

Dübendorf, 30 March 2022

Response to Report #1; Referee #2, and Editors

Dear Referee, dear Editors

Thank you very much for reviewing our manuscript: Please note the new title:

Judit Lienert, Jafet Andersson, Daniel Hofmann, Francisco Silva Pinto, Martijn Kuller, “The role of MCDA in a transdisciplinary process: Co-developing a flood forecasting system in West Africa”. hess-2021-506

<https://doi.org/10.5194/hess-2021-506>

This manuscript was written for the HESS Special Issue “**Contributions of transdisciplinary approaches to hydrology and water resources management**”

We are grateful for your time and effort to again review our paper. Thank you! We are also very pleased that you are generally satisfied with our revisions and find the paper acceptable. We are happy to do the suggested minor revisions.

We have addressed your comments one-by-one below. *The referees’ comments are given in Italics*, our response is given in normal font.

With best regards,

Judit Lienert

also on behalf of my co-authors, Jafet Andersson, Daniel Hofmann, Francisco Silva Pinto, and Martijn Kuller

Report #1, submitted on 10 Feb 2022

Anonymous referee #2

CO Editor https://editor.copernicus.org/index.php?_mdl=msover_md&_jrl=13&_l...

- 1) *The authors did a good job and incorporated several of the reviewer’s suggestions. I really appreciate the effort in reducing the text length. I also appreciate that the authors are transparent and systematic in their analysis. This increases the research reproducibility. Therefore, I recommend accepting the paper after a few minor revisions.*

Response: Thank you for the overall positive assessment of our work.

- 2) *I also think that this paper could be a potential HESS highlight paper. Overall, it provides an example of good practices for stakeholder participation. Very frequently, the term “participation” is written in several papers without having a real meaning or just to acquire a grant. But here, the authors are systematic and serious on how to do it, and how to evaluate it. I think the proposed framework could support scientists in the future.*

Response: We very much appreciate this positive feedback. Indeed, good practices for stakeholder participation are at the core of our research in general – and dear to our hearts! We would be very pleased if our paper were chosen as HESS highlight paper for this reason, as we also think it is important to provide examples of stakeholder participation to readers not so familiar with participatory approaches.

Here my minor comments:

- 3) *I am not an English native speaker. However, some sentences were still a bit awkward to me; hence, perhaps it would be good to do a copy editing if possible. I think it is even included in HESS.*

Response: Thank you. This comment is indeed very helpful. We would have engaged an external scientific editing service, not being aware that HESS provides this service.

Thanks to your remark, we contacted Meredith Gunnells, the coordinator of the copy-editing team. She confirmed that copy-editing is a standard service for HESS. The cost is even included in the article processing charges, and copy-editing will be applied once the manuscript is accepted for final publication.

Meredith Gunnells further wrote: *“If you would like to have copy-editing done before the final acceptance, then you would need to have a freelancer do it. However, I have taken a look at the manuscript, and our standard service should suffice.”*

We have decided to trust Meredith’s professional judgment and will not employ a freelancer for copy-editing this version of the paper. Therefore, if there are language problems, please bear with us and keep in mind that this should be resolved after acceptance.

- 4) *Line 12: I would rewrite, to “achieve the first aim”. And then later, “to achieve the second aim”*

Response: Done, we wrote “first aim” and “second aim”. The abstract was slightly reformulated to match the requests of referee #3.

- 5) *Line 12: this sentence is grammatically not correct, the “stakeholder analysis” seems loose here, “we used MCDA problem structuring and preference elicitation methods in workshops: stakeholder analysis, creating 10 objectives to be achieved by the FANFAR FEWS and 11 possible configurations”*

Response: We agree and rewrote as two sentences.

Page 1, line 11 – 13: “To achieve the first aim (i), we used MCDA methods for problem structuring and preference elicitation in workshops. Problem structuring included stakeholder analysis, creating 10 objectives to be achieved by the FANFAR FEWS, and designing 11 possible FEWS configurations.”

- 6) *Line 14: remove “in MCDA” here.*

Response: Done.

- 7) *Line 17: common characteristics of what? Please specify briefly with 2 words*

Response: We agree, and specified the characteristics. We also re-phrased this sentence to address the specific requests of referee #3 regarding the use of the framework:

Page 1, line 17 – 18: “To achieve the second aim (ii), we clustered common characteristics of collaborative governance frameworks from the sustainability science and transdisciplinary literature.”

