

# Development of a Questionnaire for the Screening of Communication Processes in Transdisciplinary Research Alliances

Wiebke Behrens, Claudia Joos, Anja Richert, and Sabina Jeschke

**Abstract**—Transdisciplinarity is a research strategy that is increasingly employed in a multitude of fields. Communication between the actors is of importance when it comes to ensuring successful collaboration. In order to assess communication processes in a transdisciplinary research alliance, a process screening questionnaire has been developed that can be easily evaluated and thus allows timely feedback to the actors. The process screening questionnaire has been utilized repeatedly on a specific research alliance. This article describes the scientific basis for the development of the process screening questionnaire, exemplifies its application, gives a summary of the results of this specific use, and summarizes benefits and future measures of improvement.

**Index Terms**—Transdisciplinarity, evaluation, communication, feedback.

## I. INTRODUCTION

For centuries, the traditional scientific approach has clearly distinguished between scientific knowledge and practical knowledge [1]. Even though interdisciplinarity – which “seeks coherence between the knowledges produced by different disciplines” [1] has become a widely accepted research concept, interdisciplinarity had still been limited to the scientific world. However, over the course of the past four decades, a paradigm shift has begun to occur. Since the 1970s, transdisciplinarity has been the subject of an “intensive scholarly debate” [2].

It was first considered a theoretical principle that allowed collaboration across disciplines aimed at a common purpose and was based on a set of generalized axioms as connecting principle between the disciplines [3]. However, during the last decade, the perception of transdisciplinarity has undergone a radical change. From a scientific theory it has developed into a practical research approach that has come to be known as the “Zurich approach” [2] after the venue of a ground-breaking conference in which transdisciplinarity steered into a new direction. Transdisciplinarity is nowadays considered a “reflexive, integrative, method-driven scientific principle” that aims at providing solutions to “societal problems and concurrently of related scientific problems by differentiating and integrating knowledge” [4]. In other words,

“transdisciplinarity cannot be an end in itself. It is meant to achieve particular aims” [5] and these aims are found in the establishment of practical answers to non-scientific problems [6]. Transdisciplinary research increasingly follows a holistic approach [7] while looking for solutions to problems that arise from the fusion of scientific and societal knowledge interests [6], [8]. While the working process focuses on a problem solving approach if considered by practice partners, the scientific perspective places more emphasis on knowledge generation [9]. The ideal transdisciplinary research identifies structures and analyzes problem areas in which the source of the problem and its further development are unknown [10]. Furthermore, the ideal setting consists of scientists from various disciplines as well as experts from the non-scientific world. According to Jahn [11], [12], there are three initial starting points of transdisciplinary research. The first approach is based on a practical problem and creates results that influence social discourse. The second approach is based on knowledge generation and follows a more scientific interest, with the purpose of gaining new insights and developing new models and theories. These results are mainly intended to influence the scientific discussion. Thirdly, Jahn [11] points out an integrated approach which is based on a common research topic and generates compatible knowledge that can be integrated into both target contexts.

These approaches point at the difficulties research partners of transdisciplinary research alliances face when tackling problems of both scientific and non-scientific demands. This paper will first point out the importance of communication for transdisciplinary research alliances. It will then describe the development of a screening questionnaire based on previous work on communication processes in transdisciplinary research alliances. Furthermore, the first application of the screening questionnaire in a research context will be described, the results will be discussed and further research needs will be indicated.

## II. COMMUNICATION IN TRANSDISCIPLINARY RESEARCH ALLIANCES

Researchers that are involved in a transdisciplinary research team typically view a problem, its causes, consequences and solutions through the lens of their own discipline [10]. Their approaches towards non-scientific problems have been shaped by different styles of thinking. According to Leisten [8], both scientific as well as entrepreneurial interests influence the transdisciplinary research project and the collaborative knowledge generation. Leisten [8] states that

