects and in the setting up and support of research networks. Many of the current services are related to exploring funding opportunities and acting as a contact point for new collaborations.

In the past, GFE has been involved in the management of transdisciplinary research project management with functions related to the enhancement of dialogue and cooperation between Hohenheim researchers, support the application of collaborative research and facilitation of dialogue with relevant stakeholders outside academia, including civil society organizations and the private and public sectors.

From this point of view, the implementation of the TDR strategy is based on the previous experiences developed and collected in the provision of these services.

In recent years, many funding opportunities for researchers have increased their requirements for multistakeholder interactions, the use of responsible research and innovation frameworks, professional management of communication activities and more sophisticated requirements for open data and intellectual property.

***Box 7 The current services of GFE***

1. Explore funding opportunities and act as a contact point for new cooperations
2. Identify fitting candidates and support the formation of adequate consortia for relevant project grant applications
3. Support the faculties and the presidency of the university in identifying high potential candidates for high-profile project grant applications
4. Support Hohenheim researchers in applying for collaborative research grants (information on funding opportunities and funding requirements, provision of management support in proposal writing to ensure the quality of proposals)
5. Enhance dialogue and cooperation between Hohenheim researchers across faculties and disciplines by creating networks around specific themes
6. Foster collaboration with national and international researchers outside of UHOH
7. Facilitate dialogue and collaboration with relevant stakeholders outside of academia (civil society organizations, private sector, public sector) and support knowledge exchange
8. Provide information and coaching to promising young scientists
9. Participate in collaborative research projects – in project coordination, dissemination, knowledge-brokerage and science-policy-dialogue activities
10. Care for external support (e.g. of project management firms), as far as needed
11. Continued exchange and dialogue with research funding organizations
12. Present the expertise and profile of Hohenheim to the public (website, public relations, press, public debates, conferences)
13. Represent the university in relevant networks and events
14. Contribution to the identification of future cutting-edge research topics (follow relevant debates at policy level, participate in relevant networks, promote exchange on relevant topics through visiting lectures, conferences, round tables)

The implementation of transdisciplinary approaches in the services of GFE responds to those trends and is aligned with the overall vision and objectives of the GFE, which are summarized in Table 4.

***Table 4**. Transdisciplinary approaches in the GFE strategy.*

<table>
<tr><td colspan="3">►Overall objective of GFE<br>Making a contribution to the improvement of global food security by stimulating and supporting Hohenheim researchers engagement, participation and leadership in relevant collaborative national and international research proposals and projects.</td></tr>
<tr><td colspan="3">►Objective of the Transdisciplinary Research strategy in GFE<br>Support Hohenheim researchers in the planning and management of TDR projects</td></tr>
<tr><td colspan="3">►Components of the TDR strategy</td></tr>
<tr><td>1<br>Project management support (design, implementation, synthesis and communication)</td><td>2<br>Promote collaboration between (young) researchers from different disciplines</td><td>3<br>Establish a Resource Center on Transdisciplinary research project management</td></tr>
<tr><td>Project proposal planning<br>-Facilitation of the setting up of multiactor consortia.<br>-Design, planning and preparation of TDR project proposals.<br>-Design of stakeholder engagement strategies<br>Implementing the project<br>-Facilitation and/or implementation of stakeholder engagement strategies.<br>Synthesis and reflection<br>-Facilitation of TDR methods for synthesis of integrated research questions<br>-Facilitation of assessment and reflection of TDR projects<br>External communication and scaling<br>-Design of dissemination and communication strategies<br>-Facilititation of knowledge integration, products/implementation of communication strategies</td><td>-Support on learning by doing in design and preparation of TDR proposals.<br>-Foster exchange among postdoctoral researchers on TDR project management.<br>-Facilitate spaces for ideation of new TDR projects by postdoctoral researchers.</td><td>-Showcase TDR projects, lessons learned and best practices<br>-Provide material and resources for the use of TDR methods and the facilitation of collaborations<br>-TDR help-desk to help solve problems when planning, implementing and communicating TDR projects</td></tr>
</table>

## 5.2 Description of the components of the strategy to support TDR projects

### 5.2.1 Project management support (design, implementation, synthesis and communication)

The purpose of this component is to support researchers along all project cycle management phases, considering the critical points in the research process and covering the aspects in which researchers require specific support, such as the engagement of key partners and the development and management of stakeholder involvement strategies.

The project management support works together with researchers, potential consortium members from outside the university, Work Packages leaders and cooperation networks. The services are provided according to the experience, competences and networks developed by GFE from its beginnings.

Potential activities for these components are as follows:

*Design of TDR projects:*

- Identify, contact and promote the engagement of key project partners inside and outside the university.
- Facilitate the development of concept proposal and general stakeholder involvement strategy of research project proposals
- Make available or indicate potential tools or methods that can be used by the researchers in the design of their research strategies
- Support the development of proposals and prepropoals, including monitoring and communication and exploitation plans, and planning and assessing the knowledge integration expected from stakeholders in the different stages of the project and in the working groups.

*Implementing TDR projects*

- Guide and facilitate the process of development and assessment of stakeholder involvement strategies according to the interests and objectives of the researchers.
- Support in and/or facilitate the use of TDR processes (research tools, collaboration tools) in research strategy implementation
- Support the acquirement of competences and skills of researchers and project partners when facilitating and reflecting on TDR processes
- Conduct training events for postdoctoral researchers on TDR project management.
- Implement TDR help desk-help to provide references and sources of interest according to researchers' needs and inquiries

*Synthesis and reflection of TDR results*

- Support project TDR coordinators in the planning of synthesis and integration of knowledge between scientist and nonscientist actors
- Design and conduct facilitation spaces where scientists and nonscientists synthesize and reflect on TDR research results to cocreate and integrate knowledge about the problem intended to solve
- Facilitation of exchanges (or tools) to validate and assess TDR synthesis products or services such as models, products, videos, decision support tools, platforms or networks

*External communication and scaling*

- Design of dissemination and communication strategies following the steps of identifying actors, main messages, visual identity and means of delivery.
- Facilitation and/or implementation of communication strategies according to the project-determined messages and expected audience
- Showcase TDR project results, lessons learned and best practices
- Development of specific social network campaigns to communicate results and best practices

### 5.2.2 Enhance collaboration between (young) researchers from different disciplines

GFE has supported young researchers in preparing proposals and expanding their professional networks. One of the main barriers identified for the implementation of TDR projects is the existing incentives for researchers; based on these incentives, scientists prioritize their activities and decide on intervention strategies, research topics and methodologies. The GFE aims to provide the necessary support to make TDR manageable from the researchers' point of view. With this objective in mind, activities will be carried out to foster exchange between researchers from different disciplines.

- Support young researchers on learning by doing while preparing TDR proposals.
- Regular exchanges between young researchers from different disciplines on methods and experiences in planning, monitoring and evaluation of TDR projects.
- Facilitate spaces and materials suited for the design and ideation of new TDR projects by postdoctoral researchers.

### 5.2.3 Establish a Resource Center on Transdisciplinary research project management

To capitalize on the experiences and lessons learned from the implementation of the strategy, a Resource Center is expected to be established in the long term. This Resource Center on TDR project management will make tangible (a physical space, materials) and intangible resources (lessons learned, best practices, timely advice, on-demand service) available for TDR project management by Hohenheim Researchers.

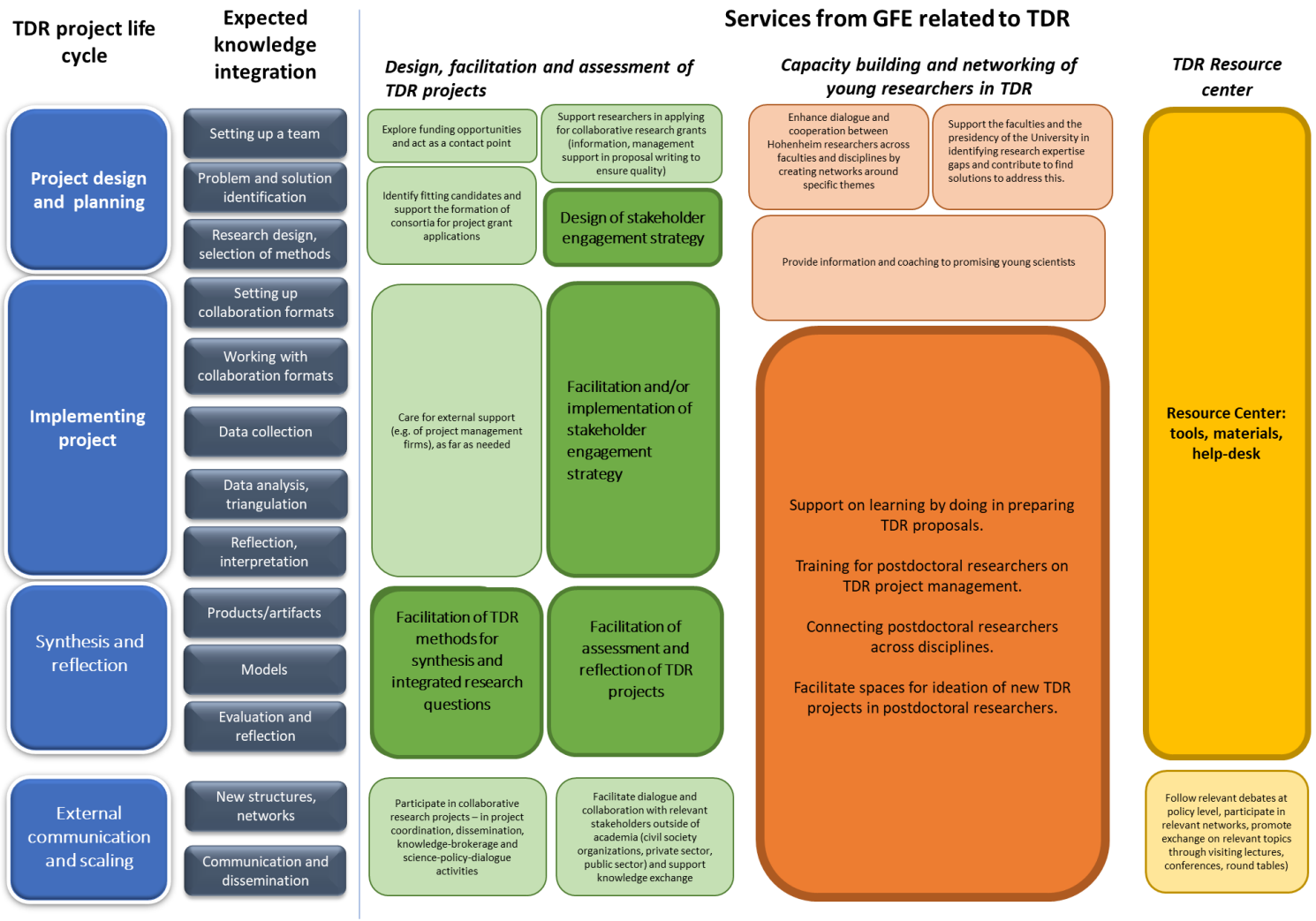


*Figure 15. Overview of services (current and new) related to TDR*project management*

** New services are presented in bold colors.*

## 5.3 Implementation of new (improved services)

Given GFE's strengths and the growing opportunities in the research landscape, a 5-year timeline is proposed for implementation of the strategy. Activities begin with a gradual build-up of the internal capacity of the GFE team to conduct, share, test and learn skills and tools. This "capacity building" activity is cyclical and is reinforced with the implementation of the components.

To address the main challenges and risks identified in the research system that hinder the implementation of the TDRs (such as lack of incentives for researchers' professional success and divergences in methods), the GFE will start gradually with the definition of concepts and methodological considerations, applying these approaches in ongoing projects and including them in new project proposals to be formulated. In addition, it is planned to work with young researchers, emphasizing a learning-by-doing process.

An overview of the gradual steps is presented in Table 5, which will be updated and complemented in the yearly plan.

***Table 5. Components and activities of the GFE strategy on TDR project management support***

| Components/activities | Time period | | | | |
|---|---|---|---|---|---|
| | Y0 | Y1 | Y2 | Y3 | Y4 |
| **0 Prepare and enhance GFE capacities for TDR project management**<br>• Identify and collect theoretical concepts and methodological resources<br>• Share experiences and develop skills of GFE team for the design and implementation of TDR projects<br>• Communicate new services to Hohenheim researchers | | | | | |
| **1 Support researchers in the design, facilitation and implementation of TDR projects**<br>• Include the concepts and methods developed in ongoing project tasks.<br>• Promote and/or include TDR concepts in the design of new research proposals | | | | | |
| **2 Promote collaboration between (young) researchers from different disciplines**<br>• Regular exchanges between young researchers from different disciplines on methods and experiences in planning, monitoring and evaluation of TDR projects. | | | | | |
| **3** Establish a Resource Center on Transdisciplinary research project management<br>• Set up a dedicated space and material for the promotion of TDR activitites<br>• Implement a "Help-desk" on TDR for Hohenheim researchers | | | | | |

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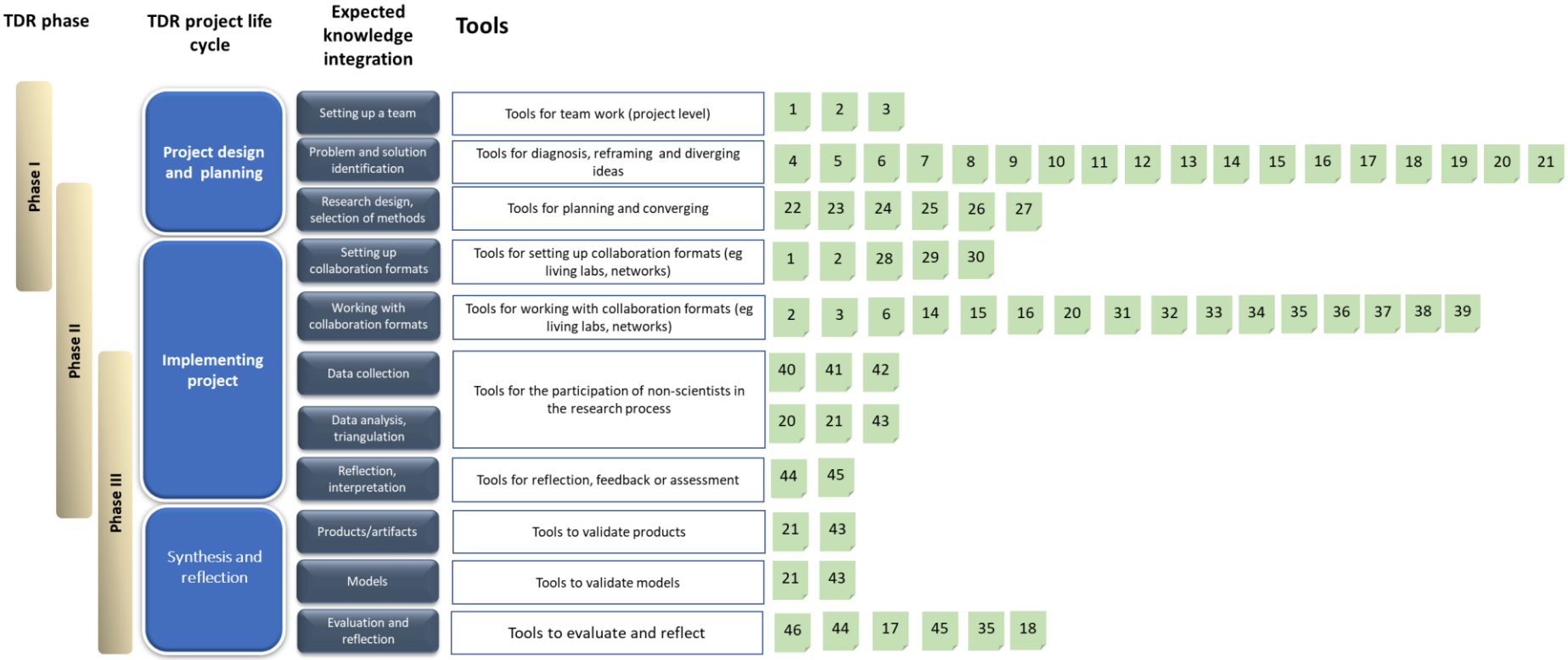
# Annex 1 Tools for TDR

## Overview of the tools according to the TDR stages



# *Tool 1 -Discussion groups*

*Source*: Bolliger and Zellweger, 2007
*TDR Phase*: Problem framing (I), Analyzing problem (II), Assesing the impact (III)
*Knowledge integration expected*: all
*Project management cycle phase*: 1, 2, 3

---

Purpose: A group of stakeholders follow a guided discusion based on the purpose of the event.

Procedure:

1) Planning an event:
    a. Determine the expected result and then choose the appropiate method
    b. Prepare and test the questions; prepare the script of the workshop.
    c. Prepare invitations, considering ethical aspects (informed consent form, data management)
    d. Check materials, seating arrangements, administrative issues.
2) Conducting an event
    a. Follow basic facilitation principles.
        i. Welcome and introduction
        ii. Setting rules and agreements
        iii. Managing the questions
        iv. Closing the workshop
    b. Visualize the questions and the (group)results. Ensure that everybody clearly understands what is being discussed
3) Debriefing and documenting an event
    a. Document (take pictures, take notes) form the main results during the workshop
    b. Debrief with the facilitation team relevant aspects to be considered when ellaborating and analyzing the report.
    c. If results are going to be used in following steps (analysis), create an standarized format in advance for data collection
    d. Try to share the key messages of the meeting with the participants within one working day.

Outputs/outcome of the tool: Report on what has been said during the discussion. The report on the session might have: 1.General information about the event and participants; 2. Description of process and tools 3. Results (answers) to the questions; 4. Comments (from the debriefing session) and 5. Transcript (when available)

Participants: Project members, participants, stakeholders

# *Tool 2 Brain storming/brain writing*

*Source*: Design Project Guide; Bolliger and Zellweger, 2007
*Link*: https://dschool.stanford.edu/resources/design-project-guide-1
*TDR Phase*: Problem framing (I), Analyzing problem (II), Assesing the impact (III)
*Knowledge integration expected*: all
*Project management cycle phase*: 1, 2, 3, 4

---

Purpose: Generate a large quantity of diverse ideas in response to opportunities or problems identified. Select a subset of ideas (two to five) to explore further.

Procedure:

1) Create questions: the basis for brainstorming is the preparation of questions. Having the 'right' questions is probably is most important factor for creating innovative ideas and solutions. Good questions should be *open*, *answerable* and *interesting* for the participants.

2) Facilitate a brainstorming:
    a. The facilitator reads aloud an introductory question written in large letters and visible to all participants.
    b. Each participant thinks about the question and writes it on separate cards/post-its (one idea per card!)
    c. Presentation of the cards: according to the objective and group composition. The presentation could be anonymous (facilitator read it), participants oriented (the participants read it) or topic oriented (the facilitator ask one participant and then other one related, and then the other…).

3) Identifying solutions to be worked in the next steps of the workshop or process
    a. Identify topics (clustering cards)
    b. Ranking or prioritazing options: participants can rank options from 1 to X. They can also vote anonymously with a dot and select those more voted. Many variations are possible according to the size of the group.
    c. Discuss further procedures: participants examine or discuss the results in order to decide further developments

Outputs/outcome of the tool:
List of ideas/ topics or themes to be worked in the next processess. Brain storming is a very flexible tool and provides an ideal way to activate participants and explore groups potential. It is useful for: identifying topics, clarifying terms, highlight different experiences, pooling creative ideas, ordering thoughts, polling opinions, formulating hypothesis.

Participants: Consortium members, stakeholders.

# *Tool 3-Card collection*

*Source*: Gerster-Bentaya and Hoffman, 2009
*Link*: ISBN 978-3-8236-1572-9
*TDR Phase*: Problem framing (I), Anaysing the problem (II), Assesing impact (III)
*Knowledge integration expected*: all
*Project management cycle phase*: 1, 2, 3

---

Purpose: The purpose of card collection is to quicly collect the ideas of the participants on a certain open question, like a collective mirror. The contributions are visualized and structured on a pin board or a wall.

Procedure:

1) The facilitator visualizes the question to be answered and distributes the same number of cards (or post-it) to each participant.
2) The participants reflect and write the answer on their cards in silence, following the rules of writing (one idea-one card!)
3) When everybody is finished writing, the collected cards are put face down on the floor in the centre of the group or collected by the facilitator and then shuffled.
4) The facilitator hold each card up so that it is clearly visible to the participants and reads ist contents. Cards which are not clear in meaning, or which are improperly written are rewritten inmediately. *The facilitator never asks who wrote the card.* Clarification comes from group discussion. The card writer may voluntarily identify himself and clarify or rewrite the card.
5) The facilitator pins the cards on the board associating ideas to the same cluster, following the instructions of the participants.
6) Duplicated cards should not normally be discarded after read it; every card belongs to someone and duplication expresses the importance of the idea for the group.
7) Once all cards are on the board, the participants review the clusters and revise, reestructure and label them, using a different color and shape of card for the cluster title. If not further discussion takes place altering the clusters, the clusters can be drawn in clouds and the cards glued to the paper.
8) If desired, the clusters can be prioritized by giving an specific number of dots to each participant to put on the cluster title card or on cards within clusters: the most important area, the three topics to discuss…

Observations: card collection requires time. Do not over use the technique, as it can become boring.

Outputs/outcome of the tool:
Usually the output of the tools is a list of ideas from the group, clustered (and prioritized).

Participants: Consortium members, groups,

# *Tool 4 -Stakeholder identification (Venn Diagram, stakeholder map)*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships; 80 participatory tools
*Link*: https://edepot.wur.nl/409844
*TDR Phase*: Problem framing (I), Problem Analysis (II)
*Knowledge integration expected*: Setting up a team; problem identification; working with collaboration formats
*Project management cycle stage*: 1,2

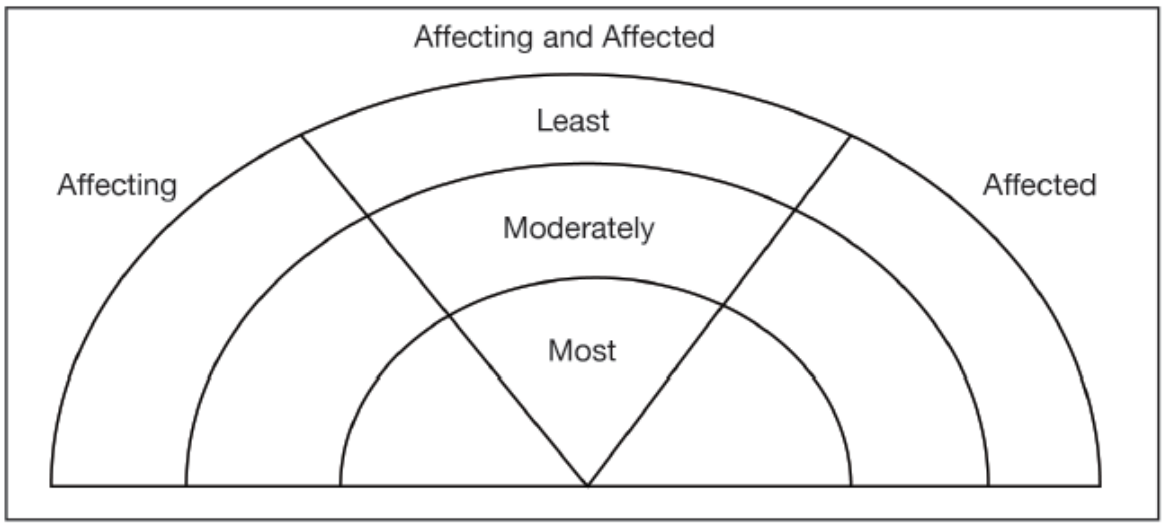
---

**Purpose:** Identifying stakeholders helps to quickly visualize actors and their interrelations as part of a system or an intervention.