- 8) *Line 19: following “our framework”.*

Response: Done. Again, we re-phrased this part to address the requests of referee # 3. This sentence now reads:

Page 1, line 18 – 19: “Our framework emphasizes issues crucial to the earth systems sciences such as uncertainty and integrating interdisciplinary knowledge.”

- 9) *Line 21: What are these steps? They were not introduced before. Before you mentioned there are 2 steps. I don’t think you need to detail it so much here. I would leave this “step” detail out as it will be mentioned later and just focus on the results.*

Response: We agree.

Page 1, lines 19 – 22: We deleted “in step 2”, “step 1”, “step 3”

- 10) *Line 22: I would rewrite here: “to use our framework” or “the proposed framework”. To make it more clear.*

Response: Done.

Page 1, line 24: We wrote: “(...) the proposed framework (...)”

11) *Figure 1: I really enjoy Figure 1 as it provides a very good overview of the procedure that was taken*

Response: Thank you.

12) *Figure 7: I suggest adding the questions to the figure itself. To do so, you just need to rotate the figure and put the question as the title.*

Response: Thank you for this good idea; we changed Fig. 7 and the caption accordingly.

13) *Table 1: In my opinion this table is too crowded here. However, I understand that all information is required. An idea would be to leave the main columns in Table 1 and have a supplementary table with all the info, but it would be hard to decide which columns stay and which go.*

Response: We agree that former Table 1 (now Table 2) with the description of the FANFAR FEWS configurations is very dense. We have two tables (not one) with more-detailed information in the Supplementary Information (Tables SI-6, and SI-7), which we reference in the main text. Thus, this table already contains much less information. As you rightly observed, it is difficult to decide, which information could additionally be excluded. We discussed this among the co-authors already in the last revisions and decided that for hydrologists actually working in FEWS development, Table 1 (now Table 2) provides relevant and interesting information, which they should be able to understand. We think that those readers who are not interested in such technical details can easily ignore the table. Since many readers of this paper in HESS are likely hydrologists, we would not feel comfortable in further reducing the content of this table and suggest leaving it as is.

Dübendorf, 30 March 2022

Response to Report #2; Referee #3, and Editors

Dear Referee, dear Editors

Thank you very much for reviewing our manuscript. Please note the new title:

Judit Lienert, Jafet Andersson, Daniel Hofmann, Francisco Silva Pinto, Martijn Kuller, “The role of MCDA in a transdisciplinary process: Co-developing a flood forecasting system in West Africa”. hess-2021-506

<https://doi.org/10.5194/hess-2021-506>

This manuscript was written for the HESS Special Issue “**Contributions of transdisciplinary approaches to hydrology and water resources management**”

We are grateful for your time and effort to review our paper. We especially appreciate that you were willing to accept this task after previous revisions, in which you were not involved. We also want to thank you for accepting the “current state” of the paper, without opening up new threads.

We have addressed your comments one-by-one below. *The referees’ comments are given in Italics*, our response is given in normal font.

We have done our best to adequately address all issues raised, and sincerely hope that the paper is now acceptable for publication in HESS.

With best regards,

Judit Lienert

also on behalf of my co-authors, Jafet Andersson, Daniel Hofmann, Francisco Silva Pinto, and Martijn Kuller

Report #2, submitted on 16 Mar 2022

Anonymous referee #3

CO Editor https://editor.copernicus.org/index.php?_mdl=msover_md&_jrl=13&_...

- 1) *I'm coming in as a new reviewer, not having been involved in any previous iterations. So I will re-emphasise issues flagged by previous reviewers without opening new threads.*

Response: Thank you so much for taking this perspective. It is probably not quite easy to take the current state of paper with its previous reviews and changes due to referees' suggestion as starting point. We really appreciate this.