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knowledge transfer from one project partner to the other is only possible if a common context has been created which allows a shared understanding across system boundaries like research versus corporate practice. Misconceptions in the communication process can lead to cooperation failures or underachievement because partners talk at cross purposes. The assessment and evaluation of transdisciplinary research usually takes place ex-post and focuses on the achievement of certain goals or the creation of solutions to common problems. Evaluation is crucial due to “the complexity and high risk of transdisciplinary research” [13]. Krott [13] also mentions three basic approaches to the assessment and evaluation of transdisciplinary research: evaluation of the project’s research activities by the scientific community, scientific meta-evaluation focussing on performance, and lastly, political evaluation based on the impact of the research on non-scientific stakeholders. Additionally, the evaluation of research is increasingly being demanded by society [14]. They also notice a changing trend which requests the scientific community to give account of the expenses that have been “invested” into research by the larger society. According to Smrekar *et al.* [14], final evaluations also act as an incentive to align the research focus according to the evaluation criteria.

There are some possible methods to assess and evaluate the end results of transdisciplinary research projects that refer to measurable objectives and indicators [15], [16], but it is almost impossible find the underlying structures that lead to a certain measurable outcome, especially with regard to the communication patterns that shape a research alliance and can steer a project onto a successful path at best. Bergmann *et al.* [17] do provide some evaluation criteria for communication processes in their “Guide for the Formative Evaluation of Research Projects”. However, these guidelines have been established for ex-post evaluation procedures rather than for continuous assessment and evaluation during the research process. This means that to our knowledge, there are no methods or tools for the assessment and evaluation of communication processes available that can be applied while the research is still in progress.

*A. Questionnaire Development Based on Guiding Principles for the Evaluation of Communication Processes*

Our process screening questionnaire is aimed at assessing the perception of the communication process of different project partners especially with regard to the collective understanding of research and work processes in a transdisciplinary context. It has been developed in order to enable this communication of communication processes.

The communication process becomes ascertainable through the establishment of operative guiding principles [18] that allow the identification of elements which “describe a communication process in its entirety, but at the same time point out the specific structures and special features of the process design in a social context” [8]. Luhman [19] defines operative guiding principles as “differences that control the information processing options of a theory”. According to Michulitz [18], these guiding principles need to be able to “demonstrate [...] the differentiation of content as well as the modifiability of a communication process” in order to be

applicable to the evaluation of communication.

The process screening questionnaire has been developed on the basis of the following guiding principles presented in Table I that have been proposed by Michulitz [18] and adapted by Leisten [8]:

TABLE I: OPERATIVE GUIDING PRINCIPLES OF COMMUNICATION PROCESSES IN TRANSDISCIPLINARY RESEARCH PROJECTS [8], [18]

Operative guiding principles of the communication process within a transdisciplinary research project	Central questions regarding the operative guiding principles
P1 Individuals	Who communicates with whom?
P2 Topics	What are the reason for and the subject of the communication?
P3 Routes	How does communication develop?
P4 Location	Where does communication occur?
P5 Time	When does communication occur?
P6 Tools	Which tools are there to support communication?

The first guiding principle “Individuals” evaluates the influence that actors from different backgrounds exert on the communication process. Principle two (“Topics”) investigates the starting point of the communication process and through this establishes the main reason of existence for the research alliance [20]. “Routes” comprises the processes and structures of communication in organizations, and “Location” takes a deeper look at the spatial organization of a communicating research project. The guiding principle “Time” signifies the importance of temporal procedures for the communication process, and “Tools” evaluates those elements that aid its support and development.

The process screening questionnaire contains questions that put the guiding principles in concrete terms and can be administered while the research is still in progress.

*B. First Application of the Process Screening Questionnaire*

The process screening tool has been tested on a complex, hierarchically organized transdisciplinary research alliance with more than 80 subsidiary projects, called “Innovative Capability in Demographic Change”.