**Procedure**:

1. Ask the participants to draw the actors in a specific space or collaboration. It can be done on a whiteboard or wallpaper with the help of cards/yellow notes and markers.

2. Participants have to agree on the position of the actors according to a given structure (see examples below).



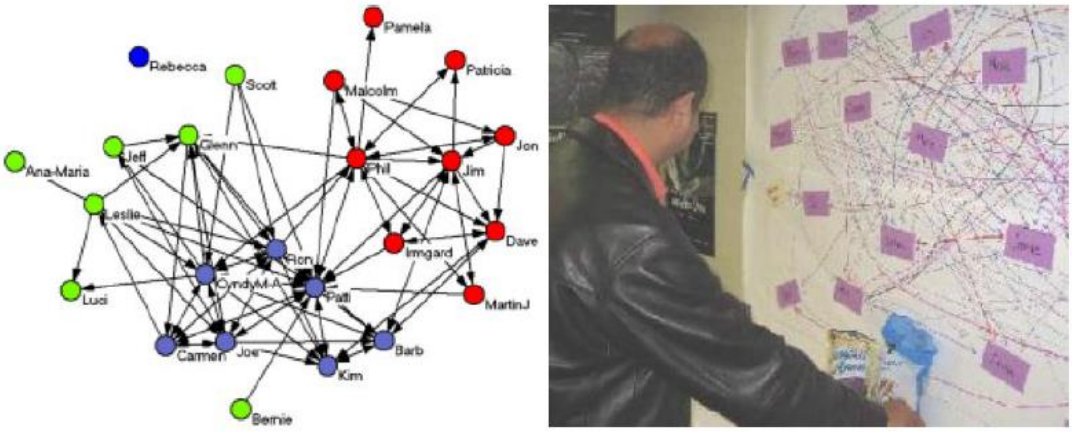

*Source: Durham et al. 2014*

3. Relationships could be also stated using arrows, such as intermittent arrows for weak connections and thick arrows for strong connections. Arrows can point both ways. You can always choose different colours to signify different types of relationships. Eventually the diagram will show which stakeholders are well connected to each other, and what sub-groups are present.

4.A spider diagram can even be extended to an inner and outer circle(s). Those stakeholders who are present and active in the inner circle and those who are not (but should be) are located in the outer circle.

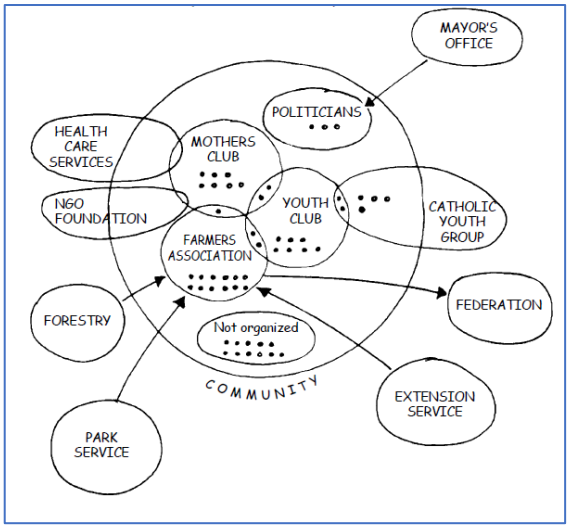
5. The identification of stakeholders could vey creative according to the desired characteristics explored by the facilitatorr.

Examples:

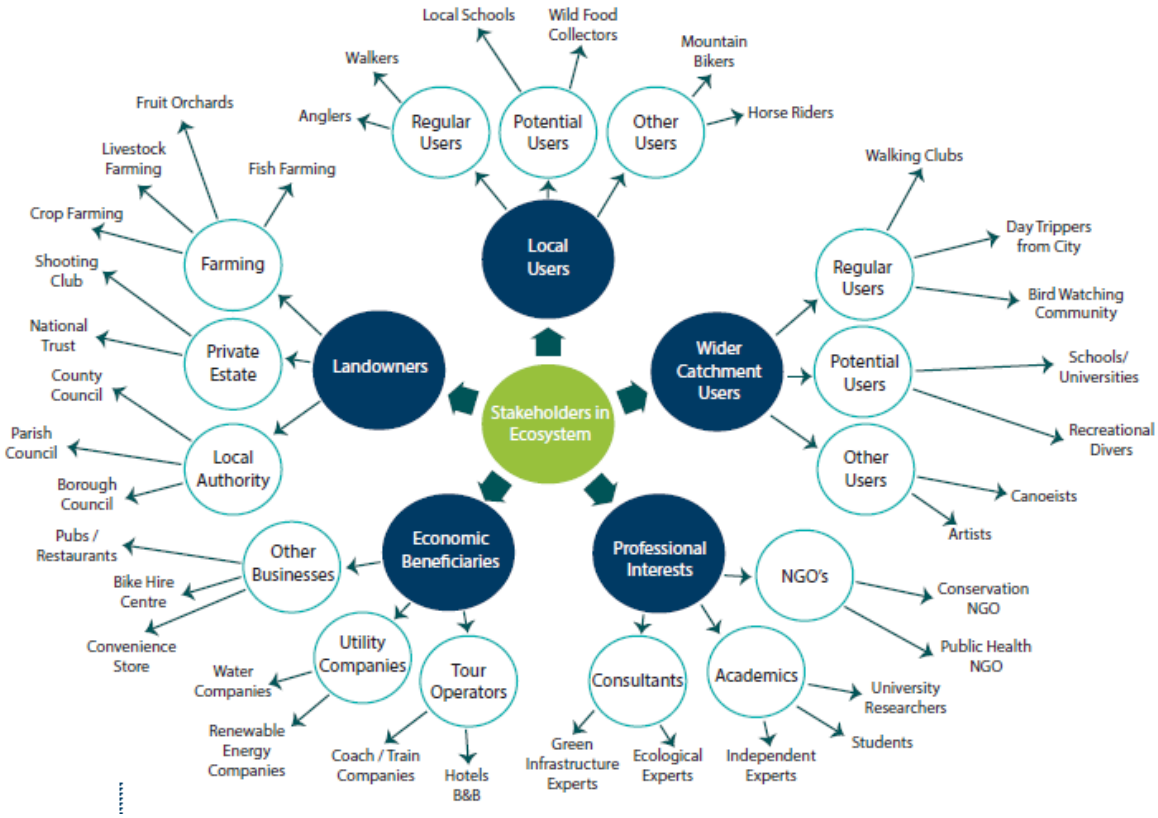



1.Identifying a network

Source: Brouwer, Herman and Brouwers, Jan, (2017)




2.Making a Venn diagram of a community
*Source: Geilfus, 2008*




3.Classifying stakeholder in an specific ecosystem

*Source: Dunham, 2020*

Outputs/outcome of the tool:

The output is a map of actors and their interrelations, organized and classified according to the areas of interest by the facilitator. It is tool mostly used to identify actors at the beginning of the project and to identify the problematic from their perspective.

**Participants:** Consortium members, group members, community members.

# *Tool 5 Stakeholder analysis, prioritization and understanding*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships; Stakeholder engagement
*Link*: https://edepot.wur.nl/409844, http://www.biodiversa.org/577.
*TDR Phase*: Problem framing (I), Problem Analysis (II)
*Knowledge integration expected*: Setting up a team; problem identification; working with collaboration formats
*Project management cycle stage*: 1,2

---

**Purpose:** Identify the relevance of the stakeholders to the project ; establish potential engagement strategies; identify critical actors and action points.

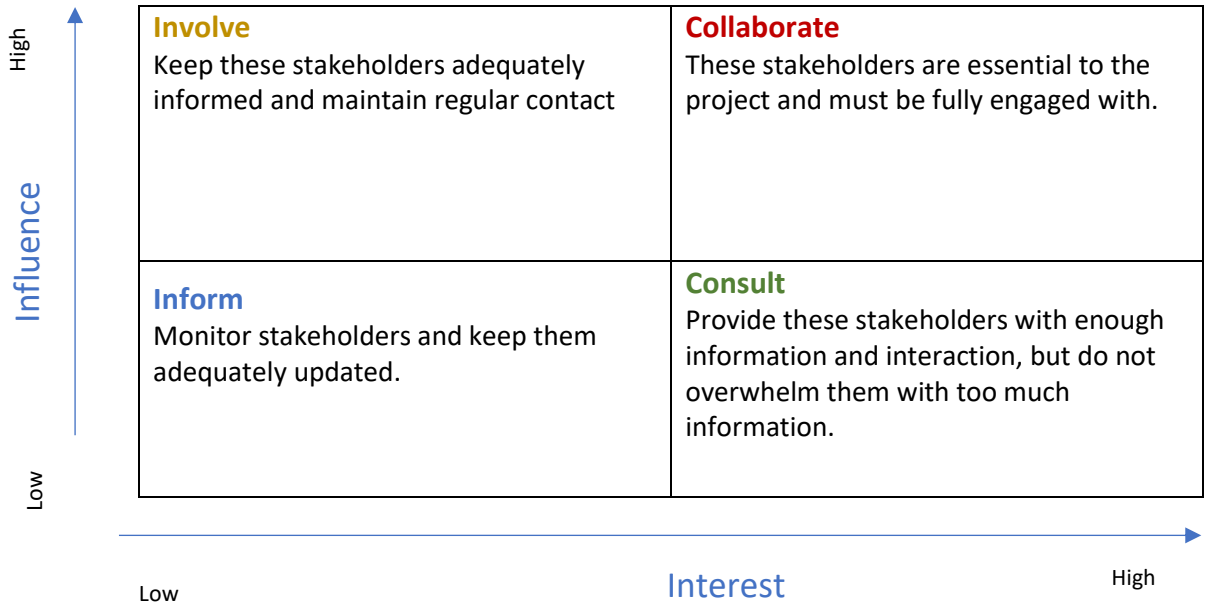
**Procedure**:

1 Option 1. Ask the participants to analyse a list of actors according to their interest and the reasons to get involved ( see for example the simple table below). The list could be derived from the stakeholder mapping or Venn diagram.

**Listing stakeholders and their interest**

| Stakeholder | Category (e.g. NGO, general public, government department) | Reasons to involve the stakeholder(s) | Why the stakeholder may want to be involved (benefits for stakeholders) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

2 Option 2. Organize the stakeholders according to their level of interest and influence to prioritize and define the level of desired engagement




3. Option 3. Ask the participants to try to understand the existing relationships between stakeholders, their knowledge and views of a project and their willingness and capacity to engage.

| | Stakeholder | Existing relationship | Relationship with other stakeholders | Knowledge of the project | Views on the project | Best means of communication | Willingness to engage | Capacity to engage |
|---|---|---|---|---|---|---|---|---|
| Collaborate | | | | | | | | |
| | | | | | | | | |
| Involve | | | | | | | | |
| | | | | | | | | |
| Consult | | | | | | | | |
| | | | | | | | | |
| Inform | | | | | | | | |
| | | | | | | | | |

*Source: Dunham 2020*

Outputs/outcome of the tool:
The output is plot of the stakeholders according to whether they have a high or low interest in, and high or low influence on, the project. The four boxes each represent a 'level' of engagement, from the lowest level ('inform'), through the middle levels ('consult', and 'involve') to the highest level ('collaborate'): The outcomes of the 'identifying stakeholders' process can be used to consider the types of engagement required and/or the timing and role of the engagement process. By developing a sound understanding of the stakeholders, the appropriate stage(s) to engage, types of suitable engagement activities, and any potential barriers that exist which could inhibit engagement, become clearer.

Participants: Consortium members, group members, community members.

# *Tool 6 -Rich picture/mind maps*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships
*Link*: https://edepot.wur.nl/409844; https://www.mindtools.com/pages/article/newISS_01.htm
*TDR Phase*: Problem framing (I), Analysing the problem (II)
*Knowledge integration expected*: Problem identification
*Project management cycle phase*: 1, 2

---

Purpose: Depiction of the reality using pictures, text, symbols and icons, which are all used to illustrate graphically the situation. It is called a rich picture because it illustrates the richness and complexity of a situation.

Procedure:
The following steps guide groups of 5-7 people in developing a rich picture.

***1. Preparation***

- Have a large piece of flip chart paper or brown paper.
- Put the paper on a table or on the ground around which everyone is sitting or standing in a way that each person can easily draw on the picture. Make sure each person has a marker (within the group different coloured markers).

***2. Facilitation***

- One person should facilitate the group work. It is essential to encourage everyone to contribute and make clear drawing skills are not important.
- Choose a case. As a group you will develop ONE rich picture about that case.
- Draw in the centre the problematic situation, as the key issue of the case. You draw the current situation.
    - Who are the stakeholders and how do they relate to the problematic or the issue?
    - Draw the relations of stakeholders to each other.
    - Draw the context, the causes and effects and any other relevant social, economic, political, environmental features or issues.
    - Make sure your drawing includes both facts and subjective information.
    - You can use a legend or some words to explain stakeholders or problems, but do not use too many words.

**3.Wrap up**

Write down on cards the 5 main challenges, actors or actions of the case arising from your rich picture.


Source: Brouwer, Herman and Brouwers, Jan, (2017)

## For making mind maps

- Write the title of the subject or project that you're exploring in the center of a page and draw a circle around it
- Draw lines out from this circle as you think of subheadings of the topic or important facts or tasks that relate to your subject. Label these lines with your subheadings
- Dive deeper into the subject to uncover the next level of information (related sub-topics, tasks or facts, for example). Then, link these to the relevant subheadings.
- Repeat the process for the next level of facts, tasks and ideas. Draw lines out from the appropriate headings and label them

Outputs/outcome of the tool:
A rich picture is a drawing of a situation that illustrates the main elements and relation ships that need to be considered in trying to intervene in order to create some improvement. Drawing echniques (also known as concept mapping, spray diagrams, and spider diagrams) can quickly capture and link ideas with stakeholders. Be careful with the use or interpretation because a rich picture meaning could be difficult to interpret by an external observer without the collaboration of those who builded it.

Participants: Consortium members, group members, community members.

# *Tool 7. Problem tree*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships; ICRC, 2008
*Link*: https://edepot.wur.nl/409844; https://www.icrc.org/en/doc/assets/files/publications/icrc-001-0951.pdf
*TDR Phase*: Problem framing (I), Analysing the problem (II)
*Knowledge integration expected*: Problem identification, working with collaboration formats
*Project management cycle phase*: 1, 2

---

**Purpose:** Create a structural analysis of the causes and effects of an issue or problem with the objective of deciding if and how to tackle them.

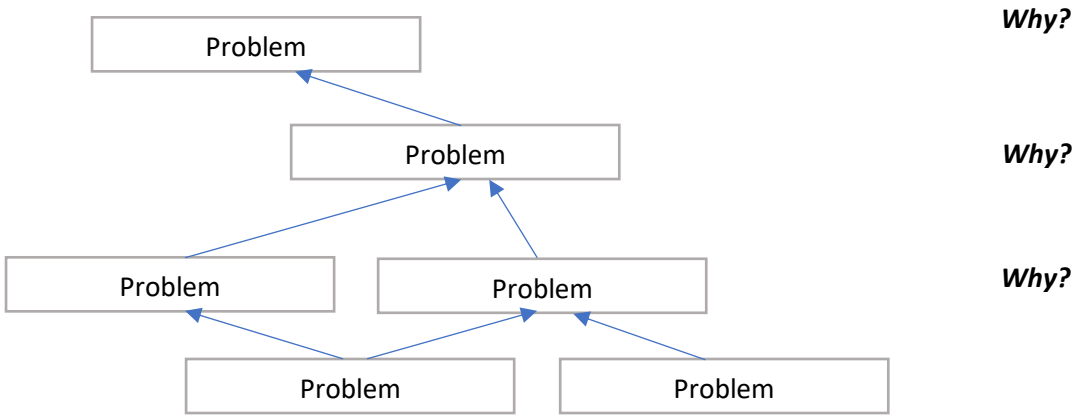
**Procedure**:

1. Brainstorm, discuss and agree the problem or issue to be analysed. The problem can be broad, as the problem tree will help break it down. The problem or issue is written in the centre of the flip chart and becomes the 'trunk' of the tree. This becomes the 'focal problem'. The problem should be an actual issue everyone feels passionate about, described in general, key wording.

2. Look for issues related to the main problem.

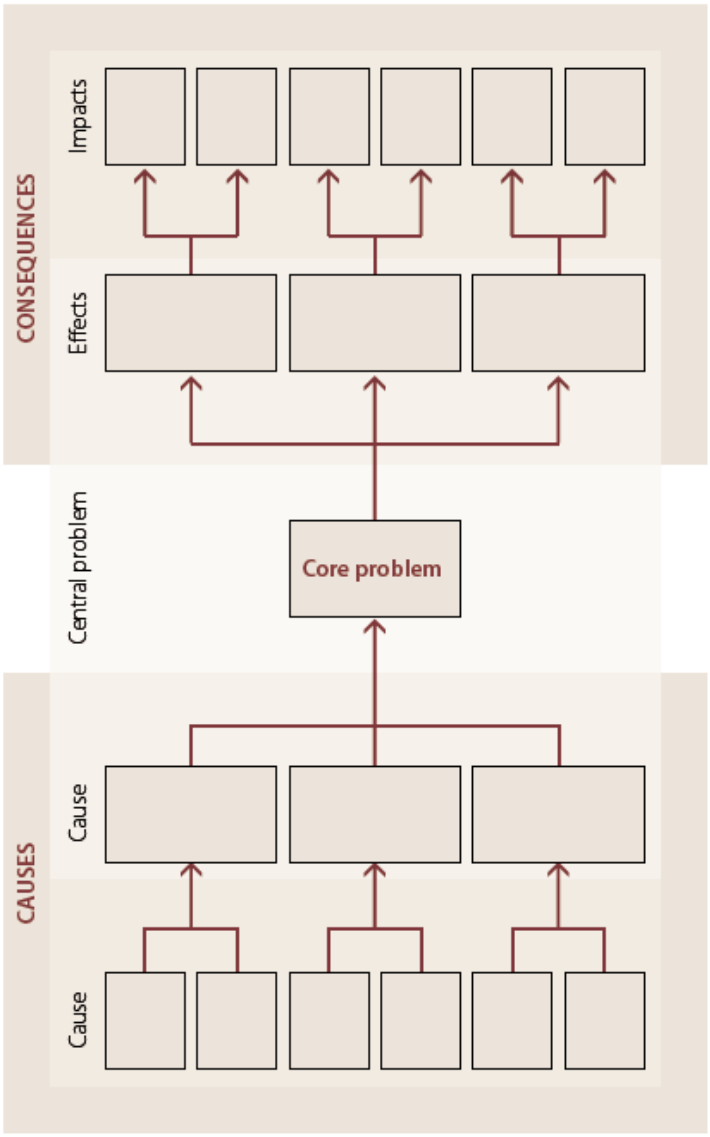
3. Establish a hierarchy of causes and effects. These causes and consequences can be created on cards, and can be arranged in a cause and- effect logic. Connect the problems with cause-effect arrows.
   -Identify the causes of the main problem by asking "*Why*?" until you can go no further. Some problems may have more than one cause. Problems directly causing the main problem are placed underneath the main problem. These are the roots.
   -Identify the effects of the main problem by asking "*What happens then*?" until you can go no further. Some problems may have more than one effect. Problems that are identified as direct effects of the main or core problem are placed above the trunk. These are the branches.

*Effects of the problem*



*Causes of the problem*

4. Review the diagram. check through the problem tree to make sure that each problem logically leads to the next. Ask yourself/the group: *Are there important problems that have not been mentioned yet*? If so, specify the problems and include them in an appropriate place.




Source: ICRC, 2008

5. Keep a record (picture or drawing of the diagram). It will be used for the development of objectives and strategies on next steps.

Outputs/outcome of the tool:

Problem tree analysis maps out the causes and effects around an issue, as a simplified version of a reality. It is used as a first step for planning and searching for solutions. The quality of the analysis will be significantly influenced by the stakeholders involved in the analysis and the way they have participated or been consulted

# *Tool 8 -Framing and reframing*

*Source*: Design Thinking -das Handbuch
*Link*: https://fazbuch.de/produkt/design-thinking/
*TDR Phase*: Problem framing (I); Analyzing problem (II)
*Knowledge integration expected*: Identification of the problem
*Project management cycle phase*: 1, 2

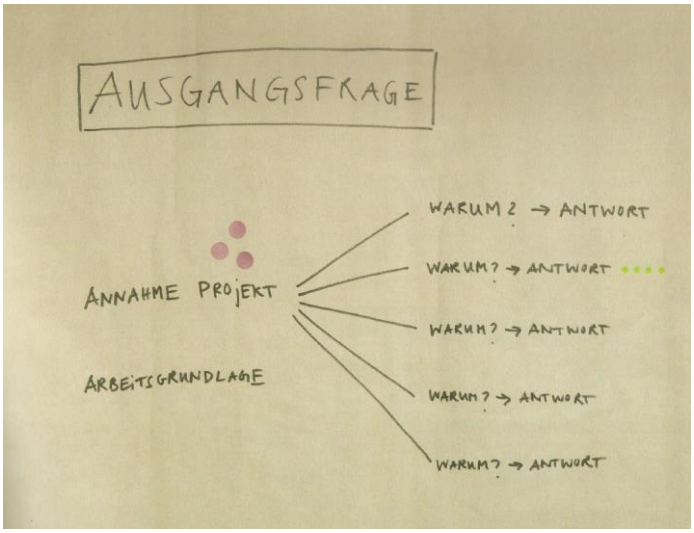
---

Purpose: Gain a new perspective about the problem, as a basis for identifying solutions

Procedure:

1) Identification of assumptions
   - Write the initial question in the whiteboard
   - Collect the assumptions (notions) about the initial question: *What are the things/factors related to the issue*?
2) Questioning the assumptions
   - Prioritize with the team the notions that will be discussed according to their relevance and importance
   - Ask 5W (ask Why? ) five times for the prioritized notions. Stop the why questions when the answers are too general or does not give additional value.
   - Write the „Why answer „to the right of the assumption
   - Select the three more important Why answers (voting)

3) Re-defining the assumptions
   - Formulate the three more interesting „Why answers" with a new framing question on „How might we …"




Source: Lewrick et al, 2018

Outputs/outcome of the tool:
The main outcomes is an analys of the problems, main assumptions and potential ideas on new solutions for the problem.The main goal is the change in attitude of the participans from a *problem* to a *challenge*.