- 2) *The main issues with this paper have been length and style (as flagged by previous reviewer 2) and this is till the case. Regarding length, I attach a version of the manuscript where I highlight unnecessary/redundant sentences that can easily go without compromising the substance of the paper (of course the surrounding text needs to be adapted as well). I also detail specific cuts and rearrangement below.*

Response: We agree that the paper is long. As explained to previous referees, the reason is that we tried to incorporate different perspectives, methods, and fields of research. These include:

- A review of literature from transdisciplinary research and sustainability science. This is needed as background information for the framework to evaluate and discuss the role of MCDA in a transdisciplinary process. We have now strongly shortened this part, following your suggestions in the annotated pdf.
- Presenting MCDA is needed for readers of HESS that are likely unfamiliar with an MCDA process. We would not do this in such detail in a Decision Analysis journal. This includes a short review of MCDA in flood management, motivating a typical MCDA process, MCDA method explanations, and a brief overview of main MCDA results. We kept this as short as sensibly possible, much additional information is given in the Supplementary Information.
- The discussion is long, because we combine these aspects. Especially section 5.2 “Evaluating participatory MCDA as a transdisciplinary process (RQB)” is long. Please note that we changed the title, and that here we address former RQC. More shortening would probably make many insights difficult to understand, and we think that the explanations are needed to “add meat” to Table 4; the table was much appreciated by referee #2 in the last revision round.

However, we are very willing to reduce the text where possible. We appreciate the concrete suggestions in the annotated pdf by referee #3 and have followed these and the other concrete suggestions (see points below). Where needed, we rephrased the text or introduced a new sentence to adapt the text to the cuts.

The paper now has 13'262 words on 30 pages (Abstract to Conclusions). In the last version there were 14'201 words on 32 pages.

Specific cuts, e.g:

Former page 2, lines 42 – 45: Section introducing FANFAR deleted as proposed in pdf.

Former page 2 – 3, lines 58 – 62: Section introducing participation and transdisciplinary / sustainability science literature deleted as proposed in pdf.

Former page 3, lines 66 – 72: Section with a general introduction of sustainability science and transdisciplinary literature deleted as proposed in pdf. One sentence added.

Former page 3, lines 74 – 83: Section with the details of transdisciplinary frameworks in three phases that stem from three papers reduced to one sentence (still citing the according papers).

Former page 3, lines 84 – 89 and page 4, lines 101 – 105: Section with details of two other transdisciplinary frameworks reduced to one sentence.

Former page 4, lines 93 and 98: Sentences shortened as proposed in pdf.

Former page 4, lines 107 – 108: Two sentences deleted that are no longer necessary.

Former page 4, lines 110 – 112: Two sentences deleted as proposed in pdf.

Former page 5, lines 149 – 150: Two sentences deleted that are no longer necessary.

Former pages 5 – 6, lines 154 – 167: Section concerning research gaps (in former Section 2.3 Aims, research gaps, and research questions) deleted as proposed in pdf. The title of this Section was changed to reflect the new content: “2.3 Aims and research questions” (**now page 6, line 124**).

Former page 6, lines 169 – 170, and 174: It is no longer necessary to repeat the two aims as there is only now only one research question for each of the two aims, and as the large text section in between has been deleted. The text at the beginning of Section 2.3 concerning the aims was slightly changed (**now page 6, lines 125 – 128**).

Former p. 6, lines 175 – 176: We deleted former RQB, as suggested in the pdf and in points 4 and 11, below.

Former page 13, line 366 – 371: We deleted the former Methods Section 3.2 Conceptual framework from transdisciplinary process (see points 4 and 10, below).

Former page 10, line 288: Sentences deleted as proposed in pdf.

Former pages 23 – 24, lines 520 – 528: We deleted large parts of the introduction to sect. 5 Discussion; as suggested in the annotated pdf.

3) *Regarding style, I understand from reading the previous reviewer comments and the authors' response that this has been an issue throughout. The style of writing is not very fluent and often lists procedures with no connecting statements. With all due respect, I strongly suggest that the authors employ a professional lector to turn the manuscript into a nicely readable paper. This is in the authors' best interest as it will increase citations.*

Response: Thank you. The other referee #2 made a similar comment and pointed out that HESS actually offers an editing service. We would have engaged an external scientific editing service, not being aware that HESS provides this service.

Thanks to the remark by referee #2, we contacted Meredith Gunnells, the coordinator of the copy-editing team. She confirmed that copy-editing is a standard service for HESS. The cost is even included in the article processing charges, and copy-editing will be applied once the manuscript is accepted for final publication.