With the aim of promoting Germany on its way to becoming Europe’s leading innovator, the German federal government passed a so-called high tech strategy plan of action in 2006. It uses an integrative approach in order to unite the work of different ministries and departments [21], [22]. Within this political space, the Research and Development Program “Working - Learning - Developing Skills. Potential for Innovation in a Modern Working Environment (German abbreviation: A-L-K)” has been established in 2007. It promotes research into personnel and organizational development as well as skill acquisition and

supports the establishment of innovation-friendly frameworks for the coherent cooperation between science, economy and politics. The demographic change and the challenges and chances it brings caused the German Federal Ministry of Education and Research (German abbreviation: BMBF) to establish the funding priority “Innovative Capability in Demographic Change” within the above mentioned Research and Development Program. It explores how Germany’s innovation capacity may be increased through the systematic identification and utilization of innovative potential and “contributes considerably to Germany’s future competitive ability” [23].

The funding priority is arranged in four hierarchical levels of recursion in order to bring together relevant actors and institutions from research and practice, which allows for a scientific exchange on a deeper level. The hierarchical structure of the funding priority is presented in Fig. 1. More than 80 subsidiary projects are clustered into 27 collaborative research projects which each represent a certain research approach. Focus groups again cluster the collaborative research projects according to thematic similarities. Focus groups in this setting are defined as a measure to enable an exchange of knowledge and experiences between the smaller projects and to release synergetic effects through the transfer of research results [24].

The funding priority is able to flexibly adjust to emerging research needs and environmental changes through its creation as a (self-)learning program. This setup contains the creation of a meta-project, which takes up a unique position beyond the thematic aim of the funding priority. It not only supports the individual actors within the different layers, but vertically connects the projects across the hierarchical levels. The meta project provides support to the focus group speakers in the design of communication and cooperation processes [24]. Within its scope, the process screening questionnaire has been developed as a means of evaluating the status quo of the project’s communication process so that immediate measures for the improvement of the transdisciplinary collaboration might be taken, should the need become evident.

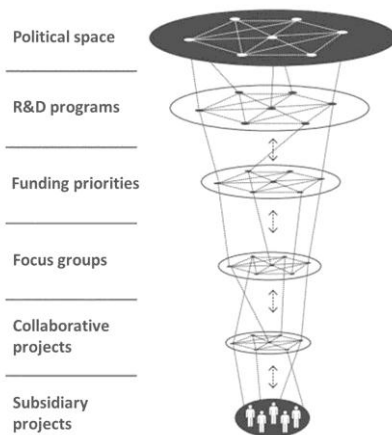


Fig. 1. The hierarchical structure of the Research and Development Program “Working - Learning - Developing Skills. Potential for Innovation in a Modern Working Environment”.

### III. METHOD

The aim of the process screening questionnaire is the

continuous and systematic assessment of communication and cooperation structures between the different actors of research alliances. The process screening questionnaire has been developed in order to support the reflection of complex and dynamic research and development activities, as well as the synchronization of the transdisciplinary research partners towards their common goal. It has been developed in such a way that recommendations for action can easily be derived from the results of the screening. It evaluates the perception of the communication process on two different levels, namely the focus groups and the funding priority.

It has been applied on the research alliance “Innovative Capability in Demographic Change”. In close collaboration, representatives of the funding priority, the project sponsor as well as members of the meta project expanded and adapted the guiding principles as proposed by Michulitz [18] and Leisten [8] to fit the specific characteristics of the interdisciplinary research alliance “Innovative Capability in Demographic Change”.

The process screening questionnaire is semi-standardized and contains 47 questions that had to be rated on a four-point Likert scale. Example questions include “How is information passed on within your focus group/the funding priority” (guiding principle 3, “Routes”) and “How often do personal meetings take place within your focus group?” (Guiding principle 5, “Times”).

From September to November 2013 and again from July until December 2014, speakers of the collaborative projects, focus group representatives and agents of the project sponsor were invited to participate in an online survey.

In 2013, 45 people were invited for participation, of which 28 completed the questionnaire (62,2%). In the following year, 33 of 56 invited participants completed the survey (58,9%). The participants were not necessarily the same in 2014 as in 2013 since invitations were issued according to the individuals’ positions within the funding priority network rather than on personal involvement.

### IV. RESULTS

The participants answered on a four point Likert scale ranging from 1 (very good or very applicable) to 4 (bad or not applicable at all). Lower numbers equal a better rating.

