

Table 3. Transdisciplinary research quality assessment framework

Criteria	Definition	Rubric scale
Relevance: The importance, significance, and usefulness of the research problem, objectives, processes, and findings to the problem context		
Clearly defined socio-ecological context	The context is well defined and described and analyzed sufficiently to identify research entry points.	The context is well defined, described, and analyzed sufficiently to identify research entry points.
Socially relevant research problem ^a	Research problem is relevant to the problem context. ^b	The research problem is defined and framed in a way that clearly shows its relevance to the context and that demonstrates that consideration has been given to the practical application of research activities and outputs.
Engagement with problem context	Researchers demonstrate appropriate ^c breadth and depth of understanding of and sufficient interaction with the problem context.	The documentation demonstrates that the researcher/team has interacted appropriately and sufficiently with the problem context to understand it and to have potential to influence it (e.g. through site visits, meeting participation, discussion with stakeholders, document review) in planning and implementing the research.
Explicit theory of change	The research explicitly identifies its main intended outcomes and how they are intended/expected to be realized and to contribute to longer-term outcomes and/or impacts.	The research explicitly identifies its main intended outcomes and how they are intended/expected to be realized and to contribute to longer-term outcomes and/or impacts.
Relevant research objectives and design	The research objectives and design are relevant, timely, and appropriate to the problem context, including attention to stakeholder needs and values.	The documentation clearly demonstrates, through sufficient analysis of key factors, needs, and complexity within the context, that the research objectives and design are relevant and appropriate.
Appropriate project implementation	Research execution is suitable to the problem context and the socially relevant research objectives.	The documentation reflects effective project implementation that is appropriate to the context, with reflection and adaptation as needed.
Effective communication	Communication during and after the research process ^d is appropriate to the context and accessible to stakeholders, users, and other intended audiences	The communication indicates that the research project planned and achieved appropriate communications with all necessary actors during the research process.
Credibility: The research findings are robust and the sources of knowledge are dependable. This includes clear demonstration of the adequacy of the data and the methods used to procure the data including clearly presented and logical interpretation of findings		
Broad preparation	The research is based on a strong integrated theoretical and empirical foundation that is relevant to the context.	The documentation demonstrates critical understanding of an appropriate breadth and depth of literature and theory from across disciplines relevant to the context, and of the context itself
Clear research problem definition	The research problem is clearly defined, researchable, grounded in the academic literature, and relevant to the context.	The research problem is clearly stated and defined, researchable, and grounded in the academic literature and the problem context.
Objectives stated and met	Research objectives are clearly stated.	The research objectives are clearly stated, logically and appropriately related to the context and the research problem, and achieved, with any necessary adaptation explained.
Feasible research project	The research design and resources are appropriate and sufficient to meet the objectives as stated, and sufficiently resilient to adapt to unexpected opportunities and challenges throughout the research process.	The research design and resources are appropriate and sufficient to meet the objectives as stated, and sufficiently resilient to adapt to unexpected opportunities and challenges throughout the research process.
Adequate competencies	The skills and competencies of the researcher/team/collaboration (including academic and societal actors) are sufficient and in appropriate balance (without unnecessary complexity) to succeed.	The documentation recognizes the limitations and biases of individuals' knowledge and identifies the knowledge, skills, and expertise needed to carry out the research and provides evidence that they are represented in the research team in the appropriate measure to address the problem.