Meredith Gunnels further wrote: *“If you would like to have copy-editing done before the final acceptance, then you would need to have a freelancer do it. However, I have taken a look at the manuscript, and our standard service should suffice.”*

We decided to trust Meredith’s professional judgment and will not employ a freelancer for copy-editing this version of the paper. Therefore, if there are language / style problems, please bear with us and keep in mind that this should be resolved after acceptance.

- 4) *One major rearrangement I recommend is to position the review of the trans-disciplinary literature and table 3 not as part of the methods and results, but as part of the introduction (or section 2) and the discussion (where it already features most strongly). I make specific comments to this effect below. Doing this will reduce complexity and length. Section 2 should then only cover what is really needed for the evaluation of the MCDA method as part of the larger transdisciplinary endeavour. I strongly advise the authors to take this seriously because section 2 is a half-baked review that opens a lot of threads without ever tying them up later, so can only ever work as one lens (of many) to reflect on this project and MCDA (which is a nice idea!) – hence it can be easily cut to the essentials! Research question B then needs to go in the process, which again reduced complexity.*

Response: We appreciate this feedback, despite the fact that it puts us in bit of a dilemma. As you know after an exchange with the editor, this suggestion is surprising, because it changes the paper structure back to an earlier version. In the version before the current one, the review of the transdisciplinary literature and insights from this review were kept together as a “package” in the Introduction, and later used in the Discussion section to reflect on the FANFAR project and MCDA (this part was kept the same in both versions). We introduced research question RQB to respond to a specific request of one referee. He/ she had suggested that we restructure the paper to a very classical intro/ literature review/ research questions/ methods/ results/ discussion section, and address both the MCDA and the transdisciplinary literature and framework in each of these sections. Obviously, this did not work well. We are willing to again restructure the paper as you now propose, and hope that the previous referee can live with this change. It seems rather difficult to give full justice to the many inputs we have received.

Specifically, we introduced following changes:

Page 1, lines 17 – 23: We slightly rephrased the abstract to adapt to the suggested changes, and to increase the understandability of the text. We included several suggested changes of referee #2 in the abstract (report #1 of this revision round).

Page 3 – 5, lines 85 – 86: We moved former Table 3 from the former Results Section 4.9 to the Literature review Section 2.1 (Sustainability science and transdisciplinary research frameworks), including the accompanying text (**page 3, lines 77 – 84**); see point 11 below.

Former page 13, lines 367 – 371: We deleted the former Methods Section 3.2 Conceptual framework from transdisciplinary process. As stated above, a short Introduction is now included in the literature review Section 2.1 (see point 10 below).

Former p. 6, lines 175 – 176: We also deleted former RQB, as suggested.

Page 6, lines 132 – 133: We re-formulated RQB (former RQC) to match the new perspective: **“RQB: How suitable is participatory MCDA as a transdisciplinary process in a large, international project? What worked well or less well in FANFAR? Is the proposed framework useful for this type of evaluation?”** (also see point 5, below).

Page 22, lines 460 – 463: Introductory text to sect. 5 Discussion was adapted to match the new set-up, which leaves only two research questions. We deleted large parts of this paragraph as suggested in the annotated pdf.

5) *Finally, I find the title misleading and vague. The MCDA doesn't “guide” here, and which “framework” doesn't become clear. Rather, from reading the manuscript, I see the MCDA as being embedded in a transdisciplinary process, which is described and reflected upon (to what extent it meets the characteristics of some transdisciplinary framework. Hence the authors should change the title to something like “the role of MCDA in a transdisciplinary process” or “MCDA as a transdisciplinary research tool”. The reference to “co-developing a flood forecasting system in West Africa” needs to stay of course. With the change in title, some sections need to be reframed accordingly.*

Response: Agreed. If we follow the line of reasoning in point 4), above, adapting the title as suggested is the logical consequence. We are happy to do so.

The revised title now is: “The role of MCDA in a transdisciplinary process: Co-developing a flood forecasting system in West Africa”.

We have adapted various parts to better match the perspective that we are evaluating the role of MCDA in a transdisciplinary process. Specifically, this concerns e.g.,

Page 1, abstract: slightly reworded in several places (see point 4, above).