Participants: Consortium members; stakeholders

# *Tool 9-Soft methodology for system analysis/Causal loops diagrams*

*Source*: Francoso et al 2022, https://doi.org/10.1080/01605682.2021.1880298,
Groundstroem and Juhola, 2020
*Link*: https://learningforsustainability.net/systems-thinking-tools/
*TDR Phase*: Problem framing (I); Analyzing problem (II)
*Knowledge integration expected*: Identification of the problem
*Project management cycle phase*: 1, 2

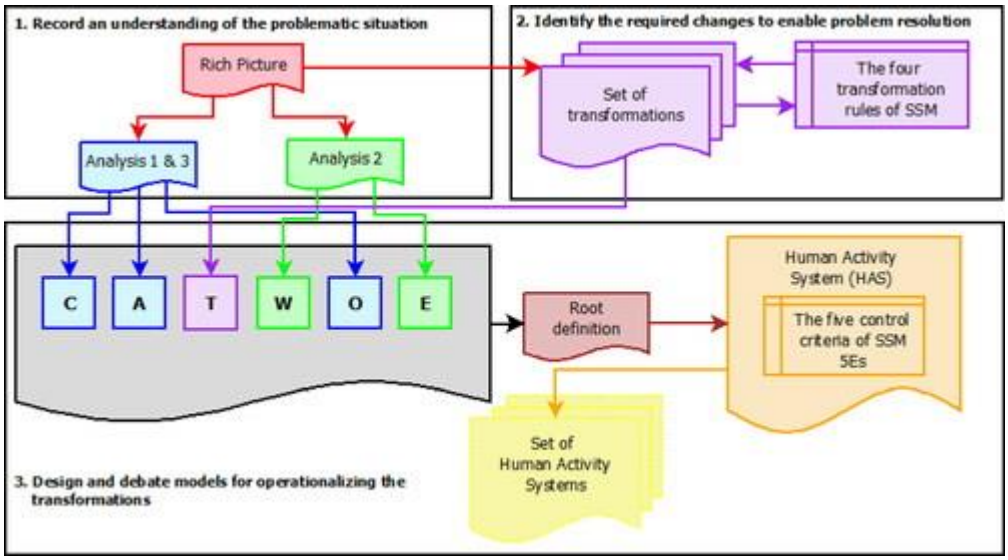
---

Purpose: Map out the structure of a system and its networks and reveal causalities and feedbacks within the system. Involve participants in understanding an issue and wider context (recognizing different perspectives/problem structuring, potential leverage points

Procedure:

A. Soft methodology analyis SMA

Soft methodology analysis **(SMA)** is structured in 3 Phases



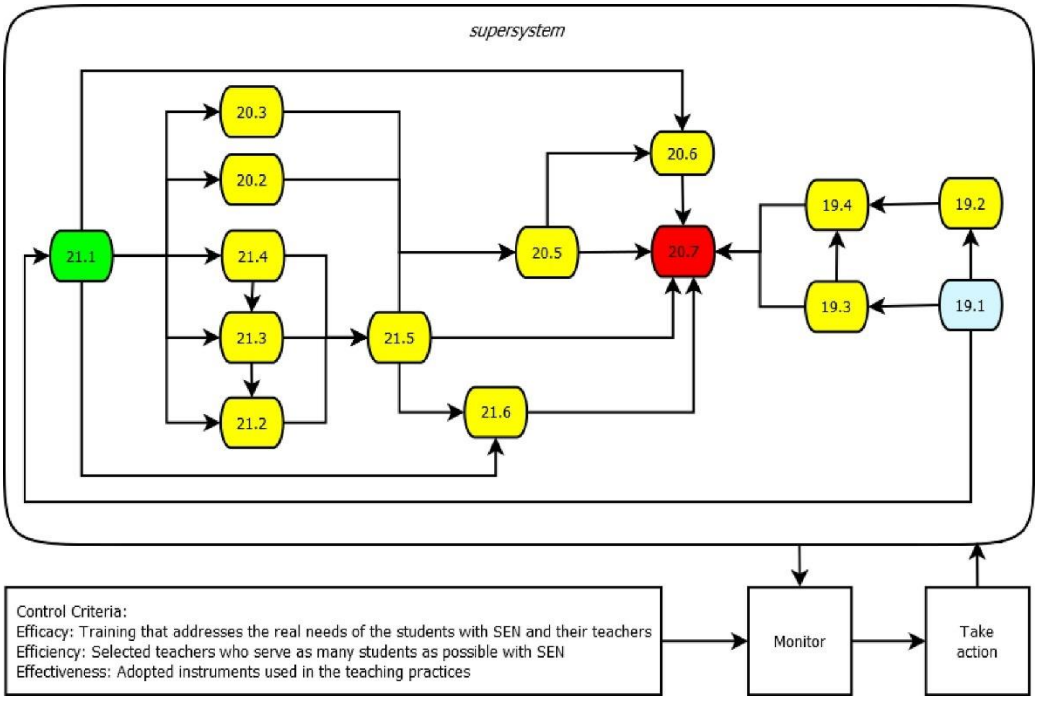

Source: Francoso et al 2022

1) Phase 1. Understanding of the problem: the pieces of information are produced with the Rich Picture, which is a free-form diagrammatic description about the problematic situation under study. Rich Picture provide information about the people (analysis 1), its power (analysis 3) and their point of view (analysis 2). It also provides information about 4 components: multiple perspectives, interconnections, influences and boundaries.

2) Phase 2. Identification of changes needed to solve the problem. For this the transformation paths are selected and four rules are followed:

- Consider only one input and one output;
- The input must be present in the output in a changed state;
- An abstract/intangible input must yield an abstract/intangible output; and
- A concrete/tangible input must yield a concrete/tangible output.

4) Phase 3.In this phase there is aneed to understand the contextual aspects for transformation using the CATWOE factors (a customer (C) is the one who will benefit or lose when the transformation (T) is performed. The actor (A) is the one who will do the transformation and the owner (O) delegates the work to be done and who will do it. The environment (E) is the constraint related with the transformations under consideration. Weltanschauung (W) i, the reason, perspective, or justification for the transformation. Then the system root definition is defined: In the end system that does (T), for (C), realized by (A), due to (W), under command of (O) and limited by (E). After that a plan for transformation is made:
    a. Firstly, for each CATWOE and the accompanying root definition, identify tasks that will operationalise the respective transformation.
    b. Then, consider the interrelationships between the tasks in order to identify the precedent and successor activities.
    c. Third, design a network diagram of the activities, with the final activity being the right-hand side of the transformation in question (its output).
    d. Fourth, enclose the network diagram by drawing a boundary around it, thus creating a Human Actity System (HAS). Lastly, identify the control criteria against which progress will be measured to ensure that the activities achieve their desired outcome, and finally, place the control criteria as a monitoring sub-system linked to the HAS. In the end, all the individual HASs are interlinked with each other thus originating a truly systemic plan called supersystem.

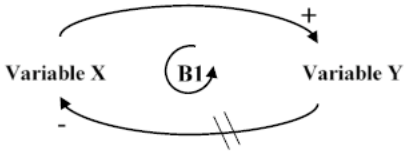



Example of a super system. Source: Francoso et al 2022

## B. Casual loops diagrams CLD

**Procedure:**

1. Determine the boundaries of systems and subsystems
2. Identify impacts in the system (could be bade on literature review)
3. Visualize cascading effects and impact loops



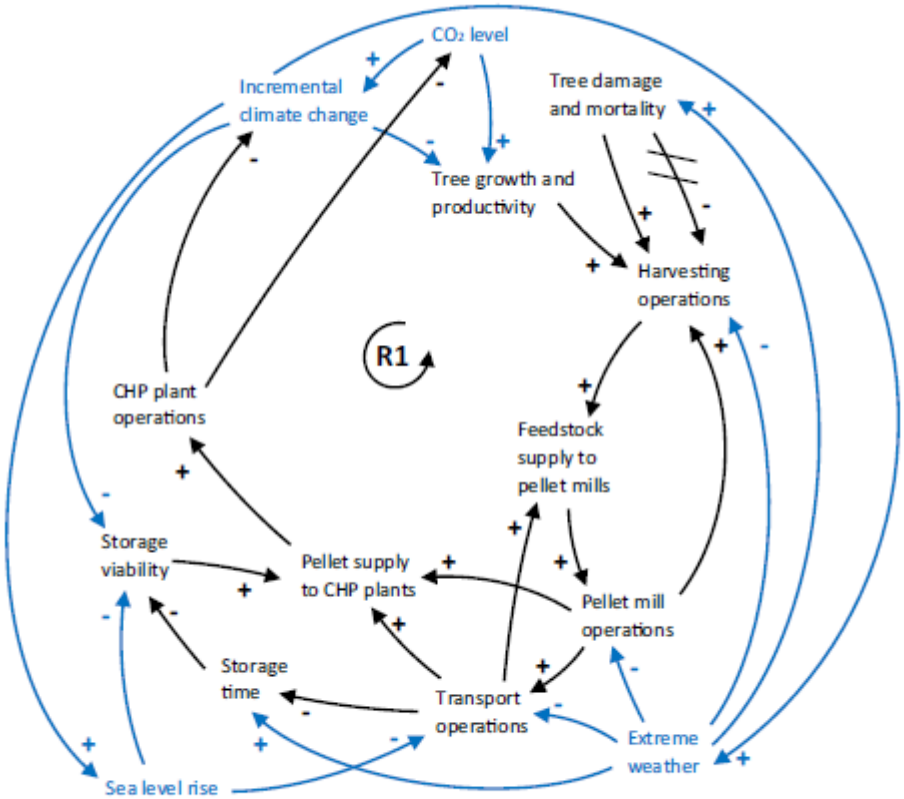




Fig. 5 CLD showing the nodes and links of the core supply chain (in black), and the potential for climate change impacts (in blue) to affect the system. R1 refers to the supply chain loop described in the text. A description of every node and link can be found in Table 3 in the Appendix

Example of a Casual Loop Diagram. Source: Groundstroem and Juhola, 2020

**Outputs/outcome of the tool:**
The output of the tool is a diagram of system, actor activities and outcomes expected to change a situation.

**Participants:** Project members

# *Tool 10 -SWOT Analyses*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships
*Link*: https://edepot.wur.nl/409844;
*TDR Phase*: Problem framing (I); Problem analysis (II)
*Knowledge integration expected*: Identification of the problem
*Project management cycle phase*: 1, 2

---

Purpose: A SWOT analysis is a strategic planning tool to discover weaknesses and strengths of an individual, group or organization, and to identify both potential opportunities and threats.

Procedure:
1. The group defines, discusses and records as many factors as possible for each heading. Emphasize that strengths and weaknesses should refer to internal aspects of the group, project site or activity. Opportunities and threats can be looked at as internal or external factors affecting them.

2. Alternatively, different sub-groups can, for example during a workshop, undertake a SWOT on their own. Comparing the different SWOTs can foster a constructive discussion about the differences and similarities of experiences and possibilities.

3. Based on this overview, discuss what actions are needed. Use these questions to help the discussion:
- How can we apply our strengths to make use of the available opportunities?
- How can we use our strengths to avert threats?
- How can we deal with our weaknesses?
- What are the threats on the horizon?

| | Helps the project objectives | Harmful to achieve the project objectives |
|---|---|---|
| Internal | Strenghts | Weakness |
| External | Opportunities | Threaths |

Outputs/outcome of the tool:
A quadrant with internal and external factors that might affect the implementation of the objectives. It might be helpful to complement the stakeholder analysis, the hierarchy of objectives, identify the risks and the mitigation measures.

Participants: Project members

# *Tool 11 -Constellation analysis*

*Source*: td-net toolbox
*Link*: https://scienzenaturali.ch/co-producing-knowledge-explained/methods/td-net_toolbox/actor_constellation_final_
*TDR Phase*: Problem framing (I)
*Knowledge integration expected*: Identification of the problem
*Project management cycle phase*: 1, 2

---

Purpose: An actor constellation is a role-play in which all scientific and societal actors involved in a project are represented and positioned around the central research question. The distance from an actor to the research question and to other actors expresses how relevant (s)he is in the project.

Procedure:
1) The project leader writes the project's overall research question on a label. He or she considers a maximum of the ten most important actors (who represent various disciplines and are stakeholders from civil society, the private and the public sectors) who can answer the overall research question. The project leader then notes their names on labels.

2) The facilitator finds participants to play the respective roles of the actors and labels each accordingly. If a role is not sufficiently clear to a participant (e.g., the general public, the decision makers), the facilitator asks the project leader for clarification.

3) The project leader places the research question in the middle of the room and positions the actors around the research question according to the rules described above. The project leader explains to the participants why each actor is standing in a specific position and what the actor will provide to answer the overall research question (e.g., information, institutional support). Arrows can be used to describe how the project leader plans to interact with the actors.

4) Once the actors are in their respective places, they react to the constellation. The facilitator asks (a) whether particular actors are missing and (b) whether an actor believes that he or she is in the wrong position, what would be the right position, and why. Through the discussion, the actor constellation changes.

The facilitator closes the discussion, for example, by summarizing the main changes in the constellation that occurred during the discussion. (procedure modified after Pohl 2014)

Outputs/outcome of the tool:
Usually, the output of an actor constellation is a different, revised constellation. New actors may come in; some may come closer to each other, become less relevant or disappear. As a consequence, the project team and organization can be redefined.

Participants: Consortium members

# *Tool 12 -Interviews (actors/experts)*

*Source*: Design Project Guide, Qualitative Research & Evaluation Methods
*Link*: https://dschool.stanford.edu/resources/design-project-guide-1
*TDR Phase*: Problem framing (I), Analysing problem (II), Assessing the impact (III)
*Knowledge integration expected*: Identification of the problem, assessing the impact
*Project management cycle phase*: 1, 2, 3

---

Purpose: Gain a deep understanding of a number of participants' beliefs, values, experiences, behaviors, and motivations.

Procedure:

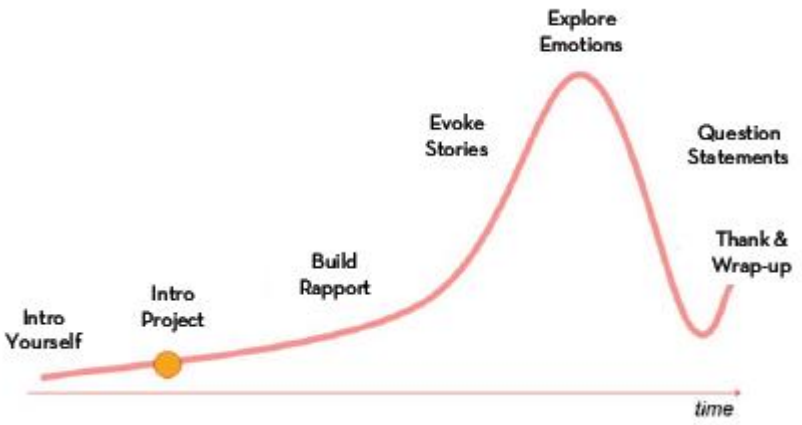
1) Preparation: refining questions
   - Brainstorm questions, trying to build on one another's ideas to flesh out meaningful subject areas and comparing different frameworks.
   - Refine questions. Once you have all the questions grouped by theme and order, you may find that there are some redundant areas of conversation, or questions that seem strangely out of place. Make sure that you include plenty of "why?" questions, plenty of "tell me about the last time you _____?"
   - Consider ethical issues in the management of the information: is informed consent necessary? Where is the data going to be stored and analysed? Who is going to have access to the data? Is there any sensitive information to be handled?

2) Performing the interview
   - Greet and build rapport

   Start by introducing yourself. Establish a conversational tone. Make eye contact, and match the postural height of your interviewee.
   - Get into the interview

   Use your interview guide to help structure the conversation, and act as your signposts for topics you want to cover. However, follow the interviewee's lead; s/he will talk about the things s/he cares about most — allow the conversation to deviate from your plan.
   - Have a flow

   Make sure you are covering the basics: open-ended questions, asking 'why?', and digging into meaning by following up. This means staying on one thread (one topic or story) for a long period of time and not jumping around by asking wholly new questions. The interviewer should not fill more than 25% of the airtime. Make sure you give people time to answer and time to consider their answers. For rich data, you should have multiple interviews of 20-60 (or more) minutes.



3) Analysis of the data
   The analysis of interviews depends on the use of the result. Most scientific works would require that verbatim transcripts are used and a book code is created to explain the categories and logical coding of the author. Coding and specific software are used when there are large data. If interviews are only an intermediate step, the recording and analysis can be simplified.

Outputs/outcome of the tool:
The results of the interviews provide insight into actors' beliefs, values, experiences, behaviors, and motivations. According to the general research design, the use of interviews is required for other methods, such as the Delphi method or the elaboration of surveys and discussion workshops.

Participants: Stakeholders, researchers

Additional sources:


- Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications
- Saldana, J. (2016). The coding manual for qualitative researchers
- Quinn P. M. (2001). Qualitative Research & Evaluation Methods. Sage.

# *Tool 13 Persona*

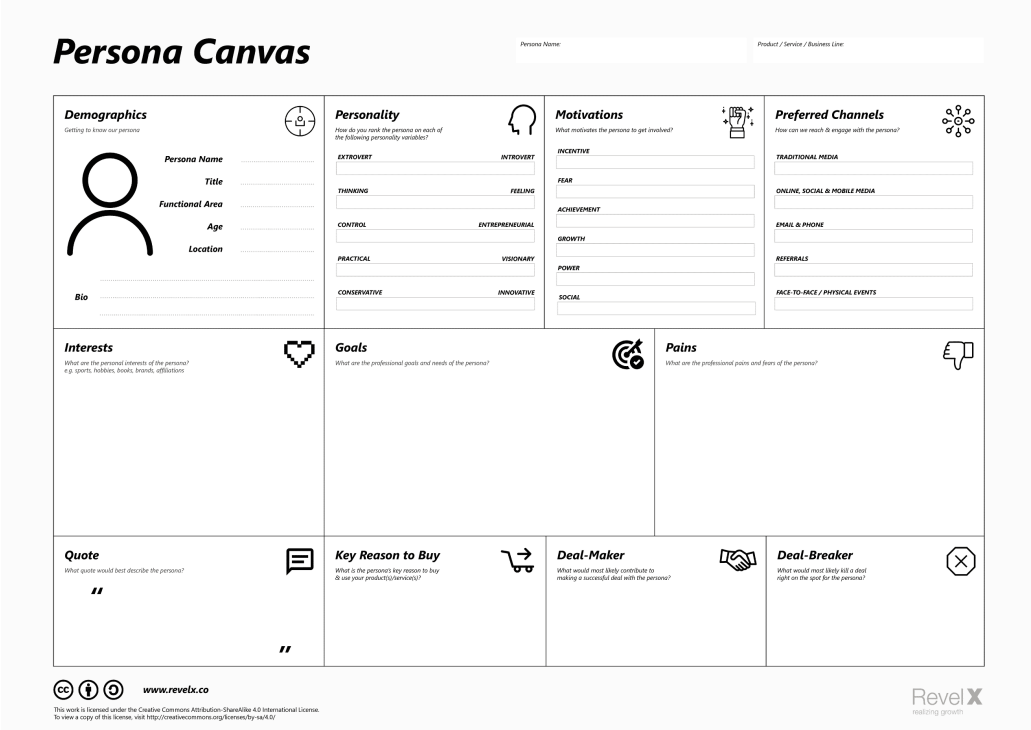
*Source*: Design Thinking -das Handbuch
*Link*: https://fazbuch.de/produkt/design-thinking/
*TDR Phase*: Problem framing (I), Analysing the problem (II)
*Knowledge integration expected*: defining the problem, working with collaboration formats
*Project management cycle phase*: 1, 2

---

Purpose: Represent persons in their daily life. Personas are models from participants, research subjects or target groups. The personification of target groups helps the designers of projects focus and be empathic with the expected users of the service.

Procedure:

1. Identify one representative person of the target group and identify the main characteristics.
2. Identify demographics such as profession, age, and location
3. Identify their jobs, main problems and issues they face.
4. Understand and describe the narrative of the person:
    - What did this person care about the most?
    - What motivates him/her?
    - What frustrates him/her?
5. Synthetize the findings in user-profile canvas




Example of a persona canvas. *Source: revelx.co*

Outputs/outcome of the tool:
Identification of types of target groups from researcher/designer point of view. It is a first step to develop the value proposition of a project or service.

Participants: Consortium members, stakeholders

# *Tool 14 -Empathy map*

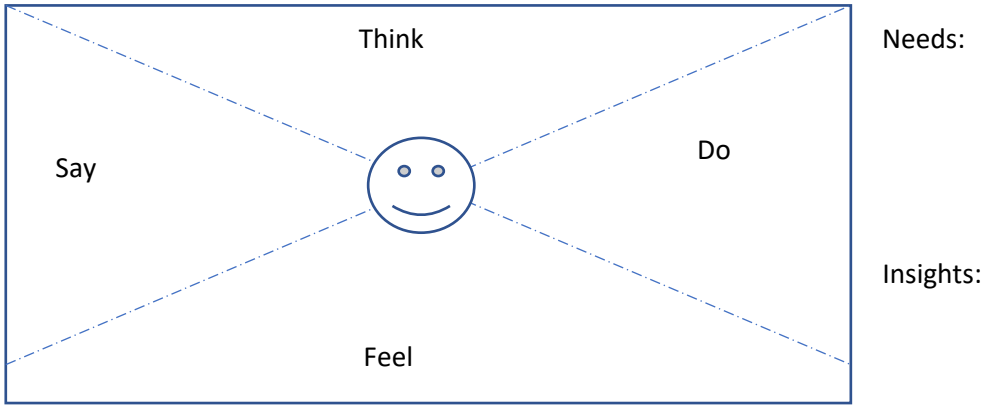
*Source*: Design Project Guide
*Link*: https://dschool.stanford.edu/resources/design-project-guide-1
*TDR Phase*: Problem framing (I), Analysing problem (II)
*Knowledge integration expected*: defining the problem, working with collaboration formats
*Project management cycle phase*: 1, 2

---

Purpose: An empathy map is a tool to help designers synthesize observations and draw unexpected insights about end users.

Procedure:

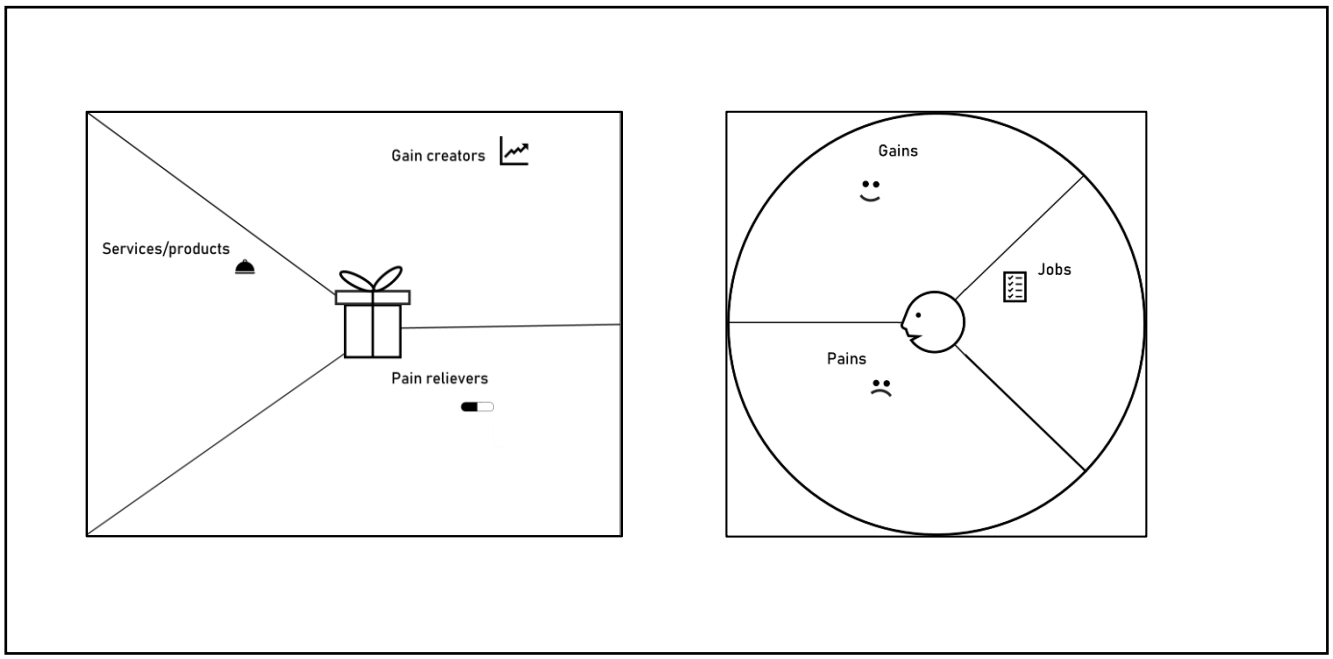
- Create a four quadrant layout on paper or a whiteboard. Fill the map by taking note of the following four traits of your user as you review your notes, audio, and video from your fieldwork:




  - SAY**:** What are some quotes and defining words your user said?
  - DO**:** What actions and behaviors did you notice?
  - THINK**:** What might your user be thinking? What does this tell you about his or her beliefs?
  - FEEL**:** What emotions might your subject be feeling? Note that thoughts/beliefs and feelings/emotions cannot be observed directly. They must be inferred by paying careful attention to various clues. Pay attention to body language, tone, and choice of words.