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Table 3. Continued

Criteria	Definition	Rubric scale
Research approach fits purpose	Disciplines, perspectives, epistemologies, approaches, and theories are combined appropriately to create an approach that is appropriate to the research problem and the objectives	The documentation explicitly states the rationale for the inclusion and integration of different epistemologies, disciplines, and methodologies, justifies the approach taken in reference to the context, and discusses the process of integration, including how paradoxes and conflicts were managed.
Appropriate methods	Methods are fit to purpose and well-suited to answering the research questions and achieving the objectives.	Methods are clearly described, and documentation demonstrates that the methods are fit to purpose, systematic yet adaptable, and transparent. Novel (unproven) methods or adaptations are justified and explained, including why they were used and how they maintain scientific rigor.
Clearly presented argument	The movement from analysis through interpretation to conclusions is transparently and logically described. Sufficient evidence is provided to clearly demonstrate the relationship between evidence and conclusions.	Results are clearly presented. Analyses and interpretations are adequately explained, with clearly described terminology and full exposition of the logic leading to conclusions, including exploration of possible alternate explanations.
Transferability/generalizability of research findings	Appropriate and rigorous methods ensure the study's findings are externally valid (generalizable). In some cases, findings may be too context specific to be generalizable in which case research would be judged on its ability to act as a model for future research.	Document clearly explains how the research findings are transferable to other contexts OR, in cases that are too context-specific to be generalizable, discusses aspects of the research process or findings that may be transferable to other contexts and/or used as learning cases.
Limitations stated	Researchers engage in ongoing individual and collective reflection in order to explicitly acknowledge and address limitations.	Limitations are clearly stated and adequately accounted for on an ongoing basis through the research project.
Ongoing monitoring and reflexivity ^e	Researchers engage in ongoing reflection and adaptation of the research process, making changes as new obstacles, opportunities, circumstances, and/or knowledge surface.	Processes of reflection, individually and as a research team, are clearly documented throughout the research process along with clear descriptions and justifications for any changes to the research process made as a result of reflection.
Legitimacy: The research process is perceived as fair and ethical. This encompasses the ethical and fair representation of all involved and the appropriate and genuine inclusion and consideration of diverse participants, values, interests, and perspectives		
Disclosure of perspective	Actual, perceived, and potential bias is clearly stated and accounted for. This includes aspects of: researchers' position, sources of support, financing, collaborations, partnerships, research mandate, assumptions, goals, and bounds placed on commissioned research.	The documentation identifies potential or actual bias, including aspects of researchers' positions, sources of support, financing, collaborations, partnerships, research mandate, assumptions, goals, and bounds placed on commissioned research.
Effective collaboration	Appropriate processes are in place to ensure effective collaboration (e.g. clear and explicit roles and responsibilities agreed upon, transparent and appropriate decision-making structures)	The documentation explicitly discusses the collaboration process, with adequate demonstration that the opportunities and process for collaboration are appropriate to the context and the actors involved (e.g. clear and explicit roles and responsibilities agreed upon, transparent and appropriate decision-making structures)
Genuine and explicit inclusion	Inclusion of diverse actors in the research process is clearly defined. Representation of actors' perspectives, values, and unique contexts is ensured through adequate planning, explicit agreements, communal reflection, and reflexivity.	The documentation explains the range of participants and perspectives/cultural backgrounds involved, clearly describes what steps were taken to ensure the respectful inclusion of diverse actors/views, and explains the roles and contributions of all participants in the research process.

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Table 3. Continued

Criteria	Definition	Rubric scale
Research is ethical	Research adheres to standards of ethical conduct.	The documentation describes the ethical review process followed and, considering the full range of stakeholders, explicitly identifies any ethical challenges and how they were resolved.
Effectiveness: The research generates knowledge and stimulates actions that address the problem and contribute to solutions and innovations		
Research builds social capacity	Change takes place in individuals, groups, and at the institutional level through shared learning. This can manifest as a change in knowledge, understanding, and/or perspective of participants in the research project.	There is evidence of ^b observed changes in knowledge, behavior, understanding, and/or perspectives of research participants and/or stakeholders as a result of the research process and/or findings.
Contribution to knowledge	Research contributes to knowledge and understanding in academic and social realms in a timely, relevant, and significant way.	There is evidence that knowledge created through the project is being/has been used by intended audiences and end-users.
Practical application	Research has a practical application. The findings, process, and/or products of research are used.	There is evidence that innovations developed through the research and/or the research process have been (or will be applied) in the real world.
Significant outcome	Research contributes to the solution of the targeted problem or provides unexpected solutions to other problems. This can include a variety of outcomes: building societal capacity, learning, use of research products, and/or changes in behaviors	There is evidence that the research has contributed to positive change in the problem context and/or innovations that have positive social or environmental impacts.

^aResearch problems are the particular topic, area of concern, question to be addressed, challenge, opportunity, or focus of the research activity. Research problems are related to the societal problem but take on a specific focus, or framing, within a societal problem.

^bProblem context refers to the social and environmental setting(s) that gives rise to the research problem, including aspects of: location; culture; scale in time and space; social, political, economic, and ecological/environmental conditions; resources and societal capacity available; uncertainty, complexity, and novelty associated with the societal problem; and the extent of agency that is held by stakeholders (Carew and Wickson 2010).

^cWords such as 'appropriate', 'suitable', and 'adequate' are used deliberately to allow for quality criteria to be flexible and specific enough to the needs of individual research projects (Oberg 2008).

^dResearch process refers to the series of decisions made and actions taken throughout the entire duration of the research project and encompassing all aspects of the research project.

^eReflexivity refers to an iterative process of formative, critical reflection on the important interactions and relationships between a research project's process, context, and product(s).

^fIn an *ex ante* evaluation, 'evidence of' would be replaced with 'potential for'.