Page 3, lines 77 – 84: We wrote at the end of Section 2.1 Sustainability science and transdisciplinary research frameworks: “We clustered shared characteristics from this literature in an own framework (Table 1). (...) We will use the proposed framework for evaluating and discussing the role of MCDA in a transdisciplinary process, specifically, how well the different elements are met by MCDA.”

Page 6, lines 125 – 128: Section 2.3 Aims and research questions was strongly shortened and re-written to match the new perspective (see point 4, above).

Page 6, lines 132 – 133: We re-formulated RQB (former RQC) to match the new perspective: “**RQB:** How suitable is participatory MCDA as a transdisciplinary process in a large, international project? What worked well or less well in FANFAR? Is the proposed framework useful for this type of evaluation?”

Page 6, line 135: We gave a new title to the first Methods section, which better matches the new structure of the paper: “3.1 Multi-Criteria Decision Analysis (MCDA) within a transdisciplinary process”, and adapted parts of the text (see point 8 below).

Page 22, lines 460 – 463: Introductory text to sect. 5 Discussion was adapted to match the new set-up, which leaves only two research questions.

Page 23, line 515: Title of sect. 5.2 in Discussion changed to: “Evaluating participatory MCDA as a transdisciplinary process (RQB)”. Section rephrased to match this.

Specific comments

6) *L39: Context missing: “lowest score” in relation to what?*

Response: Done. We it changed as follows:

Page 2, line 39 – 41: “Moreover, feedback from a stakeholder survey, interviews, and literature indicated that the perceived overall effectiveness of FEWS was very low in all but one West African country, receiving the lowest score 1 of 3 possible (Figure 5 in Lumbroso et al., 2016).”

- 7) *L122f: I would question that it is a feature of MCDA to help disentangle stakeholder values from facts. And the references used to support this optimism are quite dated now. Participatory projects are inherently political, and it needs much more than a tool like MCDA to separate facts from values.*

Response: We respect the different perspective, but from our point of view this statement is correct. In Decision Analysis, specifically MCDA it is unquestioned that a full MCDA process helps to distinguish the scientific evidence, the “hard facts”, from the stakeholders’ values or preferences. There is a lot of literature available, including standard MCDA textbooks that support this claim. We cited two high-profile researchers with accessible citations: Ralph Keeney with a paper directed at practitioners, and the excellent textbook on environmental management choices using structured decision-making by Robin Gregory et al. Both are still active in the field, and both have published a large number of papers over decades. We understand that these researchers are not so well known outside decision and risk analysis, but this is in the nature of interdisciplinary research. Please see their webpages: <https://ralphkeeney.com/> and <https://www.decisionresearch.org/researchers/robin-gregory>

We decided to add a newer paper by Reichert et al. (2015) on the conceptual foundation of environmental decision support, further backing this concept. The separation of “facts” and “values” is due to the stepwise MCDA process (steps 5, 6) and the elicitation of stakeholder preferences, e.g., the trade-offs they are willing to make regarding the achievement of objectives in step 5. We now refer to Fig. 1 to clarify this, as follows:

Page 5, lines 96 – 102: “(iv) To evaluate FEWS configurations, MCDA allows integrating different kinds of scientific and technical data from experts such as forecast accuracy or development costs in step 6 of the MCDA process (see Methods; Fig. 1). The stakeholder preferences are elicited separately in step 5: in complex decisions, not all objectives can be fully achieved and MCDA explicitly asks stakeholders which trade-offs they are willing to make. Preferences are combined with the prediction data in step 7. Especially in case of conflicting interests, it can be helpful to disentangle stakeholder values from facts (Gregory et al., 2012a; Keeney, 1982; Reichert et al., 2015).”

- 8) *L181-185: This doesn’t read well in this order. I would structure the description along table 3 (even if not all steps were followed) and at one point MCDA just comes in. Jumping back and forth between two process sequences is very confusing. See also comments about rearranged table 3 below.*

Response: Thank you for pointing this out, we agree. We included following changes:

Page 6, line 135: We gave a new title to this first Methods section, which better matches the new structure of the paper: “3.1 Multi-Criteria Decision Analysis (MCDA) within a transdisciplinary process”

Page 6 – 8, lines 136 – 161: We re-wrote parts of this first Methods paragraph to better match the transdisciplinary process in the new Table 1 (former Table 3). We now explicitly start with step 1 of the transdisciplinary process (Table 1), and as suggested, the MCDA is weaved into this where appropriate.