- **Identify needs**: "Needs" are human emotional or physical necessities. Needs are *verbs* (activities and desires with which your user could use help), not *nouns* (solutions). Write down needs on the side of your Empathy Map.
- **Identify insights**: An "Insight" is a remarkable realization that you could leverage to better respond to a design challenge. Insights often grow from contradictions between two user attributes (either within a quadrant or from two different quadrants) or from asking yourself "Why?" when you notice strange behavior. Write down potential insights on the side of your empathy map.

Another variant of the empathy map is to ask for Job, Pains and Gains




Outputs/outcome of the tool:
The tools identify the main needs to be solved by a specific actor from the designer/researcher point of view. New services and characteristics (that will serve the main value creator for business/project model canvas) are identified during this phase.

Participants: Project or team members

# *Tool 15 -Concept canvas*

*Source*: IgnoreGravity
*TDR Phase*: Problem framing (I)
*Knowledge integration expected*: defining the problem, defining solutions, working with collaboration formats
*Project management cycle phase*: 1, 2,3

---

Purpose: The concept canvas is a simple tool that helps to formulate and sharpen the final problem definition and solution approach, looking closer at the different aspects of an idea. The idea of the canvas gets participants to think and synthesize ideas in a given space.

Procedure:
1) Individually, participants are provided with the concept canvas according to the questions to be analyzed.


Example of Concept canvas. Source: i gnore gravity

2) Participants filled the content of each canva and left empty those aspects for which they do not have an answer. Potential questions/canvas are added according to the topci that is being discussed.

3) Participants share their answers and provide feedback to the others.

4) The facilitator tries to reach consensus on final concepts if there are important disagreements.

Outputs/outcome of the tool:
An analysis of the problem and solution statements. The tool could be used to start the analysis, review the strategy, and identify potential risks.

Participants: project members

# *Tool 16-Rural/Participatory Rapid Appraisal tools*

*Source*: Hoffman et al 2011
*Link*: ISBN 978-3-8236-1572-9
*TDR Phase*: Problem framing (I); Analysing problem (II); Exploring impact (III)
*Knowledge integration expected*: identifying the problem, planning, monitoring and reflecting, working with collaboration formats
*Project management cycle phase*: 1, 2, 3

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Purpose: PRA or RRA are a set of communication tools for a semistructured process of joint learning of local people and facilitators/researchers/development workers. The approach respects rural people as knowledgeable experts regarding their livelihoods and encourages their participation in situation analysis, problem identification and technology development.

Procedure:
PRA/RRA identified eight stages of problem solving

1) Creating rapport – form a relationship with local villagers. Sometimes PRA is used during the early planning stages of a project. If there is no rapport between the team and the outsiders, suspicion and rejection will come. Other preconditions are having a basic idea of the cultural background and power structures and a clear management of expectations.
2) Understanding-The objective is to understand the problem from the perspective of all actors. Tools such as interviews, direct observation, maps, transects, timelines, seasonal diagrams, daily routines, and life stories are used for this purpose.
3) Reframing-The objective is that partners are encouraged to see the problem from a perspective that makes its management possible. When they are ready, they can move to the next step. Shared diagnosis tools help with this purpose: participatory maps, ranking, rating sorting, village models, simulations, and participatory impact indicators.
4) Solution- The objective is to identify a solution after having explored various alternatives. Commitment from all the partners is necessary. Tools for generating divergence on creative solutions (brain storming, inspiration) as well as convergence tools for decision making (ranking, rating, voting and prioritization) are useful.
5) Solution planning: the objective is to stage a planning a specific solution. Tools for planning: road to progress, problem-solution tree, local solution diagnosis, SWOT analysis, farm planning, community planning, work plan.
6) Implementation: carry out the plan; advise and support with motivation, focus and persistence.
7) Evaluation and adjustment: assess the plan against the situation. Tools useful are particpatory monitoring and reflection tools.
8) Closure and consolidation: The purpose is to generate problem solving skills in local participants and/or promote the adoption of new solutions. Assessment and reflection tools are used.

Outputs/outcome of the tool:
The expected outcomes of the process are the improved skills of the community to identify, plan and solve their perceived problems. The outcomes are often unpredictable because of the open and flexible character of the process. The use of tools as a research instrument (data, analysis) is mostly based on the systematic documentation of the process and the content analysis outcomes of the tools (qualitative analysis).

Participants: local actors (local stakeholders), external actors (researchers, development workers, external staekholders)

# *Tool 17 -Timeline/trendline Analysis*

*Source*: Geifus 2008
*TDR Phase*: Problem framing (I)
*Knowledge integration expected*: identifying the problem, assessing the impact
*Project management cycle phase*: 1, 2

---

Purpose: To identify significant changes in the past that continue to influence events and attitudes in the present. A timeline is a list of key events as the participants remember them. The tool can be used as a diagnosis or as an assessment of an intervention.

Procedure:
1: Organize 1 or several working groups; this step is important, as working groups allow participants to agree on answers and have stimulating discussions. Explain the objective of the exercise.

2: The facilitators should begin the discussion by asking questions such as "When was the community founded?" and "Who were the first to arrive?" After that point, they should not become involved in deciding which events were important; that task should be left to the participants.

3: As events are recalled, arrange them in a vertical column representing the timeline, with the oldest events at the top. Cards may be useful, as information will have to be rearranged to keep events in chronological order. If recalling dates becomes difficult, try to use important national or international events as points of reference.
4: All comments on events should be placed alongside the timeline. Care should be taken not to forget these comments; participants should be encouraged to discuss them.

5: As the timeline nears completion, discuss the trends that emerge (e.g., the frequent appearance of a given phenomenon).

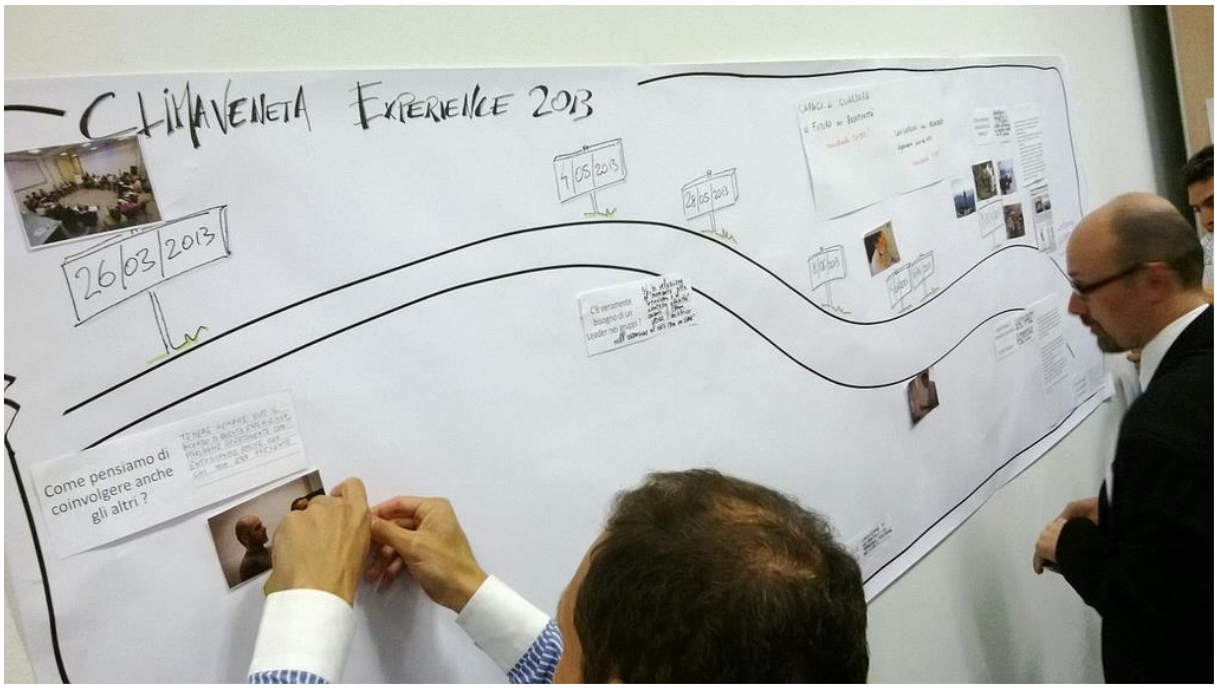
6: If the participants have been working in subgroups, discuss the work of each one and agree on a common thread. Write down the results and explain how they will be used.

7: Check the results against other sources.

Outputs/outcome of the tool:

The output is a drawing of a timeline of events or phenomena as far back into the past as possible to the earliest events. The results might be used to analyse the current situation and frame the problem to be solved. It is very constructive to determine whether different groups have different perspectives on change.

Participants: Project members, stakeholders, workshop participants




Example of a timeline

Source: Sixty tools to facilitate multi-stakeholder partnerships

# *Tool 18 -Transect Analysis*

*Source*: Geifus 2008
*TDR Phase*: Problem framing (I)
*Knowledge integration expected*: identifying the problem, assessing the impact, working with collaborative formats
*Project management cycle phase*: 1, 2

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Purpose: To conduct a field discussion on various items (topographical or otherwise) found within the community's sphere of influence, focusing on their uses, the problems they entail, and their potential for development, and to illustrate these features in a diagram, which may be used as a starting point for a discussion of alternatives. The purpose is to visually portray different features and changes by taking a tour of the area.

Procedure:

1. Select a small group of respondents/participants (3-5) and explain the exercise to the group using a practical example. Discuss the best route for the transect walk, while it does not have to be a straight line, it should be as diverse as possible in terms of terrain, land use, etc. Transect walks in mountainous areas usually run from one peak to another, traversing the valley in between and covering every vegetation altitude band. It is easier to establish a route if the participatory mapping exercise has already been conducted.

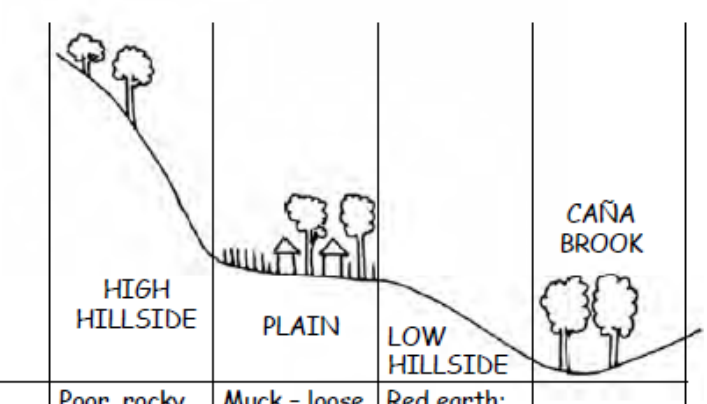
2.Begin the tour, following the agreed itinerary. Write down the main features and changes, always using local terms. It takes time to stop and speak to the people encountered along the way.

3.This can be done during or after the walk, depending on the complexity of the exercise: write information on the participants on a large sheet of paper, and create a diagram to describe the terrain, the areas visited, and their names. Check with the participants to make sure they agree with the classification employed.

4.Based on an individual or group discussion with the participants, add the following essential information on the use and status of resources in each area to the diagram:

- *What does each area contain? (land use, vegetation, soils – whatever is relevant).*
- *Why are those particular items found in this area?*
- *Who works in this area and benefits from its resources? (access to resources)*
- *Have significant changes occurred in the past?*

5. Ask the participants what they think of the exercise. Write down the results and turn the paper over to the group.




| | | | | |
|---|---|---|---|---|
| SOIL | Poor, rocky | Muck – loose earth | Red earth; very rocky | |
| WATER | Does not retain water; very dry | Fresh; heavy rains bring floods | Dry | Available year-round |
| CROPS | Forest; pastureland | Corn; beans; fruit | Pastureland | Forest |
| ANIMALS | Livestock; horses | Swine; poultry | Horses | |
| WHO WORKS? | - The entire community<br>- Women gather wood | Individual farm plots | Women and children tend to the animals | |
| WHAT WAS DONE BEFORE | There was more forest | Cassava and sweet potato were once grown | Fuelwood was gathered | There used to be more water |

Example of a summary of a transect walk. *Source: Geifus 2008:*

Outputs/outcome of the tool:
The diagram may be a simple map used to help people express what they know about their environment and to share potential alternatives. It may also be enhanced with data from other sources and can convey large amounts of information.

Participants: Project members (field level).

# *Tool 19. -Participatory mapping*

*Source*: IFAD
*Links*: http://www.ifad.org/pub/map/PM_web.pdf, https://doi.org/10.14512/gaia.31.1.10
*TDR Phase*: Problem framing (I), Problem analysis (II), Assessment of impact (III)
*Knowledge integration expected*: problem identification, solution identification
*Project management cycle phase*: 1, 2, 3

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**Purpose**: The purpose of mapping is to **assist in collaborative spatial planning exercises, land-related research and analysis, amelioration of land and resource conflicts, or assessing local development potential.** Although there are differences among initiatives in their methods, applications and users, the common theme linking them is that the process of map-making is undertaken by a group of nonexperts who are associated with one another based on a shared interest.

**Procedure**:
**The application of participatory mapping is highly flexible and uses a range of tools for data collection.** The choice of which to use will be determined by the way in which the map will be employed, the perceived impact the mapping tools will have on the target audience and the available resources (e.g., financial, human and equipment).

The use on which map is determined by the following questions:
- *Why do we want to make a map?*
- *Who do we want to show it to?*
- *What are some of our most important land-related issues?*
- *What can we use the map for in the short term?*
- *What can we use the map for in the long term?*
- *Is there a predefined reason for creating the map?*

There are several types, broadly:
**Hands-on mapping**
- Ground mapping
- Sketch mapping
- Transect mapping

**Scale mapping – drawing information on existing scale maps**
- Scale mapping – making scale maps using survey techniques

**Participatory 3-D modelling (P3DM)**
- Participatory 3-D models (P3DM)

**Participatory mapping using scale maps and images**
- Geographic Information Systems (GIS)
- Participatory geographic information systems (PGIS)
- Using aerial and remote sensing images

**Multimedia and Internet-based mapping**
- Multimedia mapping
- Internet-based mapping

**Outputs/outcome of the tool:**
**Map representing the desired characteristics, which can be read by persons not taking place during the workshop**

**Participants:** Stakeholders

Examples of participatory mapping

Source: IFAD 2009

**FIGURE 1:** Local residents identifying and mapping ecosystem services in a Spanish agroforestry landscape: screen capture from the online survey designed by the research team using the survey platform *Maptionnaire*.


**FIGURE 2:** Regional workshop held in 2016 to discuss the findings of the PPGIS study. The workshop was facilitated with the help of a local facilitation company called Observatorio para una Cultura del Territorio: *https://observatorioculturayterritorio.org*.


Source: Fagerholm et al, 2022

# *Tool 20. -Field visits, cross visits*

*Source*: i2connect
*Link*: https://i2connect-h2020.eu/wp-content/uploads/2022/03/i2connect-Deliverable-3-4-final.pdf
*TDR Phase*: Problem framing (I), Problem analysis (II), Assessment of impact (III)
*Knowledge integration expected*: problem identification, solution identification, reflection
*Project management cycle phase*: 1, 2

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Purpose: A field visit consists of the review of a practical case process by colleagues (peers) from another innovation case, with the purpose of observing and analysing practices, learning from the way innovation has been implemented by others and providing recommendations to the reviewed case.

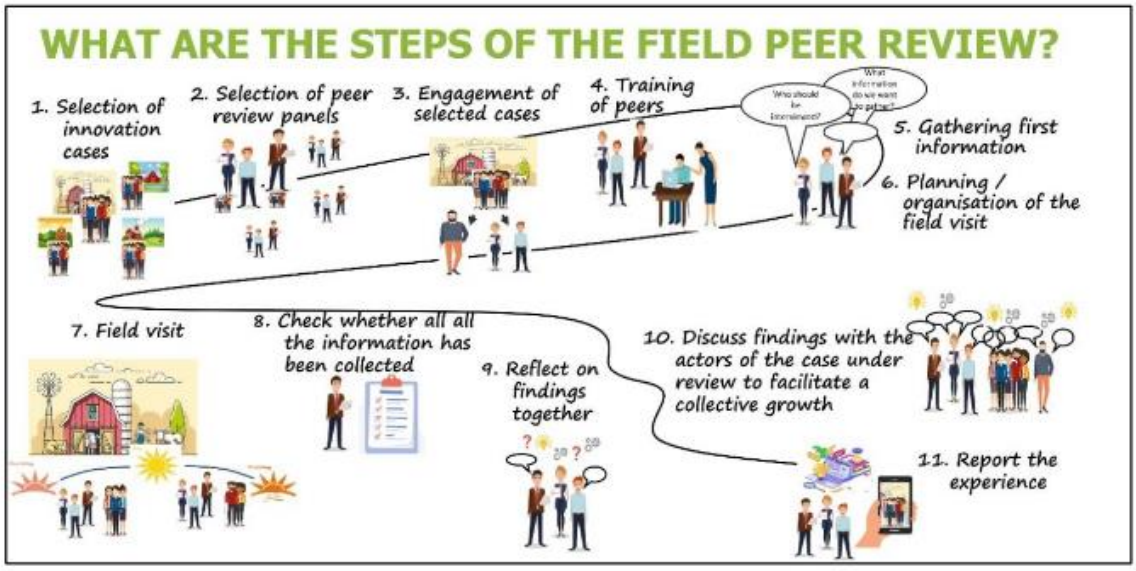
Procedure:
Field visits are carried out through field visits, observations and interviews with different actors. The procedure includes 4 steps, usually requiring approximately two months to be prepared and organized:

1. Participant selection and training. The composition of the field review team depends on the type of organization and coordination of the peer review. In general, field visits are completed by teams of 3-4 peer reviewers that could represent the different types of actors involved.

2. Organization of the field visit. The coordination of all the activities concerning the field visit is assigned to a facilitator. The facilitator is responsible for the organizational aspects of preparing and managing the field visit. Before the visit, participants should be provided with preliminary information concerning the case through documents or interviewing a key actor. Based on the documents received and the preliminary interview, the participants develop a plan that defines i) the subjects to be interviewed (specific actors or typologies of actors); ii) the questions to be asked of each actor or group of actors (following the analytical tool); iii) the methods of collecting information (e.g., how many individual/group interviews, guided visits, etc. ); iv) the estimated time for the visit.

3.Field visit. The field visit is built on interviews (individual or group), focus groups and observations. Practical case actors and stakeholders are interviewed preferably in groups of approximately 5 people for 90 minutes, but individual interviews are also possible if they better fit the goals. The questions (not more than 7-8 questions; otherwise, due to time limits, not everyone will be able to answer each question) are chosen according to the analytical tool. The duration of the visit depends on the complexity of the reviewed practical case. It is advisable to plan rather short visits.

4. Participants' reflections and reporting. At the end of the field visit, the participants have to schedule a feedback session during which they share their results with the practice case. This allows for communicative validation with direct comments from the case and a request for further explanation, as well as an exchange between the participants and the case on crucial aspects of the process. According to the goal, different reflection methodologies can be used.




Example of a field peer review for farm advisors i2connect. *Source: i2connect 2022*

Outputs/outcome of the tool:
The output is a report based on the questions and reflections derived from the analytical tool prepared before the field visit. According to the objective of the visit, inspiring observations, appreciations, lessons, doubts and feedback can be provided between different groups.

Participants: project members, project participants

# *Tool 21. Delphi methodology*

*Source*: Biodiversa
*Link*: https://www.biodiversa.org/717/download
*TDR Phase*: Problem framing (I), Problem analysis (II), Assessment of impact (III)
*Knowledge integration expected*: problem identification, planning, assessing, validation of models
*Project management cycle phase*: 1, 2

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Purpose: The Delphi technique is a participatory method used in reflective research by structuring a group communication that involves gathering feedback from a panel of experts over multiple rounds.

Procedure:
There are several variants of the Delphi methodology, but usually the steps follow the following sequence:

1. Participant panel members' responses remain anonymous throughout.
2. Participants completed a series of written questionnaires developed by the researcher.
3. Questionnaires are returned to the researcher who collates the responses to the questions posed in each round and feeds these responses back to the participants for their consideration, giving each panel member the opportunity to adjust their responses accordingly, if they so wish.
4. The researcher uses these responses to identify areas of consensus and conflict and presents these back to the panel for further comment.
5. By exchanging information, participants can change their positions in light of new evidence and generate new ideas.
6. The question posed needs to be asked over a series of stages to allow deliberation and iteration and to give participants time to consider their ideas and opinions in the context of others.
7. Ideally, the Delphi process should be between 3 and 5 rounds.

Outputs/outcome of the tool:
The tool builds consensus about a topic and conducts an early identification of key barriers or points of potential conflict.

Participants: Experts

# *Tool 22. Scenario development*

*Source*: Biodiversa, Reed et al. (2013)
*Link*: https://www.biodiversa.org/713/download
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: problem identification, planning, assessing, validation of models
*Project management cycle phase*: 1, 2

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Purpose: Scenario analysis helps to explore a range of possible and plausible futures. Scenario analysis enables management choices, strategic planning and decision-making to be better structured for stakeholders. The process of mapping out different scenarios and what may be required to implement them can help stakeholders consider the implications of a range of options when the future is uncertain. There are two types:

A) Forecasting: Creating projections about what may occur in the future and the alternative paths to getting there. Here, scenario analysis is employed to choose the path or future point that is desired, and groups work to identify how to create that desirable future situation. Patterns and trends from the past are identified to help make projections about likely change in the future; such patterns and trends may be identified through research and statistical analysis or via formal and informal observation.

B) Backcasting: Project groups determine a desired future situation, and the group works backwards from this point to identify steps needed to reach the desired future position. Backcasting has been found to be particularly useful where problems are complex and a significant change in direction is needed. The group must reach consensus on a desired future end point and 'work backwards' defining what goals, objectives or activities are considered instrumental to achieving this desired end point.

Procedure:
The implementation of the process is complex according to the problem and usually makes use of quantitative and qualitative data. It should usually do with an experienced facilitator.