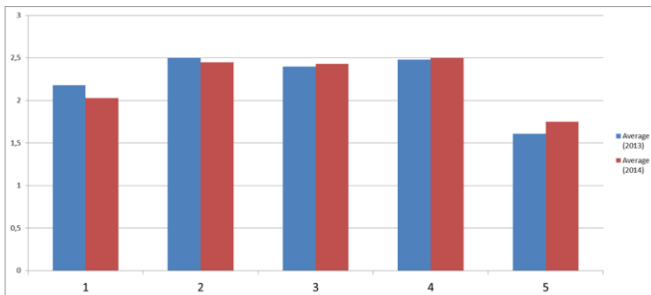
Table II exemplarily shows the results of the guiding principle-category “Tools”. The average rating per year is calculated for each question. Fig. 2 allows graphical comparison of the results. The questions typically refer to two levels of the hierarchical structure (the focus groups and the funding priority), which makes it possible to evaluate differences in communication processes across the levels. All questions are listed in the appendix.

The analysis of the results for the first guiding principle “Individuals”, which evaluates the questions of who communicates with whom, shows that most of the participants assess the communication process within the focus group as better than the processes on the funding priority level. The same is true for the second guiding principle. It analyses the satisfaction of the participants with the cooperation within focus group and funding priority especially with regard to

publications and fostering and inhibiting factors for transdisciplinary research. The participants were more satisfied with the work of the focus groups on all aspects and at both times they were interviewed. Guiding principle 3 “Routes”) contains questions regarding processes and structures of communication within focus groups and funding priority. The pattern continues – participants were more satisfied with the transparency of decision making processes and the feedback of results from collaborative and subsidiary projects within their focus group than on the level of the funding priority. The results for this guiding principle also showed that a discussion about possible deficits and their correction was more likely to take place within a focus group.

TABLE II: ANSWERS TO THE OPERATIVE GUIDING PRINCIPLE “TOOLS”. LOWER NUMBERS EQUAL BETTER RATINGS

	Average (2013)	Average (2014)
How would you assess the incentive for active involvement within the focus group?	2,18	2,03
How would you assess the incentive for active involvement within the funding priority?	2,5	2,45
Would you say that the communication within the focus group resulted in new project ideas with cooperation partners of the funding priority?	2,4	2,43
Would you say that the communication within the funding priority resulted in new project ideas with cooperation partners of the funding priority?	2,48	2,5
How satisfied are you with the virtual platform demoscreen.de?	1,61	1,75



- 1) How would you assess the incentive for active involvement within the focus group?
- 2) How would you assess the incentive for active involvement within the funding priority?
- 3) Would you say that the communication within the focus group resulted in new project ideas with cooperation partners of the funding priority?
- 4) Would you say that the communication within the funding priority resulted in new project ideas with cooperation partners of the funding priority?
- 5) How satisfied are you with the virtual platform demoscreen.de?

Fig. 2. Answers to the operative guiding principle “Tools”. Lower numbers equal better ratings.

Guiding principle 4 (“Location”) inquired about the quality of public relations especially with regard to online presence, print media and presence at exhibitions. “Location” is the only category in which the work of the funding priority continuously received better feedback than the focus groups. The following set of questions (“Time”) asked participants to indicate how often members of the focus groups and the funding priority met face-to-face. For the focus groups, meetings took place mostly on a monthly basis, while the representatives of the funding priority mostly came together every six months. For the final category (“Tools”), participant were asked to assess the incentive for active involvement within the focus group and funding priority as well as the

range of new project ideas that followed from communicating with partners of the funding priority. Again, the average ratings were better for the focus groups on all questions.

## V. DISCUSSION

The process screening questionnaire has been developed with the aim of screening and assessing the communication processes within a transdisciplinary research alliance. The results above exemplify the utilization of the questionnaire in the research alliance “Innovative Capability in Demographic Change”. The following discussion demonstrates the analysis of the results.

The participants’ answers about the communication processes within the research alliance “Innovative Capability in Demographic Change” generally indicated that on the level of the focus group, communication processes were more sufficient and effective than on the level of the funding priority. This may be true because representatives of the funding priority exclusively come from academic settings, which is why on this level, transdisciplinarity by definition cannot happen.