- 9) *L253f: Notes like these in brackets are very confusing for the reader when they are asked to go back and forth between different tables and figures. Please delete these if you can. And try to organise the text such that the necessary information come in bit by bit and one table/figure after the other.*

Response: In this case, we decided to delete the entire comment in brackets, which concerned the use of Italics for names of objectives, attributes, and FEWS configurations. The reference to a table and a figure where the names can be found does not come in the clean order. It seems that this causes more confusion than help.

However, we see the point, and removed remarks in brackets in various sentences to increase the understandability of the text. Specifically, e.g:

Page 2, lines 58 – 59

Page 3, lines 68 – 70, 82

Page 5, lines 96 – 98

Page 6, lines 129 – 131

Page 7, lines 146 – 147, 156 – 157

Pages 8 – 9 , lines 191 – 195

Page 9, lines 210 – 213, 220 – 224

Page 10, lines 232 – 243, 247 – 249

Page 11, lines 266 – 268

Page 22, lines 473, 475

Page 24, lines 521 – 522, 538 – 539

Page 27, lines 582 – 586

Page 28, lines 638 – 640

Page 29, lines 663 – 667

Page 30, lines 682 – 683

- 10) *L367-371: This can be left out. In effect you are analysing your process in terms of a transdisciplinary framework (which aspects are met, which aren't etc.). If you introduce this in section 1 or 2 then you can apply this lens in the discussion section (but not results; see next comment). Here it's out of place because it is a metaframework used to reflect on your methodology. RQB then needs to go (will also reduce complexity!).*

Response: Done. We deleted the former Methods Section 3.2 Conceptual framework from transdisciplinary process. A short Introduction is now included in the literature review Section 2.1 (see point 4 above).

Former p. 6, lines 175 – 176: We also deleted former RQB, as suggested.

- 11) *Section 4.9: Similar to the previous comment, it will reduce the complexity of the paper if this is presented in section 2 or section 1 along with the transdisciplinary framing. So not as a result as such. It's nice that you check your process later on against table 3 (table 4) but it works better as a discussion/reflection. The results are then purely about the MCDA. As saidy, RQB then needs to go.*

Response: Done. We moved **former Table 3** from the former Results Section 4.9 to the Literature review Section 2.1 (Sustainability science and transdisciplinary research frameworks). This includes the accompanying text (**now p. 3, lines 77 – 84**); see point 4 above.

Former p. 6, lines 175 – 176: We also deleted former RQB, as suggested.

12) L515: *A research question cannot be confirmed (at least this would be weak): please reword.*

Response: Done, we rephrased this sentence:

Page 22, lines 460 – 461: “Addressing RQA, it was possible to find robust FEWS configurations despite large uncertainty and different stakeholder preferences (sect. 5.1).”

13) L740f: *This is a weak conclusion (“hopefully”) and should be left out.*

Response: Done, we deleted this sentence.

14) L755ff: *This last paragraph is relatively weak as a conclusion, not all claims being substantiated in the paper. I strongly recommend a final statement more grounded in the actual analysis.*

Response: We changed the last paragraph as follows:

Page 30, lines 690 – 696: “This paper documents in detail the participatory MCDA process for co-developing a good FEWS for West Africa, together with many stakeholders in the FANFAR project. The MCDA can serve as blueprint for engaging in such transdisciplinary endeavors. Our MCDA emphasized the integration of stakeholders, of interdisciplinary expert knowledge, and of uncertainty, which is rarely done in flood risk research using MCDA. These aspects are certainly of high importance to other projects in the earth systems sciences. Moreover, we analyzed the strengths and limits of using MCDA in a large, international transdisciplinary project with help of a framework based on literature. This framework can generally support colleagues from the earth system sciences when engaging in complex transdisciplinary research with stakeholders and society.”

References

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- Lumbroso, D., Brown, E., & Ranger, N. (2016). Stakeholders’ perceptions of the overall effectiveness of early warning systems and risk assessments for weather-related hazards in Africa, the Caribbean and South Asia. *Natural Hazards*, 84(3), 2121-2144. <https://doi.org/10.1007/s11069-016-2537-0>
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