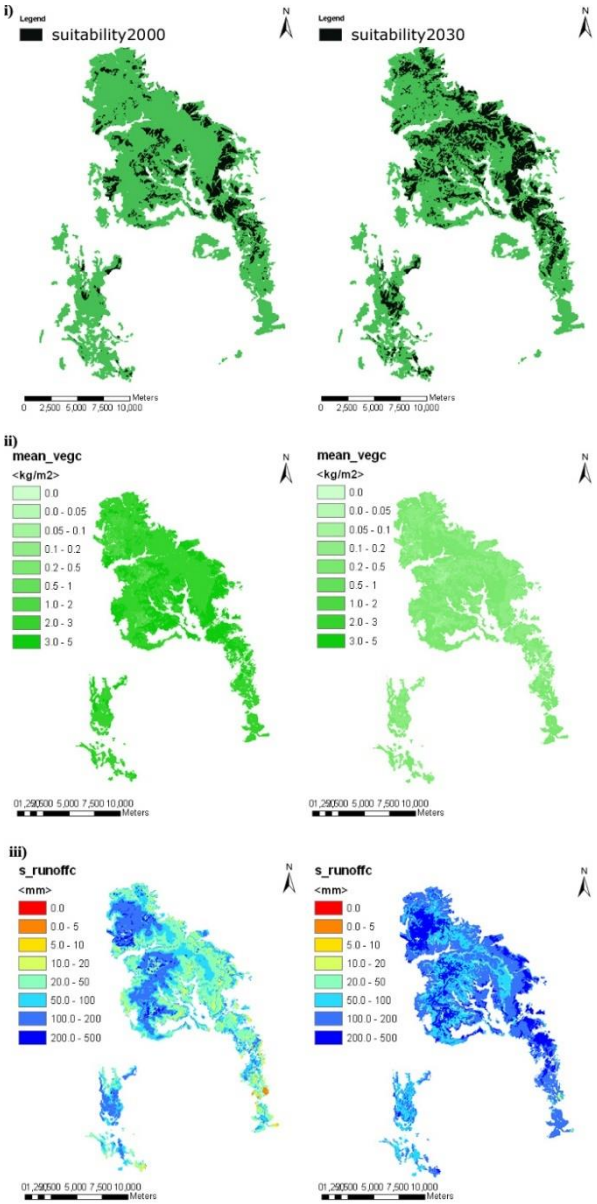
Reed et al 2013 defined 4 steps:
1- Define the context in which you wish to develop scenarios (biophysical, socioeconomic and political) and establish whether there is a basis for stakeholder engagement in scenario development.
2-Systematically identify stakeholders to ensure that all relevant stakeholders are represented appropriately in the process
3- Define clear objectives for scenario development with stakeholders, including spatial and temporal boundaries.
4- Select relevant methods

- Construction of scenarios (interview, qualitative conceptual modelling, fuzzy cognitive mapping, Delphi method, 2x2 matrix containing 4 scenarios)
- Evaluation of scenarios (visualization techniques, GIS, multicriteria evaluation). The optimum number of scenarios is between two and five.
- Support decision making considers backcasting from desired scenarios, identifying steps that could be taken to reach particular future states. Alternatively, scenarios may be used as management options in a multicriteria decision analysis.

Outputs/outcome of the tool:
The outcomes are "stories of the future". The process of defining scenarios provides opportunities for individuals to consider different futures instead of accepting the inevitable. Through scenario analysis, it is possible to visualize how multiple variables interact. This can facilitate more critical thinking and stimulate creative ideas and solutions.

**Participants:** Consortium members, communities, stakeholders

**Example:** see https://www.sciencedirect.com/science/article/pii/S0301479713003447 and http://dx.doi.org/10.5751/ES-04924-180105 for examples of the application of the procedure. To see the narrative, videos also available under: https://www.youtube.com/watch?v=bKo3IPYBAII, https://www.youtube.com/watch?v=KduOlzABanI




**Example of ouputs of 4 scenarios analysis**

Source: Reed et al 2013

**Analysis of scenarios**

Source: Reed et al 2013

# *Tool 23. Project objectives hierarchy*

*Source*: ICRC 2008
*Link*: https://www.icrc.org/en/doc/assets/files/publications/icrc-001-0951.pdf
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats
*Project management cycle phase*: 1, 2

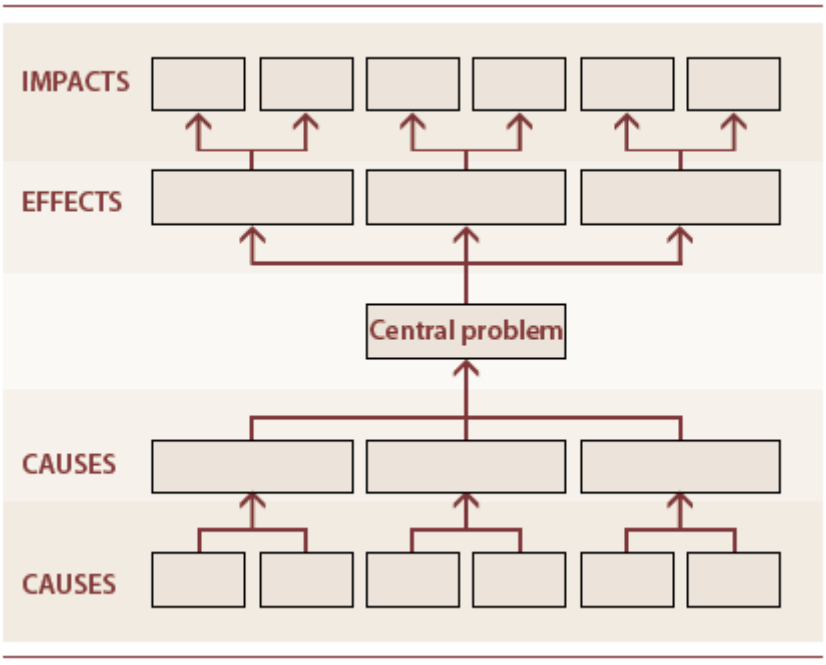
---

**Purpose**: A methodological approach is employed to describe the situation in the future once the identified problems have been remedied. It helps to prioritize the objectives and illustrate the means-ends relationships in a diagram.

**Procedure**:
1) Turn each of the problems in the problem tree into positive statements. This means reformulating all the negative situations into positive situations that are • Desirable and • Realistically achievable.

| PROBLEM | NEEDS | OBJECTIVES |
|---|---|---|
| High rate of malnutrition. | Access to an adequate food ration. | Beneficiaries in region X have access to sufficient quality and quantity of food. |

2) Reproduce the shape of the problem tree and place the objectives in the same place as the problems. This will result in an objective tree.



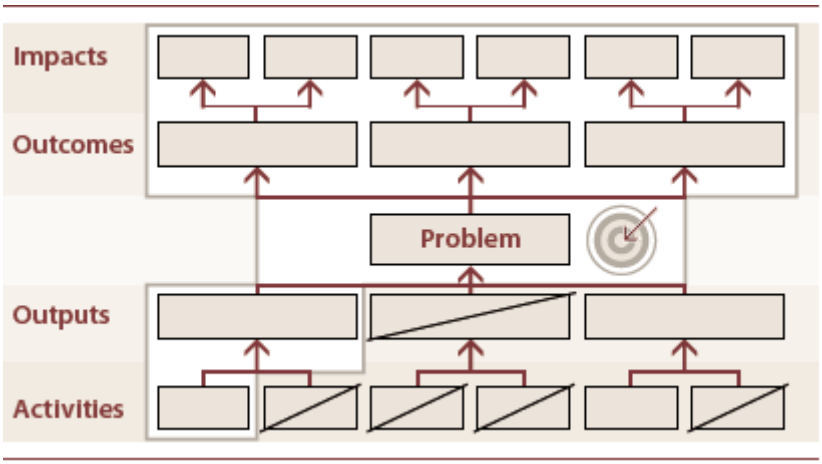

Source: ICRC 2008

3) Check the logic – the means-ends relationships – to ensure the validity and completeness of the hierarchy.
(cause-effect relationships from the problem tree are turned into means-ends relationships). Will one layer of objectives achieve the next?
Modify the objectives, if necessary, by:
• Revising the statements

• Adding new objectives if these seem to be relevant and necessary to achieve the objective at the next level up
• Deleting objectives that do not seem suitable or necessary

4) Define the scope of the intervention, asking the team:

• Should all the identified problems and/or objectives be addressed or only a select few?
• What is the combination of interventions that is most likely to bring about the desired results and promote the sustainability of benefits?




Source: ICRC 2008

Outputs/outcome of the tool:

The output of the tool is a revised and agreed structure on the objectives to be followed by the team. It keeps the analysis of potential project objectives firmly based on addressing a range of clearly identified priority problems. The hierarchy of objectives could be part of a more complex process when developing a Theory of Change.

Participants: Project team, participants, network members

# *Tool 24. -Theory of Change*

*Sources*: td-net toolbox, sustainability research effectiveness program
*Link*: https://scienzenaturali.ch/co-producing-knowledge-explained/methods/td-net_toolbox/theory_of_change; https://researcheffectiveness.ca/wp-content/uploads/sites/7/2018/10/Theory-of-Change-Facilitating-Questions.pdf
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats
*Project management cycle phase*: 1, 2, 3, 4

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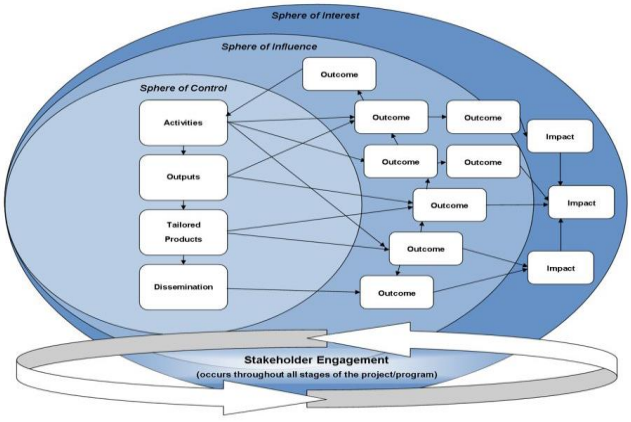
Purpose: A theory of change (ToC) is a model of a change process. It provides a description and explanation of how and why an activity or a set of activities (such as a project or program) is expected to lead or contribute to a process of change. ToC can be used as a planning tool, as a framework for monitoring and evaluation, and as an analytical tool.

Procedure:
First part: Identifying the hierarchy of objectives
1) Define the overall purpose: the overarching goal to which the research aims to contribute (but is not accountable for) *Q: What is the overall purpose of this project or program? What change do we want to see? What change do we aim to make a contribution?*
2) Identify main activities, the actors to be involved, and the engagement processes planned *Q. What actions will the project undertake? What kinds of processes, tools, and strategies are needed?*
3) Identify the outputs
*Q: What knowledge, attitudes, skills, and relationships do we need to build? How do we accomplish this? What behaviours do we need to influence? How can these be influenced by the research activities?*
4) Identify outcomes
What will the targeted actors do differently as a result of project activities and outputs? What changes for them?
5) Identify impacts
What will they do as a result? What new behaviours do they exhibit? What is the reason (theory and assumptions) for this change? What further changes could be triggered?
6) Visualize assumptions and establish causal relationships: Revise and refine the model, ensuring that the main activities, actors, and project/program logic are sound and adequate to contribute effectively to the main outcomes.




Second part: Identifying indicators

- Identify the key outcomes: Q What are the key outcomes (defined as changes in knowledge, attitudes, skills, and/or relationships by specific actors or groups of actors) that are expected, and how will they manifest? Which actors will do what differently (what actions/behaviours) as a result of the project and its activities?
- Identify measures to assess outcomes:
  iii. What measures or indicators can be used to assess outcomes?
  a. For each key actor or set of actors, what outcome(s) is expected at a minimum (expect to see)?
  b. For each key actor or set of actors, what outcome(s) would indicate a moderate level of success (like to see)?
  c. For each key actor or set of actors, what outcome(s) would indicate a high level of success (love to see)?

Template table to identify SMART indicators

| **Outcomes Underlying Theory/Assumption** | **Indicators (Expect to See, Like to See, Love to See)** | **Data Needs: What data do we need?** | **Data Available: What data do we have/exists?** | **Data Sources: How do we get that data we need (tool)? Who do we need to talk to?** |
|---|---|---|---|---|
| | | | | |
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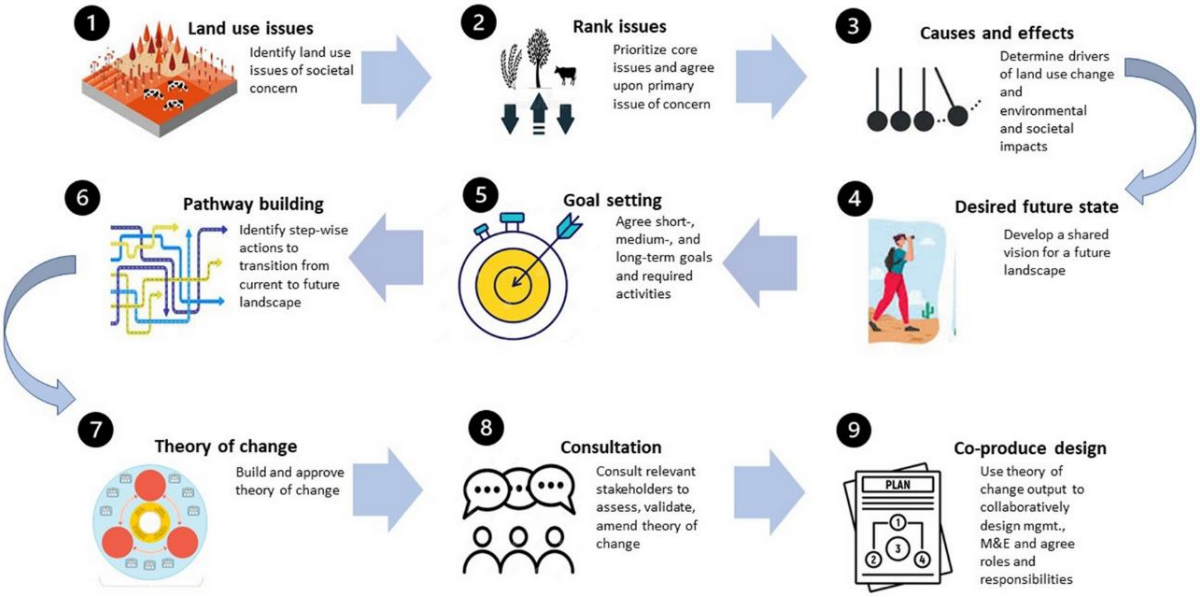
Outputs/outcome of the tool:
The output of the tool is a visualized model of the intervention that provides a reference point to monitor and evaluate progress by more clearly defining what activities and actors are needed.

Participants: The participants in a ToC workshop should include the research project or program management, collaborators, and ideally any key stakeholders who will be engaged (i.e., consulted, informed, or involved) in the research. A facilitator moderates the discussion.




Example of a process of development a theory of change.

Source: Reed et al. (2022).

# *Tool 25. Stakeholder involvement strategy*

*Source*: Biodiversa
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 1, 2, 3

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Purpose: The levels of engagement of stakeholders are likely to vary at different times throughout the lifecycle of the project, depending on the possible and actual contributions of stakeholders at different times. The purpose of this plan is to identify how actors are going to be involved in the different phases of the project, narrowing down the expectations and visualizing potential conflicts.

Procedure:
1) Based on the hierarchy of objectives, a revision of the areas in the project phases and the involvement of stakeholders is performed.

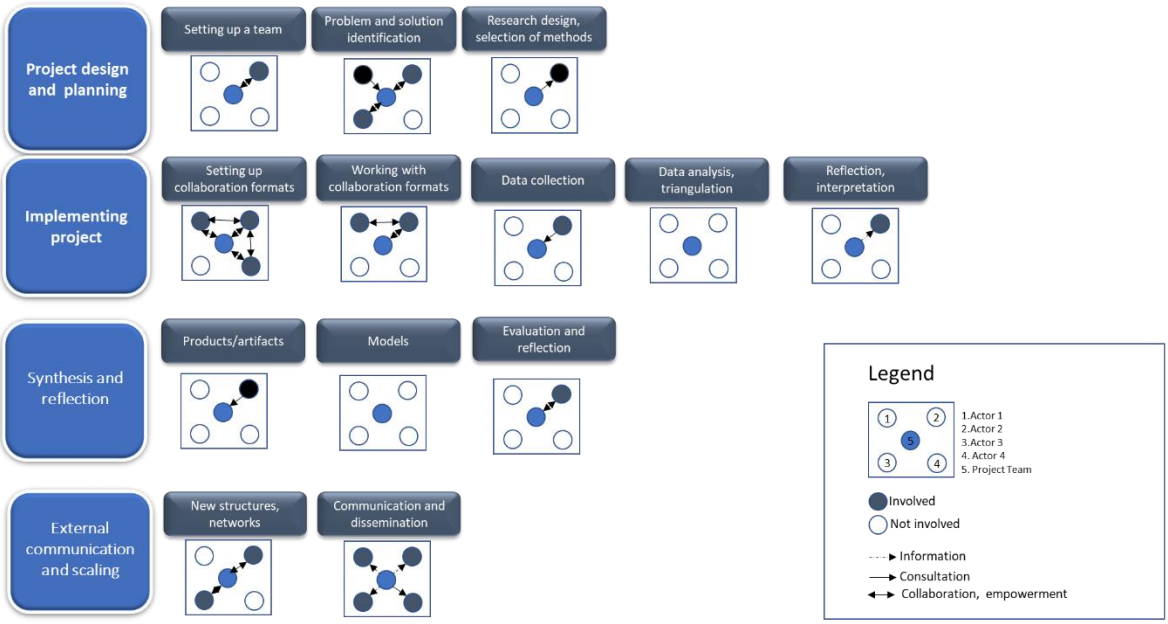
2) Taking the project life cycle stages, stakeholders and their role are identified in a table (Table 1) or a graphical representation (Figure 1) of the expected involvement is developed.

Table 1. Overview of stakeholder involvement in the research project

| | Project life cycle | Stakeholders involved | Role of stakeholders |
|---|---|---|---|
| Project design | Problem or solution identification | | |
| | Research design, selection of methods | | |
| Implementing the project | Setting up collaboration formats | | |
| | Working with collaboration formats | | |
| | Data collection | | |
| | Data analysis, triangulation | | |
| | Reflection, interpretation of results | | |
| Synthesis and evaluation | Products/artifacts | | |
| | Models | | |
| | Evaluation and reflection | | |
| External communication and scaling | New structures, networks | | |
| | Communication and dissemination | | |

Source: adapted from Biodiversa

Figure 1. Graphical presentation of the involvement of stakeholders in a research project




Source: authors

4) Review the expected levels of engagement and adjust the design accordingly: *are these levels desired and required? Are the objectives aligned with that level of engagement? The resources allocated are enough and sufficient to reach that level of engagement? What are potential risks and measures to cope with them?*

Outputs/outcome of the tool:
The output of the tool is an overview and a plan of the desired levels of engagement of stakeholders along the project. With this summary, a clear vision of expectations and tasks is provided, and activities and objectives are adapted.

Participants: Consortium members

# *Tool 26. Project Canvas*

*Source*: academic-toolkit
*Link*: https://www.academic-toolkit.com/
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 1, 2

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Purpose:. "Canvas" is a way of visualizing the essential components of an idea or project as blocks in such a way that the important message is easily transmitted and synthetized. The canvas cells are small to force the participants to edit down to fit the space.

Procedure:

1) Select and adpat the canvas (and their question) with key points that are part of your project. Visualize the canvas in a wall or pinboard (see examples). It is recommended that the initial canvas are developed by project members.

2) Distribute the participants' canvas individually. Participants fill them individually.

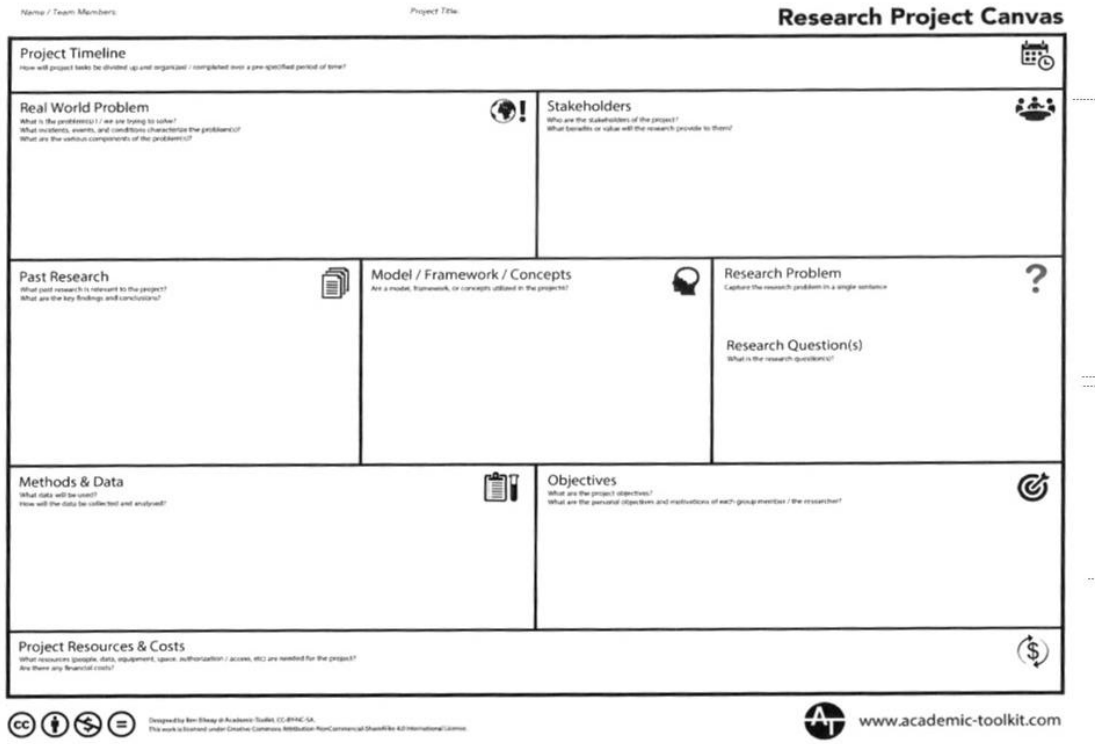
3) According to the number of participants, group the participants in pairs or in working groups to discuss their personal opinions on the topics and reach an agreement. Group answers are visualized in sticky notes or cards.

4) If there are diverging opinions on the main concepts, the facilitator should conduct a discussion, prioritization, and voting if necessary.