The results of the implementation of the process screening questionnaire on the research alliance “Innovative Capability in Demographic Change”, however, need to be considered with caution, since the number of participants is not sufficient for a proper statistical analysis.

For the further use of the process screening questionnaire within the context of this funding priority, the number of participants needs to be increased. It is also advised to evaluate the communication processes on more than the two top hierarchical levels. This is especially true for the research alliance “Innovative Capability in Demographic Change”, since here, the actual transdisciplinary work commonly takes place on lower levels in close collaboration of scientific institutions with partners from practice, while the representatives of the focus group and funding priority itself generally belong to a purely scientific circle.

## VI. CONCLUSION

Even though the discourse concerning transdisciplinary research has been intense during the past decades, no instrument had been devised which actually analyzed the communication processes in an active research alliance. The process screening questionnaire closes the gap and is able to provide direct feedback in order to enable immediate adjustments in the communication processes.

The process screening questionnaire provides a basis for comprehensive analyses of the different aspects of the communication processes that can either lead to a successful completion of a transdisciplinary research project or to improvable results that would be difficult to implement in a practical setting.

However, there is still demand for further research and adaption of the process screening questionnaire so that the process screening questionnaire can be utilized on other transdisciplinary research alliance that may even have a different structure.

In order to reach the participants of complex research alliances, those members primarily working on transdisciplinary levels actually need to be consulted, even if they may not be the primary decision-makers. Also, a higher number of participants need to be invited so that statistically valid conclusions can be drawn. In summary, the process screening questionnaire has been accepted very well by the participants and can increase the success of transdisciplinary communication through the direct feedback of results.

#### APPENDIX

##### Guiding principle 1 - Individuals

1. Are the results of the focus group/the funding priority communicated to others?
2. Are the target groups of the focus group/the funding priority being addressed?
3. Are the target groups of the focus group/the funding priority effectively being reached?

##### Guiding principle 2 - Topics

4. How satisfied are you with the cooperation within your focus group/the funding priority?
5. How would you assess the quality of the scientific publications within the focus group/the funding priority?
6. How would you assess the quality of the transdisciplinary publications within the focus group/the funding priority?
7. To what extent would you agree to the following statement: The initiation of inter- and transdisciplinary publications and products within the focus group/the funding priority is an aim worth striving for.
8. Which of the following factors do you personally consider as supporting factors for transdisciplinary cooperation? Multiple factors may be chosen.
  - a. Common goals
  - b. A common, structured approach
  - c. A common agenda
  - d. Communication
9. Which of the following factors do you personally consider inhibiting factors for transdisciplinary cooperation? Multiple factors may be chosen.
  - a. Increase in complexity
  - b. Knowledge and acceptance barriers
  - c. Globalization

##### Guiding principle 3- Routes

10. How is information passed on within the focus group / the funding priority?
11. How would you assess the transparency with regard to decision making within the focus group/the funding priority?
12. Are the results of the collaborative projects reported back quickly and transparently within the focus group/the funding priority?
13. How would you assess the communication procedures within the focus group/the funding priority with regard to a) promptness and b) effectiveness?
14. In your opinion, is there sufficient opportunity within the focus group/funding priority to talk about a) possible deficits, b) their correction, and c) intended measures of

improvement?

15. How would you assess the opportunities for the contribution of feedback within your focus group/the funding priority?
16. How would you assess the ratio between face-to-face and media-based communication within your focus group/the funding priority?

##### Guiding principle 4 - Location

17. Please rate the quality of public relations of your focus group/the funding priority with regard to a) online presence, b) print media, c) presence at exhibitions.

##### Guiding principle 5 - Time

18. How often do members of the focus group/funding priority meet in person?

##### Guiding principle 6 - Tools

19. How would you assess the incentive for active involvement within the focus group/funding priority?
20. Would you say that the communication within the focus group/funding priority resulted in new project ideas with cooperation partners of the funding priority?
21. How satisfied are you with the virtual platform demoscreen.de?

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