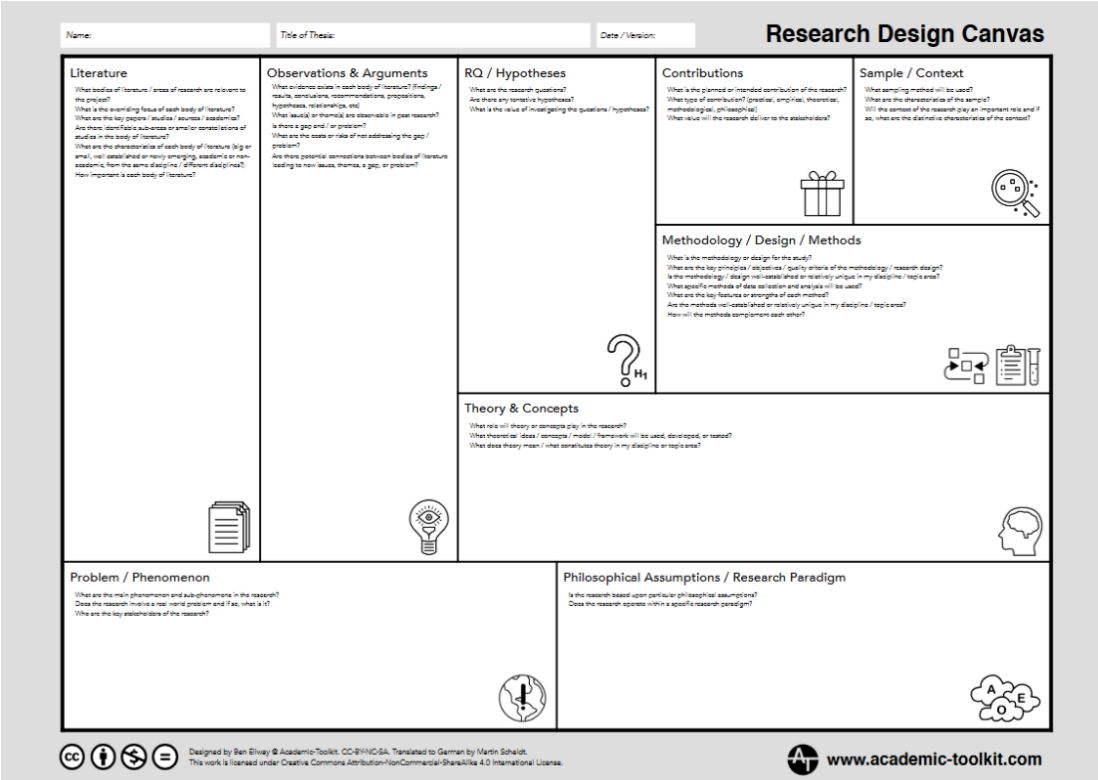
Outputs/outcome of the tool:
A canvas sheet with the most important information of the project. This summary is the basis for further elaboration of the proposal and a practical format to present the concept to external persons. The use of Canvas for the design of projects has been popularized by online collaboration tools such as Miro or Mural, where participants can bring and discuss their ideas simultaneously.

Participants: Consortium members

Example 3. Design of research projects




Example 2. Design of research questions



# *Tool 27. Give and take matrix*

*Source*: td-net toolbox; https://zenodo.org/record/4627136#. Y4cOf32ZOUl
*Link*: https://scienzenaturali.ch/coproducing-knowledge-explained/methods/td-net_toolbox
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

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Purpose: Establish links between individual research parts or subprojects with diverse disciplinary backgrounds. It helps to make mutual expectations explicit and to identify potential for collaborations with project members.

Procedure:
Preferably, the tool is applied at the very beginning of project planning, best during the actual problem framing. The tool is organized with one core matrix (give-and-take matrix) and proceeds as a group workshop of at least three hours along the following steps:

1) Each subproject individually prepares answers to the following questions:
– TAKE: what would you like to get from each of the other subprojects ("desired TAKEs")?
– GIVE: what can you offer to each of the other subprojects ("proposed GIVEs")?

| | **WP1 gives** | **WP2 gives** | **WP3 gives** | **WP4 gives** |
|---|---|---|---|---|
| **WP1 takes** | | | | |
| **WP2 takes** | | | | |
| **WP3 takes** | | | | |
| **WP4 takes** | | | | |

2) Mixed groups of two or three subprojects (depending on the number of subprojects and/or team members, these steps can be followed in one or several groups) perform the following tasks:
– The first subproject starts by presenting its "desired TAKEs" and "proposed GIVEs."
– The other subproject(s) react(s) by showing its (their)"desired TAKEs" and "proposed GIVEs."
– The discussion of interfaces should fit as many "desired TAKEs" and "proposed GIVEs" as possible.

3) They meet again in the subprojects to perform the following tasks:
– Share what they have learned in the mixed group(s).; Discuss how feasible it is to secure the "proposed GIVEs" for the other subprojects in the research process.

4) The plenary session covers the following agenda items:
– All subprojects summarize their proposed GIVEs to the other subprojects using the give-and-take-matrix; All presented GIVE elements are acknowledged.

5) Concrete follow-up actions may be defined, detailing necessary adaptations in the different subprojects in response to the GIVEs promised and the TAKEs received. Some sort of (binding) agreement to follow the mutually discussed "give-and-take matrix" can be helpfu

Outputs/outcome of the tool: The research design is revised and changed according to the follow-up actions defined.

Participants: Project consortium

# *Tool 28. Coherence tool*

*Source*: toolsfornetworkers.nl
*Link*:https://www.linkconsult.nl/files/Modellen%20(2014)/Engels%20(2014)/Circle%20of%20coherence/140109_description_Circle_of_Coherence.pdf
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

---

Purpose: The Circle of Coherence visualizes how interaction patterns in a network are governed by biological mechanisms. There are four basic interaction patterns that feed this vital space:
• Exchange: a positive balance between give and take
• Challenge: incentives to use the best abilities
• Structure: clarity about the order that regulates the interaction
• Dialogue: willingness and effort to learn from each other

Procedure:

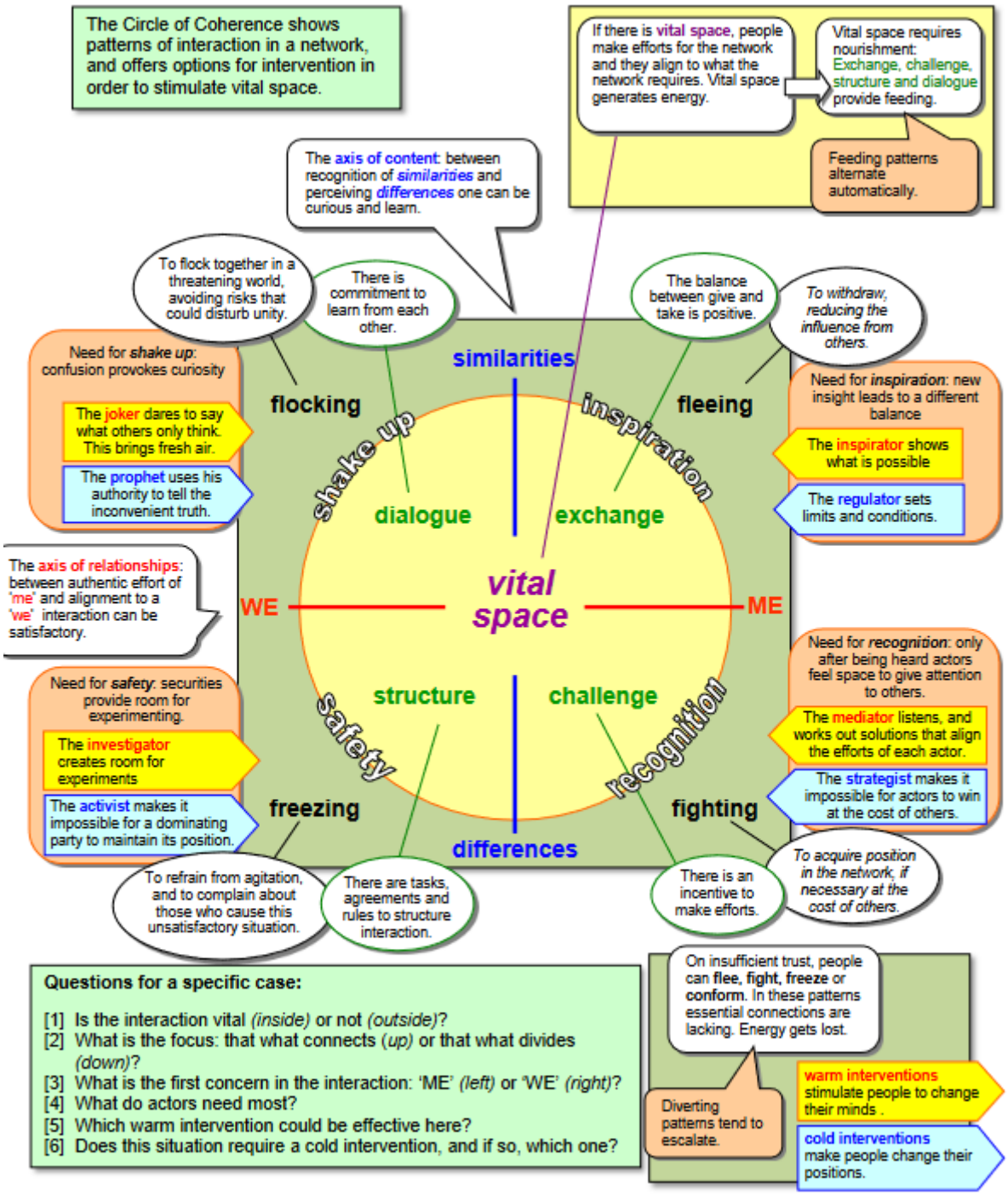
- Create a circle, with two axes on it made by using rope, and names covering a big space in your workshop room.
- Participants locate themselves inside the picture to reflect on the group dynamic
- Facilitator asks for potential interventions to change the dynamics of networks
- Facilitator debrief the results of the exercise

More details on the procedure: https://www.youtube.com/watch?v=KwXWS7yC27Y

Outputs/outcome of the tool:
The outputs of the tool are the analysis of the dynamics of a network in a given period of time. It can be used to reflect different positions of different actors as a means of reflection or to find potential interventions.

Participants: Network members

# The Circle of Coherence





Sources:
Wielinga, H.E. (2001): *Netwerken als levend weefsel. Een studie naar kennis, leiderschap en de rol van de overheid in de Nederlandse landbouw sinds 1945. [Networks as Living Tissue. A Study on Knowledge, Leadership and the Role of Government in Dutch Agriculture since 1945]*, PhD Thesis Wageningen University. Uilenreef Publisher, 's Hertogenbosch.Wielinga, H.E., Zaalmink, B.W. et al (2008): Networks with Free Actors. Wageningen University and Research.

# *Tool 29. Network analysis*

*Source*: toolsfornetworkers.nl
*Link*:https://www.linkconsult.nl/files/Modellen%20(2014)/Engels%20(2014)/Network%20Analysis/120726_description_Network_Analysis.pdf
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

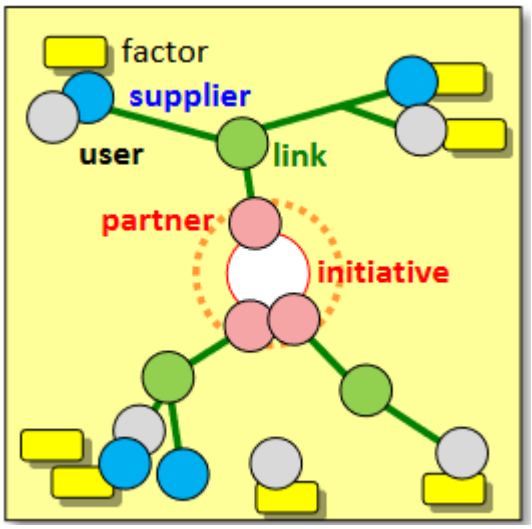
---

Purpose: Network analysis is a tool to identify who is involved and map the relationships to be worked on during an specific period of time. It identifies suppliers, users, links and partners.

Procedure:
1. Put the initiative in the middle of a large sheet, draw a red circle around it
2 Put all factors that matter in a large circle around the initiative
3 Identify what actors should move to connect the factors to the initiative

4 Distinguish different positions of involvement of these actors:

- Suppliers: are required to contribute.
- Users: will benefit from the initiative.
- Links: connect partners to suppliers and users.
- Partners: feel ownership towards the initiative

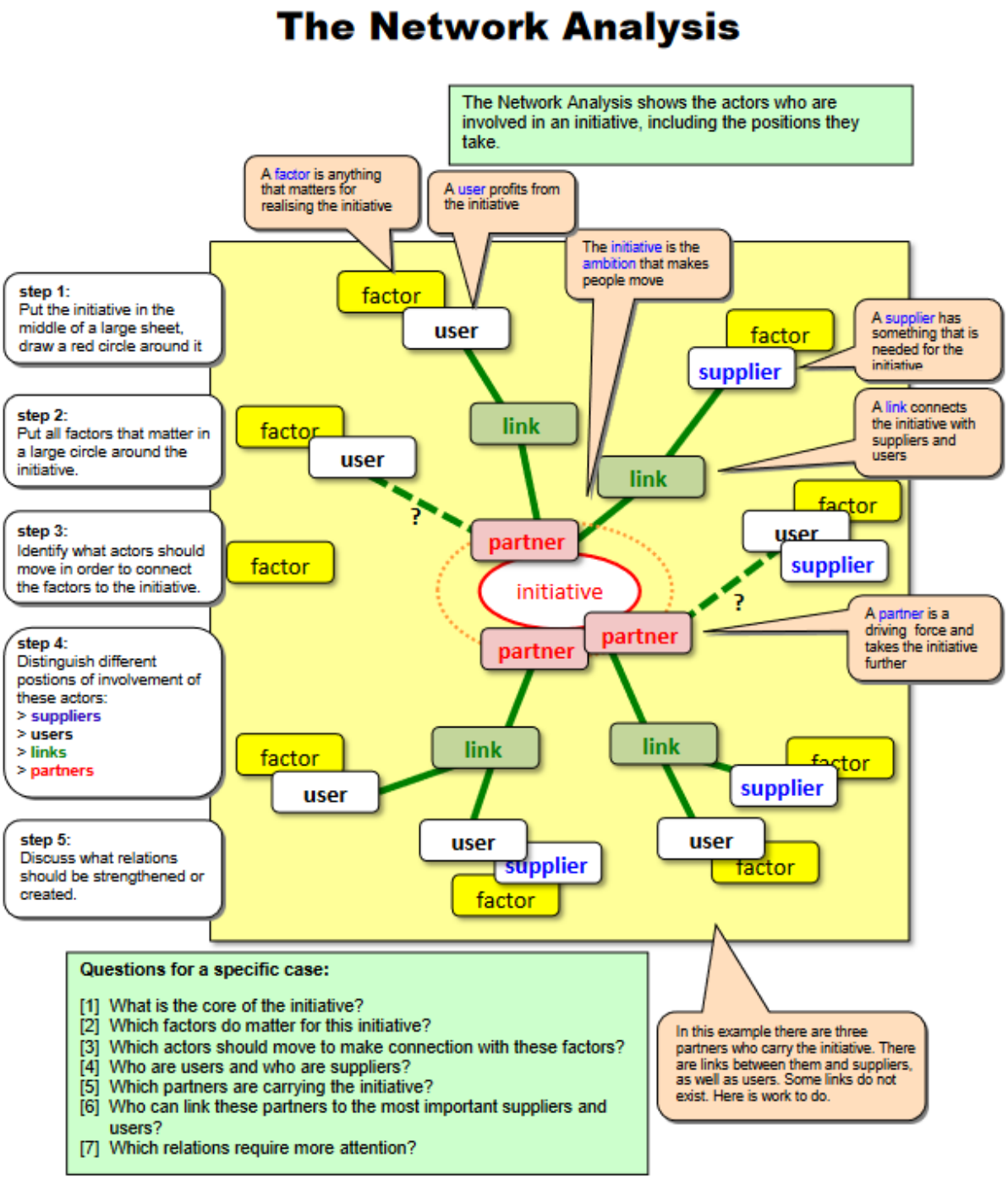


Source: Wielinga (2012)

5 Discuss what relations should be strengthened or created

Outputs/outcome of the tool:
Network analysis maps out the necessary connections, identifying priorities for strengthening the relationships of various actors that are involved in an initiative.

Participants: Network members, stakeholders involved in the initiative/innovation




Source: Wielinga (2012)

# *Tool 30. Initiative spiral*

*Source*: toolsfornetworkers.nl
*Link*: https://www.youtube.com/watch?v=3LeSCWfQ9Js, https://www.linkconsult.nl/files/Modellen%20(2014)/Engels%20(2014)/Spiral%20of%20Initiatives/140113_tool_1_Spiral_of_Initiatives.pdf

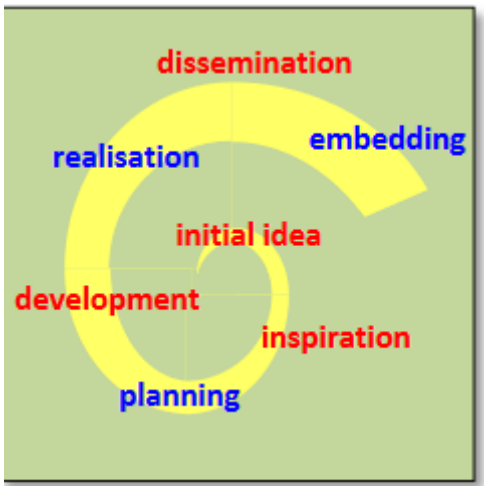
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

---

Purpose: This tool visualizes what stages the facilitators might be assisting in the development process of an initiative or innovation: the stages of inspiration, planning and development.

Procedure:
1) Ask participants to develop the graph of the initiative
2) According to the purpose, ask a list of questions on each stage:

- What happened/is expected to happen in this stage?
- Who was involved/should be involved in each stage?
- Which action should have more clarity?

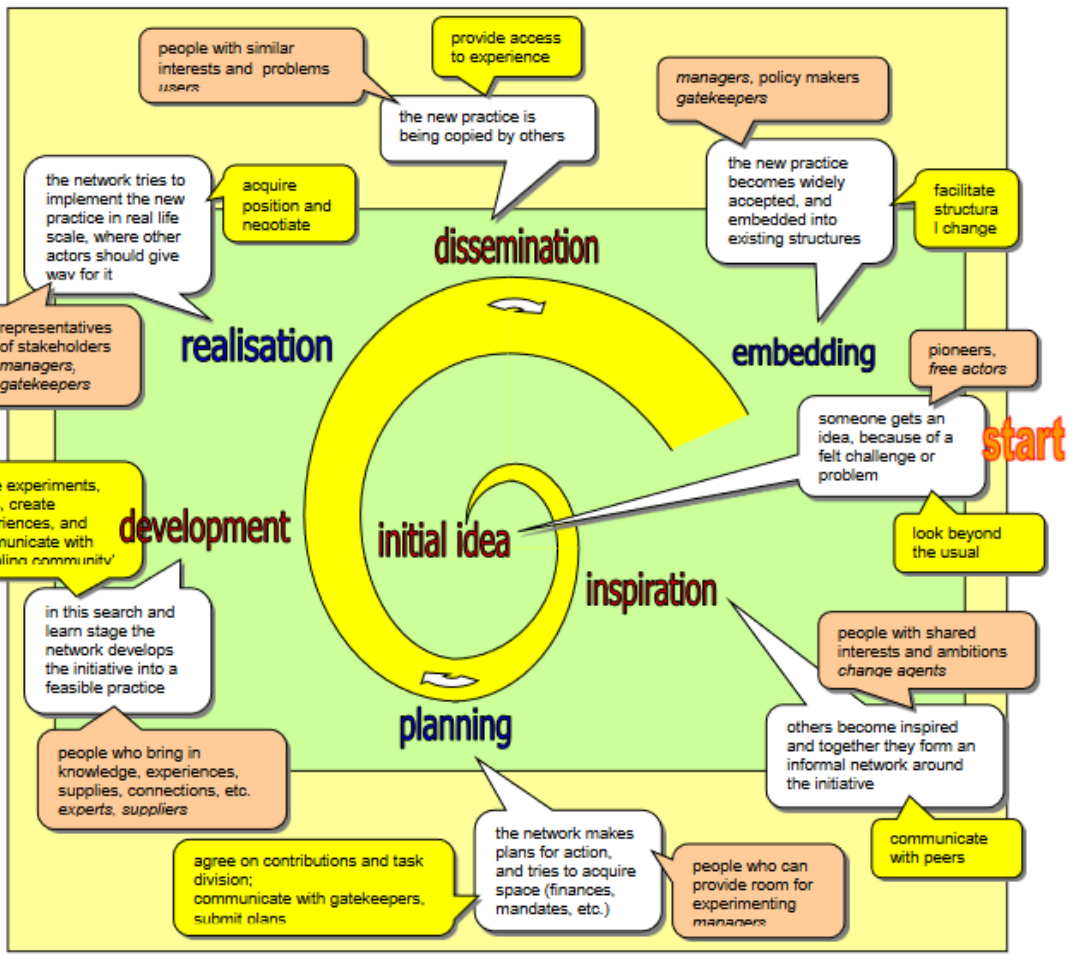



3) Present the results of the analysis and discuss the main points.

Outputs/outcome of the tool:
Ilustrates the various stages in the development of an initiative, identifying warm and cold stages. It could be used as a planning or monitoring tool.

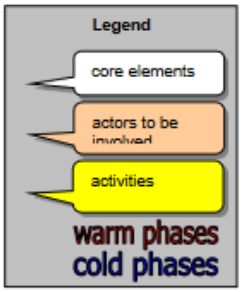
Participants: Network members, stakeholders involved in the initiative/innovation

The Spiral of Initiatives shows the development of an initiative. Each phase requires different activities, and the involvement of different actors.




**Questions for specific cases:**

[1] What stage is requiring most attention?
[2] Which actors need to be involved in this phase?
[3] What needs to be done before the network can take the initiative to the next phase?
[4] Which actions should get priority?




Source:
Wielinga, H.E., Zaalmink, B.W. et al (2008): Networks with Free Actors. Wageningen University and Research.

# *Tool 31 Six Thinking huts*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships
*Link*: https://edepot.wur.nl/409844; https://doi.org/10.1080/13892249685300321
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

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**Purpose**: To look at a decision or problem from different perspectives to achieve a complete and rounded view of the situation. Get people to use all six modes of thinking (lateral thinking).

**Procedure**:

1. Present to the group the problem or the solution to analyse
2. Present to the groups the six huts (it works better if you have six colours of hats)

   - **Factual (white)**: Objective, neutral thinking in terms of facts, numbers and information. This thinking focuses on available data and information. It looks for knowledge gaps and tries either to fill them or take account of them. For example, past trends should be analysed and extrapolated from historical data.
   - **Emotional (red)**: Emotional, with judgments, suspicions and intuitions. 'Wearing' the red hat, one will look at problems using intuition, gut reaction and emotion. Additionally, to understand other people's responses.
   - **Cautious (black):** Negative, risk seeing and thinking about why something will not function. Using black hat thinking, one will look at all the bad points of the decision cautiously and defensively. This hat is used to see why things might not work out, which is important to highlight the weak points in a plan. The weak points can then be eliminated or altered, or a contingency plan can be drawn up to counter them. This makes plans more resilient and prepared for risks.
   - **Logical (yellow)**: Positive, optimistic, clear, effective and constructive. The yellow thinker helps you to think positively and to put concrete suggestions on the table. It is the optimistic viewpoint that helps to see all benefits of the decision and the value in it. Yellow hat thinking helps to keep everyone going when everything looks gloomy and difficult.
   - **Out of the box (green):** Creative, seeks alternatives. The green hat is where you can develop creative solutions to a problem. It is a freewheeling way of thinking, in which there is little criticism of ideas. Provocation is an essential part of green thinking. A whole range of creativity tools can help you here.
   - **Management (blue):** Thinking about thinking. The blue thinker's role is to keep an overview of what kind of thinking is necessary at a certain moment in dealing with a problem. The blue hat thinker might request green hat thinking whenever running into difficulties because ideas are drying up. If contingency plans are needed, the blue hat will look for black hat thinking. The blue thinker is responsible for giving summaries, surveys and conclusions. The blue thinker keeps the discipline and brings the discussions back on to the right track. The blue hat stands for process control, worn by those who chair meetings.
3. Engage people by asking questions such as "Could we look at the new government policy x from a white hat perspective? Who wants to start?" or "We have heard some great red and yellow hat contributions now... let's see if there are black hat contributions to the issue of y"
4. Rotate the huts, so all participants can experience the six modes of thinking**. Do not put people into categories**. It is totally wrong to say, "She's a green hat thinker" or "He only uses the red hat."

**Outputs/outcome of the tool:**
Participants change their perspective, detaching their ego from thinking.

**Participants:** project participants

# *Tool 32 World Cafe*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships; Coffee to go: A Quick Reference Guide for Hosting World Café
*Link*: https://edepot.wur.nl/409844; https://theworldcafe.com, https://theworldcafe.com/wp-content/uploads/2015/07/Cafe-To-Go-Revised.pdf
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

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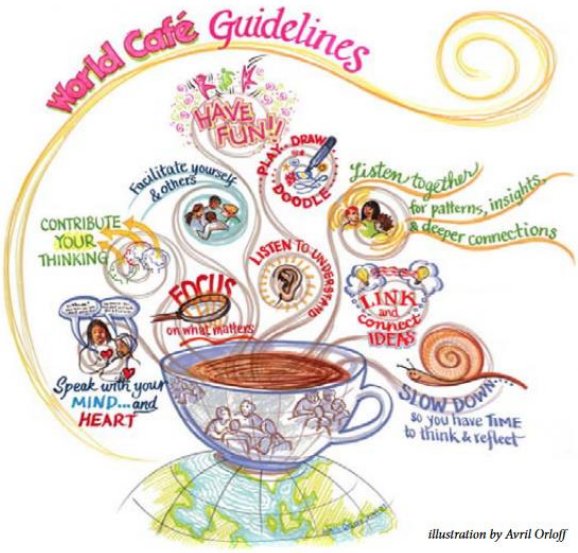
Purpose: World Café is a creative process for leading collaborative dialogue, sharing knowledge and creating possibilities for action in large groups. By organizing several discussion rounds where people are invited to discuss a topic of mutual interest in small groups; the technique enables bringing together individual ideas into one comprehensive message.

Procedure:

1) Setting: Create a "special" environment, most often modelled after a café, where people feel invited to contribute, i.e., small round tables covered with a tablecloth, plenty of paper or a flipchart paper tablecloth, coloured pens. There should be 3-6 chairs at each table. Small group sizes are essential.



Source: The World Café Community Foundation

2) Welcome and Introduction: The host begins with a word of welcome and an introduction to the World Café process, setting the context, explaining the etiquette of the cafe (see graph), and putting participants at ease.

3) Small Group Rounds: The process begins with the first of three twenty-minute rounds of conversation for the small group seated around a table. At the end of the twenty minutes, each member of the group moves to a different new table. Only the table host stays to welcome the next group and briefly fills them in on what happened in the previous round, using the flipchart tablecloths as a visual reminder of the previous conversation.

4) Questions: Each round is prefaced with a question designed for the specific context and desired purpose of the session. The same questions can be used for more than one round, or they can be built upon each other to focus the conversation or guide its direction. The question is at the heart of the conversation so make sure it matters for all participants.

5) Harvest: After the small groups (and/or in between rounds, as desired) individuals are invited to share insights or other results from their conversations with the rest of the large group. These results are reflected visually in a variety of ways, most often using graphic recorders in the front of the room.

Source: https://theworldcafe.com/

**Outputs/outcome of the tool:** The World Café methodology is a simple, effective, and flexible format for hosting large group dialogue. The technique builds on the notion of group intelligence. the group obtains an opportunity to see and link all the harvested information from a broader perspective. Patterns can be identified, and collective wisdom becomes visible. Additionally, possibilities for action might emerge.

**Participants: S**takeholders

# *Tool 33 Margolis wheel*

*Source*: *Reflection Methods. Tools to make learning more meaningful. Practical Guide for Trainers and Facilitators*
*Link*: [www.mspguide.org/tool/reflection](www.mspguide.org/tool/reflection)
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

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**Purpose**: Have brief interactions with different people, generating many ideas and a lot of energy.

**Procedure**:

1. Participants sitsat in two circles facing each other (the inner circle facing outwards, the outer circle facing inwards). Everybody is facing one other person. If the group has an uneven number of people, one threesome is formed or the facilitator can join. Make sure that it is clear who is facing whom; this can be done by asking everybody to shake hands with the person opposite.
2. Do three to four rounds. Each round consists of a question, which is then discussed in the pairs for three to five minutes. Emphasize the fact that three/five minutes is short and that each participant should take care to leave time for the other to talk.
3. In plenary the facilitator invites a few pairs to comment on what they discussed. Subsequently, the outer circle moves one place to the left, and the next question is asked.
4. Alternatively, participants can be asked to sit in two straight rows, one facing the other. One row asks a question to the other row, and participants discuss in pairs. After a first round, one row moves one (or more) chairs to the right, while the other row stays. (the person at the end of row has to walk to the other end). Now they all face a new person. Then, the other row asks a question.

Source: Gordijn et al.

**Outputs/outcome of the tool:** As the participants have interacted with each other, the groups build connections and stimulate interaction and learning from each other.

**Participants:** Participants

# *Tool 34 Voting, ranking and prioritizing*

*Source*: Sixty tools to facilitate multi-stakeholder partnerships; Moderation and Visualization for Group Events
*Link*: https://edepot.wur.nl/409844;
*TDR Phase*: Problem framing (I), Analysis of the problem (II)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2

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Purpose: These tools (or techniques) help to select the most promising ideas or options when many ideas have been generated. It is used when the range of different ideas and options needs to be narrowed down, promoting discussion but reaching consensus withing a group.

Procedure:

1. Be clear about the procedure you propose, and prepare for it. If you have the choice, keep it simple. Proposing an unnecessary complicated voting or scoring procedure creates confusion and delegitimizes the result. Avoid negative argumentations and the identification of ideas or issues with individuals. Make sure that the decision--making process is transparent and that the 'losers' will remain integrated so they will continue collaborating constructively.

Option A VOTE FOR FAVOURITE IDEAS

1. *Ask the brainstorm participants to select an idea* that is their personal favourite, the one they want to work on, or the one they believe is most promising. Give everyone a limited number of choices. Let people decide in silence first so that they are not swayed by others' opinions. Vote directly on the brainstorm cards/Post-its, either using sticky dots or simply drawing a dot.
2. *Discuss the results*: Count the votes and determine the most popular ideas. As a team, take the most promising ideas and decide which ones to develop further. Be realistic about the number you can pursue—aim for three ideas to start with. Identify and explore disagreements if any exist

Option B. NARROWING A LONG LIST-RANKING EXERCISE

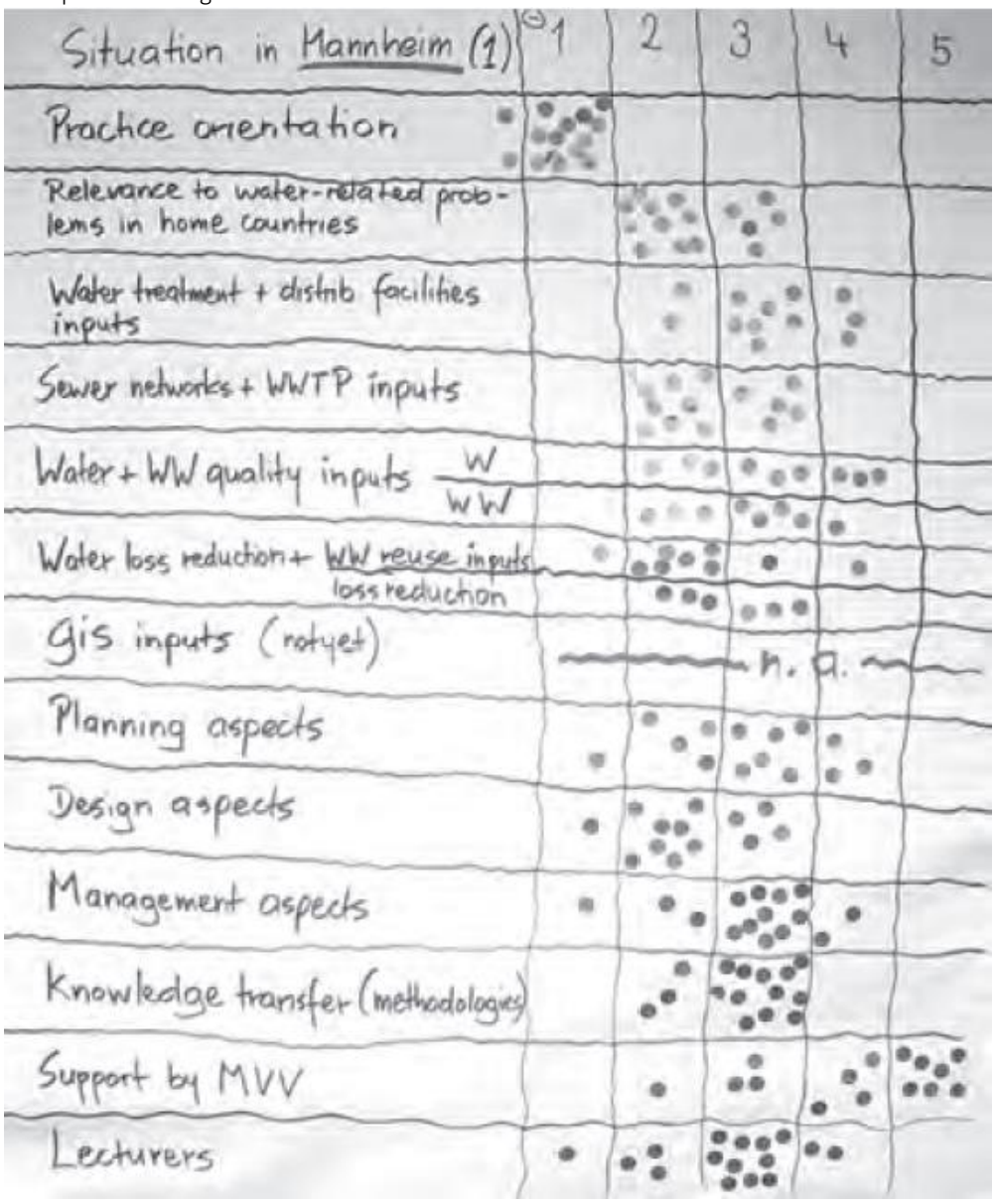
1. Be clear about the criteria for selection: Examples of criteria: most important, time needed, cost, urgency, feasibility, desirability, next step.
2. Divide the number of items on the brainstormed list by three. Each person receives that number of choices. (e.g., if there are 15 ideas, everybody gets 5 choices)
3. Everyone may distribute his or her choices in any way s/he wants.
4. The top third of the list – the items chosen most often – becomes the high-priority list.

Option C-RANKING AND SCORING

If you have, e.g., 10 ideas and it is not obvious which idea is the most important (or: relevant; feasible; or whatever criterion), this method can be a satisfying way to help make a group decision about priorities.

1 Have these 10 ideas written on a flip chart so that they are visible to the whole group.
2 Each member of the group rank the ideas in descending order by assigning a number to each item, from most (ten) to least (one) important.
3 Calculate average scores based on the individual rankings.
4 Rewrite the items in the order of their scores.
5 Discuss the setting of priorities.
6 Redo ranking, if desired.

Example of a voting result




Source: Oepen, 2003

**Outputs/outcome of the tool:** Selection of ideas in the convergence phase of group decision making, facilitating the agreement withing the group. Consensus is helpful in increasing group commitment to a program of action.

**Participants:** Consortium members, participants, network members

# *Tool 35 Story wall*

*Source*: td-net toolbox
*Link*: Storywall | Methods and tools for co-producing knowledge (scienzenaturali.ch); https://zenodo.org/record/3717396#.Y33PrX2ZPcd
*TDR Phase*: Problem framing (I), Analysis of the problem (II), Assessing the Impact(III)
*Knowledge integration expected*: planning, working with collaboration formats, reflection
*Project management cycle phase*: 2, 3

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Purpose: Contrast different perspectives, increasing mutual understanding of the experience of a process in different ways and stressing different elements considered as important.

Procedure:
1) A simple timeline indicating the start and end dates of the joint process or story is provided.
2) The group members collectively discuss whether to further structure the paper's timeline, for example, into project parts, organizational levels, or main process phases.
3) The actors individually identify key events or dominant influences. They may also want to identify those that have either supported or hindered the process, as well as other relevant story elements with respect to reflection and exchange.
4) Based on the individual elements, the actors jointly create a storywall picture of their process, representing their group's collective understanding of it. This is the main step because different perceptions and experiences are shared, and the process elements are discussed.
5) In case the storywalls are made in subgroups, they can subsequently be presented to the full group.
6) In addition to the reported stories with their elements, the main lessons learned can be selected and used to create an ideal storywall.
7) Stoy walls can create a "customers journey" to foresee the potential use of a product.

**Outputs/outcome of the tool:**
The outcome of a storywall exercise is a poster of the story featuring its most important elements from the perspective of the group and its members.

**Participants:** Project members/stakeholders participating in the project

# *Tool 36 Prototyping*

*Source*: Design Project Guide, Design Thinking -das Handbuch
*Link*: https://dschool.stanford.edu/resources/design-project-guide-1, https://fazbuch.de/produkt/design-thinking/
*TDR Phase*: Analysis of the problem (II), Assessing the Impact(III)
*Knowledge integration expected*: working with collaboration formats, reflection
*Project management cycle phase*: 2, 3

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Purpose: Build one or more prototypes—artifacts and experiences—that will solicit feedback on issues to be explored about the solution.

Procedure:

1- Think about what you are trying to learn with your prototypes.
2- Build low-resolution objects and scenarios that probe those questions. There are several techniques to prototype a solution, according to the type of service or product
    - Wireframes
    - Mock-up
    - Rol play
    - Paper prototyping
    - Video prototyping
    - Service blue printing
    - Sketch and scribble
    - Business model prototyping
    - Project model prototyping
    - Storytelling and story writing

- Test assumptions
    - What assumptions are you making in your solutions?
    - What needs to be true about the user's feelings and motivations for the solution to be successful?
    - What do you want to learn about people through your prototypes?

- Check the context
    - The best option is to go into the real environments where the solution would exist.
    - The second option is to create or approximate the context: consider a theatrical metaphor: "In creating this experience, what props (physical objects), scene (environmental and situational context), and roles (players in the experience) do we need?"

Outputs/outcome of the tool:
Participants/users experience a product/service and react to it. The solution decision and assumptions are examined as well as the perception of the users and their needs. It is used ot improve a soultion.

Participants: Researchers, developers, designers, end-users of a service or tangible product.

# *Tool 37-I like, I wish, what if*

*Sources*: Design thinking toolbox
*Link*: https://conceptboard.com/blog/i-like-i-wish-what-if/#I_like_I_wish_what_if_activity_for_design_thinking_and_retrospectives
*TDR Phase*: Analysis of the problem (II), Assessing the Impact(III)
*Knowledge integration expected*: working with collaboration formats, reflection
*Project management cycle phase*: 2, 3

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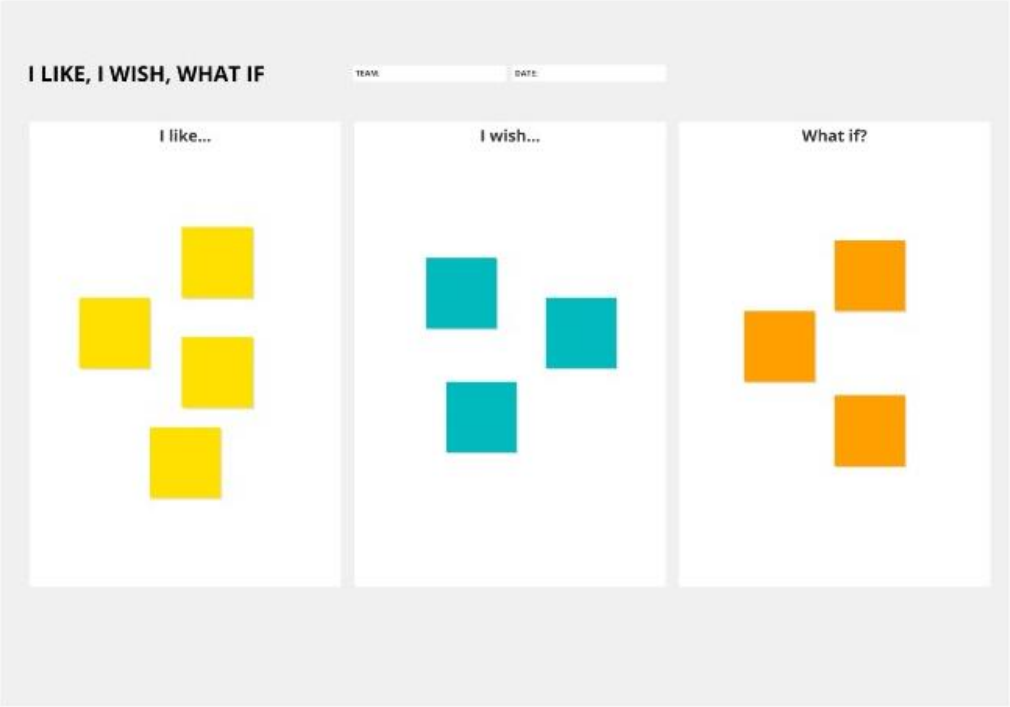
Purpose: I like, I wish, what if it is a popular design thinking activity used to gather feedback during the prototyping phase. Participants are encouraged to start the session by sharing positive feedback (I like) before moving to what they felt was lacking or could be improved (I wish) and brainstorming (what if) about future actions that have not previously been considered.

Procedure:
A moderator facilitates the entire session, setting the expectations and sharing the board. Tackle each question one after the other with everyone adding their feedback on color coded cards or sticky notes. Finalize with a potential action plan.




Outputs/outcome of the tool: A list of features, learnings and recommendations to start a new cycle of interactions and improve a process or product.

Participants: the persons involved in the design, implementation or use of a predefined process or experience.

# *Tool 38 Feedback capture grid*

*Source*: Design Thinking -das Handbuch
*Link*: https://fazbuch.de/produkt/design-thinking/
*TDR Phase*: Analysis of the problem (II), Assessing the Impact(III)
*Knowledge integration expected*: working with collaboration formats, reflection
*Project management cycle phase*: 2, 3

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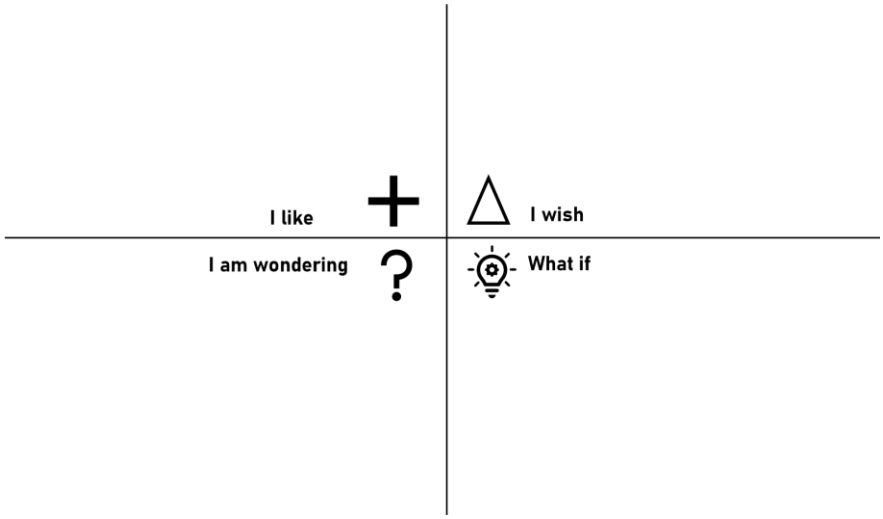
Purpose: The feedback capture grid is a technique to capture and organize feedback from participants about a prototype, a session, a topic or a workshop.

Procedure:

1. Present the quadrant with four aspects:

- Likes
- Wishes
- Questions
- Ideas




2. The participants write their opinion on cards, and the facilitator collects and classifies. According to the size of the group, the group can classify, prioritize or write it individually.

Outputs/outcome of the tool:
Feedback from participants organized and visible to all the participants

Participants: stakeholders, consortium members, network members

# *Tool 39 Usability test*

*Source*: Design Project Guide, Design Thinking -das Handbuch
*Link*: https://dschool.stanford.edu/resources/design-project-guide-1, https://fazbuch.de/produkt/design-thinking/
*TDR Phase*: Analysis of the problem (II), Assessing the Impact(III)
*Knowledge integration expected*: working with collaboration formats, reflection
*Project management cycle phase*: 2, 3

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Purpose: Test solutions with users and stakeholders to gain feedback from multiple users about the solutions and ideas. Advance the empathy for users and refine the insights and perspective about the problem and the solution.

Procedure:

1. Preparation

Plan the testing approach using the following questions:

- How can an experience be created?
- What is the scenario or context to get quality feedback on the prototype?
- How will you observe, or otherwise see the prototypes in use?
- How will you follow up for discussion with those who test the concept?

2. Engage users, participants or stakeholders

1. Greet and welcome the participant who will test the prototype. Test with a progressive procedure: give the participant a minimal context, let them experience the prototype, observe their reaction, and then follow up with questions.
2. Answer questions with questions (i.e., let the user make the interpretation before telling her your intention). For example, if the user asks “Would I be able to select that online?”, one might respond “Would you want to? Why?”

3. Adjust prototypes as you go

Make adjustments to your prototypes as you continue to test. Those can be adjusted from solutions (concepts) or prototypes (embodiments). Each testing session serves to optimize the solution, try a number of options and obtain reactions to improve new versions.

4. Test with multiple people

Test with multiple people in a session or round of prototyping.

1. Synthetize resultsk

Use a shared visual structure, such as a feedback capture grid, to review feedback.

Outputs/outcome of the tool:

The outcome is a feedback capture grid with comments from the users, the observers or the participants of the testing session.

Participants: end-users, stakeholders

# *Tool 40 - On-farm (on-site) experimentation*

*Source*: Lacoste et al 2021
*Link*: https://doi.org/10.1038/s43016-021-00424-4
*TDR Phase*: Analysis of the problem (II), Assessing the Impact(III)
*Knowledge integration expected*: working with collaboration formats, reflection, research process
*Project management cycle phase*: 2, 3

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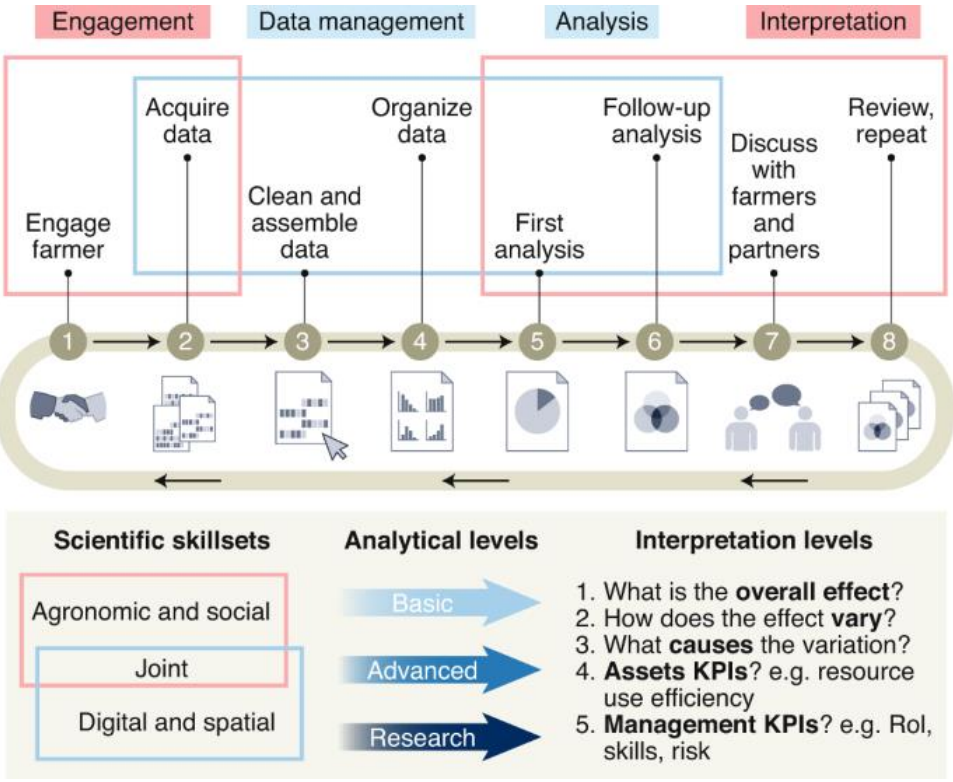
Purpose: On-farm experimentation is defined as an innovation process that brings agricultural stakeholders together around mutually beneficial experimentation to support farmers' own management decisions.

Procedure:
On-farm experimentation follows an iterative process during which practical information is generated that farmers can easily understand, assess and readily convert to farm practices. The steps are presented below:




On-farm experimentation steps *Source: Lacoste et al 2021*

Outputs/outcome of the tool:
As a result, the research process harnesses farmers' own knowledge, focuses on the external perspective of other experts, and creates value for all by stimulating the production of new insights through colearning and the hybridization of knowledge.

Participants: Researchers and farmers

# *Tool 41. Citizen science tools*

*Source*: Biodiversa, Fraisl et al. (2022)
*Link*: https://doi.org/10.1038/s43586-022-00144-4
*TDR Phase*: Problem framing (I), Problem analysis (II), Impact assessment (III)
*Knowledge integration expected*: working with collaboration formats, reflection, research process
*Project management cycle phase*: 2, 3

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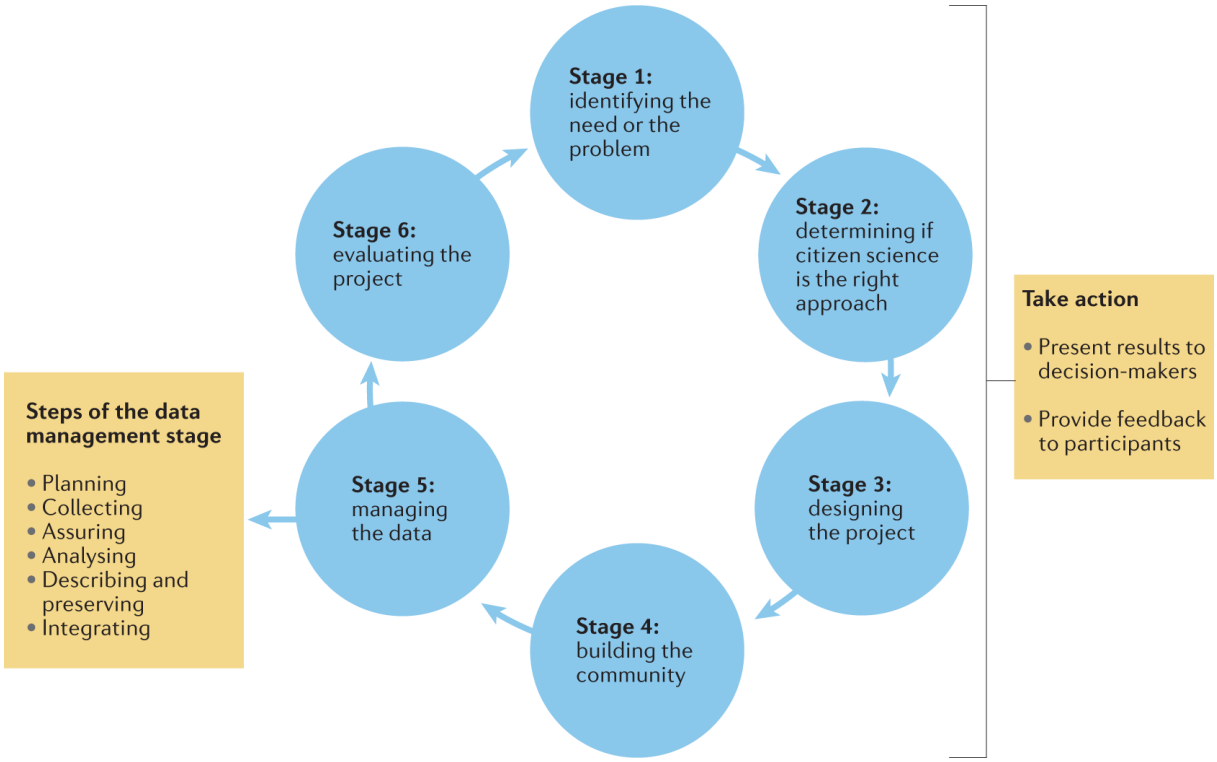
Purpose: Citizen science is an approach applied in many scientific domains, particularly within the environmental and ecological sciences, in which nonprofessional participants contribute to scientific research and knowledge production.

Procedure:
Citizen science projects are planned in stages and steps. Fraisl et al. (2022) describe the following steps:




Source: Fraisl et al. (2022)

Outputs/outcome of the tool:
Participation of public participants in research outputs. That includes large data sets, research outcomes, training and dissemination material in a broad range of disciplines

Examples: https://iiasa.ac.at/models-and-data/earth-observation-citizen-science
https://doi.org/10.1038/s43586-022-00144-4
http://www.cientificosdelabasura.cl/en/

Participants: Citizens, researchers

# *Tool 42. -Tricot approach*

*Source*: van Etten et al 2020
*Link*: climmob.net
*TDR Phase*: Problem framing (I), Problem analysis (II), Impact assessment (III)
*Knowledge integration expected*: working with collaboration formats, reflection, research process
*Project management cycle phase*: 2, 3

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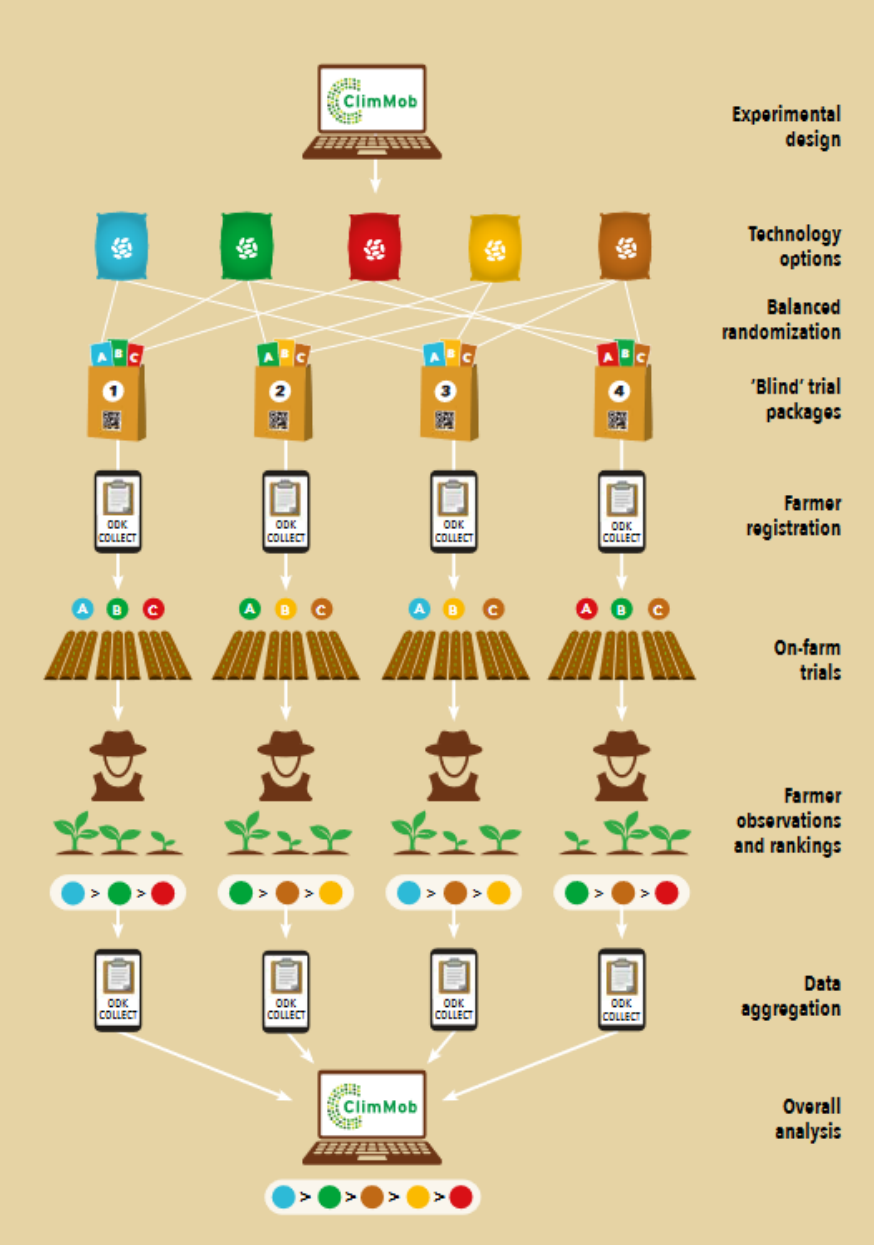
Purpose: Large numbers of farmers carry out many small, simple trials on their own farms instead of a few large, complex trials conducted at research stations.

Procedure:
Tricot is a methodology for introducing agronomic innovation in interactive steps. It is most useful in situations where farmers are experiencing agronomic challenges or where they are dissatisfied with the product quality of their harvests.

1: Preparation
Researchers have defined a set of comparable technology options to test. As a start, a total number of 8-12 technology options is recommended.
2: Design
The implementing organization uses software to design the project.
3: Recruitment
The implementers recruit dedicated farmers interested in improving their farming through the use of new technologies.
4: Distribution
Farmers are trained in the tricot approach and on how to collect data. Each farmer receives a trial package of three technologies to be tested.
5: Execution
Farmers use their trial packages to apply the new technology options separately, on small plots next to each other, in a mini-trial on their own farm. To avoid any bias, they are not aware of the names of the crop varieties or other technology options they are testing. These are revealed to them only after the data have been collected.
6: Observation
Every farmer is responsible for their own trial and makes various easy observations about their three options over the course of the season. For example: Which variety had the highest or the lowest yield?
7: Compilation
The local designated field agents collect and compile the observation data from the tricot farmers, either in person or by phone. They record the information digitally and send it to the implementing organization.
8: Analysis
The implementers compile and analyse the data from the trials to identify which technology options showed the best performance and under which conditions
9: Feedback
The implementers provide feedback to every participating farmer: the names of their three technology options, which options were most suited to their farm (out of the three options tried by them and out of all the options tried by farmers throughout the project), and where to obtain them.
10: Evaluation
Tricot is an iterative process: after every project cycle, researchers, implementers and farmers collaboratively evaluate how the process may be improved in the next cycle.

Outputs/outcome of the tool:
As a result, the research process farmers have been trianed and experience the advantages/disadvantages of a specific technology; researchers have collected data from different sites and can evaluate agronomic innovations.

Participants: Researchers and farmers




Flow of the application of the tricot approach

Source: https://climmob.net/blog/wiki/about-tricot/#case-study-honduras

# *Tool 43. Development and validation of models*

*Source*: Biodiversa stakeholder engagement guideline
*Link*: https://www.biodiversa.org/714/download
*TDR Phase*: Problem analysis (II), Impact assessment (III)
*Knowledge integration expected*: working with collaboration formats, reflection, research process
*Project management cycle phase*: 2, 3

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**Purpose**: Researchers and stakeholders work closely to develop research outputs together.
**Procedure**:
There are several methods to work together in modelling:

a) **Qualitative**: development of conceptual models that describe stakeholder perceptions of the systems or issues being studied. Ther perceptions are usually taken from interviews, participatory mapping or diagrams developed individually or in groups and incorporated in further studies (example: assessing indicators).
b) **Semiquantitative**: development of conceptual models with stakeholders and then trying to quantify relationships (Dynamic Systems Models, Fuzzy Cognitive Mapping, Social Network Analysis, Net-mapping, Qualitative Comparative Analysis, Q-Methodology)
c) **Quantitative**: To create quantitative models that require specific inputs, rules or estimations to generate quantitative models, for example, adjusting decision rules in agent-based models, adjusting unknown variables in Bayesian belief networks or determining attribute thresholds of choice cards in discrete choice experiments.

**Outputs/outcome of the tool:**
**The purpose is to provide support for the main assumptions to be incorporated into the outputs of a study. The type of contribution of the stakeholders is determined by the type of methodology used, and its implementation depends on the objective and research question.**

Some Examples of modelling with stakeholders:

Dynamic Systems Models: https://doi.org/10.3389/fenvs.2015.00066

Fuzzy Cognitive Mapping: https://doi.org/10.3389/fenrg.2018.00112

Social Network Analysis: https://doi.org/10.1371/journal.pone.0169634

Net Mapping: https://www.ifpri.org/publication/net-map

Qualitative Comparative Analysis: 10.1016/j.jenvman.2015.03.053

Q-Methodology: https://doi.org/10.1007/s10460-021-10242-w

Agent Based Modelling: https://doi.org/10.1007/s10980-017-0502-2

Bayesian Belief Netowrks: https://doi.org/10.1016/j.scitotenv.2021.152146

Discrete Choice Experiments: https://doi.org/10.1007/s10640-015-9920-2

**Participants:** Stakeholders, Researchers

# *Tool 44. Most significant change*

*Source*: td-net toolbox
*Link*: https://zenodo.org/record/3717069#.Y3x2un2ZOUl;
https://www.betterevaluation.org/en/plan/approach/most_significant_change;
https://www.betterevaluation.org/resources/guides/most_significant_change;
https://www.mande.co.uk/wp-content/uploads/2005/MSCGuide.pdf
W
*TDR Phase*: Impact assessment (III)
*Knowledge integration expected*: working with collaboration formats, reflection
*Project management cycle phase*: 2, 3

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**Purpose**

The **Most Significant Change** is a qualitative tool to participatory identify and assess the main outcomes from an intervention from different participants' points of view. The method is particularly well suited for monitoring or evaluating complex interventions, programmes or projects that intend to produce change.

**Procedure**:

1) A facilitator leads the discussion; 3-5 relevant domains of change can be determined for the process under investigation (e.g., changes in the quality of life of those affected by the intervention programme). The reporting period is defined.
2) The actors (researchers, practitioners: those most directly involved) individually provide short stories describing the most significant change that took place for participants out of their personal perspective and giving reasons why this is most significant to them (1-2 pages in length, depending on the complexity of the programme and topic or using a flipchart). The actors allocate their story to the domains of change determined in step 1.
3) Once changes have been captured, people sit down together, read the stories aloud and discuss the value of the reported changes (analysis) to select the most significant change per domain.
4) Depending on the group size and complexity of organizational or hierarchical levels, this can involve several rounds of filtering. Story selection criteria should be recorded, and feedback should be provided between rounds (videos are sometimes used).
5) The results are discussed with respect to expectations, the lessons learned are collected, and the stories are documented.

**Outputs/outcome of the tool:**

The outcome is a collection of the most significant changes of a process that a group of people went through together, showing similarities and differences of the group with respect to how the process was perceived. It can be very helpful in explaining HOW change comes about (processes and causal mechanisms) and WHEN (in what situations and contexts). It can therefore be useful to support the development of programme theory (theory of change, logic models). It provides some information about impact and unintended impact but is primarily about clarifying the values held by different stakeholders. By itself, it is not sufficient for impact evaluation, as it does not provide information about the usual experience but about the extremes.

Example: https://www.youtube.com/watch?v=pShTqFF-beU&list=PLUtvIa4Yp5ykpS_UR0xbAjj0XQRiTonUm&index=1

**Participants:** Project participants

# *Tool 45. Identifying lessons learned*

*Source*: *Reflection Methods. Tools to make learning more meaningful. Practical Guide for Trainers and Facilitators*
*Link*: *www.mspguide.org/tool/reflection*
*https://web.archive.org/web/20160308173732/https://mande.co.uk/blog/wp-content/uploads/2009/08/what-is-a-lesson-learnt.doc*
*http://www.ilo.org/wcmsp5/groups/public/---ed_mas/---eval/documents/publication/wcms_180328.pdf*
*https://www.conservationgateway.org/ConservationPlanning/partnering/cpc/Documents/Capturing_Lessons_Learned_Final.pdf v*
*TDR Phase*: Impact assessment (III)
*Knowledge integration expected*: working with collaboration formats, reflection
*Project management cycle phase*: 3

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Purpose: Promote the reflection and reflection skills of project participants. The lessons learned session is a very important opportunity for learning and deriving lessons for future projects.

Procedure:

1) Identify comments and recommendations that could be valuable for future projects. Depending on how much theory you want to add, you can refer to the experiential learning cycle of Kolb or explain that learning takes place in three domains: knowledge, skills and attitudes. Then, participants are asked to think individually and in silence of the most important lesson learned (they choose one) and write it down on a card.

   A potential guide of questions can be derived from the Kolbs reflection model:
   - **What?** What were the most important things we did? What happened, what did you observe, hear, etc.? (recapping).
   - **Why?** What surprised or impressed you most, and why? What questions or challenges did you see? What did you agree/disagree with and why? (zooming in/analysing).
   - **So what?** What did you learn or come to realize? What conclusion can you draw or what generalizations can you make? (zooming out, conceptualizing).
   - **Now what?** What does this mean if you were to apply this in practice? What could the implications of this learning be for your work and your organization? Which lessons or ideas can you apply? Which questions do you still have, and what actions will you take to explore them? (planning, experimenting)

2) The learned lessons can be discussed in plenaries or the participants mingle and pair up into pairs. The pairs exchange their lessons learned and are followed by a brief discussion in plenary about the lessons learned.

3) Doument the lessons learned. Maurer (2012) suggests including the four following points as criteria for quality lessons learned:
   - **Rationale**: Gives the prospective user a justification by stating how this lesson was learned. The focus is on three aspects: What happened? Why did it happen? Why is it important?
   - **Preconditions**: They refer to the specified conditions in which the application of a lesson learned could be considered appropriate.
   - **Lesson suggestion**: It refers specifically to what has been learned through the experience and therefore is appropriate to be repeated or avoided in future contexts.

- **Applicable task**: This describes the task to which a lesson learned could be applied. Depending on the context, a lesson learned may be applied to an activity, a decision or an organizational process.

**Outputs/outcome of the tool**: A list and descriptions of lessons learned and an increase in the reflection skills of the participants of the project.

**Participants**: Project participants

# *Tool 46. Multicriteria Analysis*

*Source*: Biodiversa
*Link*: https://www.biodiversa.org/720/download
*TDR Phase*: Impact assessment (III)
*Knowledge integration expected*: working with collaboration formats, reflection, validation
*Project management cycle phase*: 3

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Purpose: Multicriteria analysis or multicriteria decision modelling is an approach for exploring issues and making decisions that involve multiple dimensions or criteria, such economic, social and environmental criteria, including competing priorities, to be systematically evaluated.

Procedure:
The process depends on the objective of the research. Broadly, the process involves context or problem definition, representation of evaluation criteria and management options, and evaluation. Potential steps to develop participatory multicriteria include the following:

1. Establish context and identify participants: This ensures the early identification of key issues; socioenvironmental dynamics and identification of stakeholders for involvement in the multicriteria decision-making process made with a combination of methods such as interviews, focus groups, workshops and document analysis can indicate perceived differences and views on the issues of interest and help structure stakeholder involvement.
2. Define criteria: Criteria are defined that capture stakeholders' interests via facilitated discussion and literature (e.g., research outputs, policy documentation).
3. Rank or weight criteria: To reflect differing values and priorities, criteria are ranked to indicate their importance relative to the objective of the process – this may be done individually or by agreeing ranks within groups.
4. Define management options: Alternative management options are defined and compared with potential future scenarios.
5. Score management options against criteria: The performance of each management option is scored against each criterion. This may be completed by all stakeholders (individually), a subset of participants or by researchers. This may involve the use of empirical data, expert opinion, scenarios and modelling.
6. Multicriteria evaluation: Normally, algorithms are used to calculate weighted values based on combined scores and ranks that describe the overall preference towards each option. The results can be presented for individuals or aggregated for different groups. Statistical analyses can be applied to test whether differences exist between individuals or groups.
7. Discuss options based on MCDA results: MCDA is a decision-support tool, so outcomes may be deliberated with participants or amongst decision-makers to assess the degree of consensus, negotiate compromise and manage trade-offs.

Examples of participatory developed processes:

- LIU, S., PROCTOR, W. and COOK, D. 2010. Using an integrated fuzzy set and deliberative multicriteria evaluation approach to facilitate decision-making in invasive species management. Ecological Economics, 69, 2374–2382

- https://www.surefarmproject.eu/wordpress/wp-content/uploads/2019/06/D5.2-FoPIA-SURE-Farm-Guidelines.pdf

- Participatory Impact Assessment of Soil and Water Conservation Scenarios in Oum Zessar Watershed, Tunisia. DOI 10.1007/s00267-012-9865-y

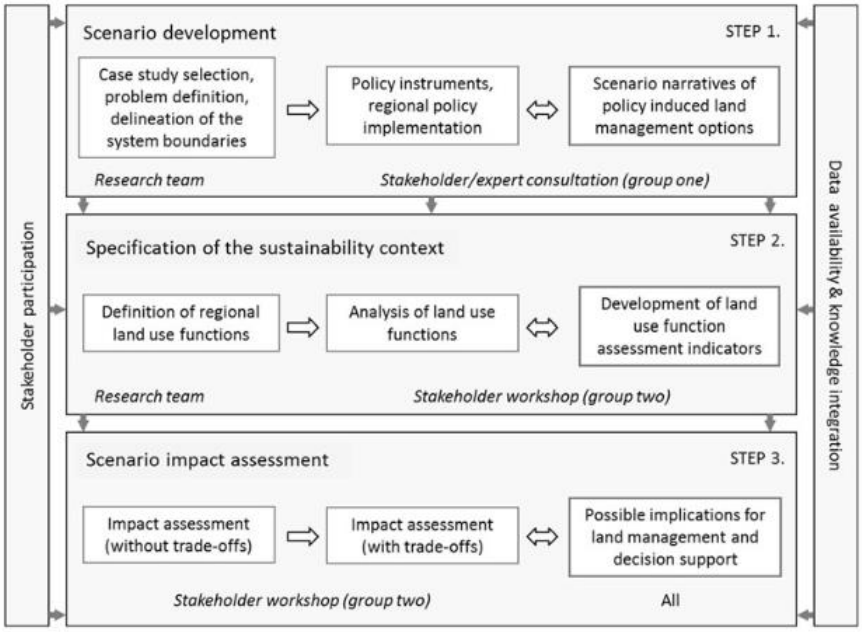


**Fig. 1** The implementation structure of the Framework for Participatory Impact Assessment (FoPIA) to the case study of Oum Zessar watershed, Tunisia

**Source:** König et al 2012

**Outputs/outcome of the tool:**
Integrated multicriteria evaluation assessment

**Participants:** Stakeholders