

Dear reviewer,

Thanks for your comment. We have now included our responses (plain) to the comments from referees (bolded) and the proposed changes in the manuscript (in italics and under quotation marks). The new text is now included in the marked-up manuscript version with track changes.

**The paper provides an interesting contribution to water resource planning theory through the realistic application of MAVT to a planning problem. Whilst the basic technique has been demonstrated in other water planning contexts, the paper makes a good contribution to the literature as it attempts to tease out how the tool can be used to realistically aid the planning process. In contrast, many MAVT studies do not move beyond the basic theory of application to demonstrate how the results can be used to assist in conflict mediation.**

**The paper is well structured and generally clear however some improvements could be made. Some sections which require improvement to presentation quality are discussed below however this is not a comprehensive listing.**

Thanks for these very positive comments and for the useful suggestions.

#### **Specific comments:**

**(1) The paper undertakes a sensitivity analysis to test the effect of uncertainty in attribute scores and stakeholder attribute valuation. This aspect of the paper requires some improvement. For example: \* There is insufficient detail on how the uncertainty analysis was conducted.**

The sensitivity analysis was applied to test the robustness of the results towards uncertainties in the inputs. The results of the MAVT depend on two principle input factors:

- The attribute levels of the alternatives (consequence matrix)
- The valuation of the attributes by the stakeholders

The uncertainty of attribute levels in the consequence is expressed by a possible variation of the forecasted attribute levels for every alternative. The sensitivity analysis was realized by varying the attributes separately in the possible fluctuation range and analysing the influence on the outcome of the alternatives. The fluctuations

arise from uncertainties of the underlying models of attributes, but also from expert rated uncertainty ranges in qualitatively evaluated attributes. Uncertainty in the attribute levels influences the results of all stakeholder groups. The attributes *high irrigated area, low implementation costs and maintenance and management costs*, were excluded from the sensitivity analysis (treated as fixed).

The uncertainty in the valuation of the attributes is given by different value functions and weights assigned by different representatives within one stakeholder group. The uncertainty of the preferences is analyzed by comparing the differences of the outcomes for each representative within one stakeholder group. The range of the rankings across the stakeholder group is represented through the uncertainty range. A similar valuation within a stakeholder group creates homogeneity and uncertainty becomes low. The sensitivity analysis for uncertainty in valuations was done for stakeholder groups with more than one representative.

The aspect of uncertainty has been improved and is now described in more detail.

**For example, how was uncertainty in attribute scores quantified? \* No results have been presented for the effect of uncertainty in the consequence matrix \* The conclusion that the ecologists stakeholder group had the greatest divergence in results has not been supported with presentation of results \* Figure 8 illustrates a box whisker with indication that the full range includes a zero score for all alternatives; is this correct or an error in presentation?**

Results have been added to the text (with figures). Figure 8 (now in fig. 10, with new Fig 9 to show also the results for the stakeholder group "Ecologists") is a bar plot with fluctuation range based on responses from different members of the stakeholder group. The representation of the figure has been changed to avoid misunderstandings.

**(2) The paper concludes that: "The acceptance of the method is quite high, because of its simplicity" This conclusion is presented with reference to another paper. It would have been useful if the study could have incorporated feedback from the stakeholders to verify that the method was accepted.**

The reference was taken from another study that tested if the method was understandable for the stakeholders. In this study at

the end of the interviews some questions for evaluation of the method and the interview were included.

In this study we also tried to elicit stakeholders' understanding of the method, their acceptance of the results, and whether they considered that the MAVT method a useful tool for conflict resolution. contributes to a better understanding of the complexity of the problem and of the different views for addressing them. We also tested if they consider the methodology a useful approach in conflict mediation and solution.

Results have been added to the text (see fig. 11).

*"The evaluation of the method by the stakeholder was tested through a follow-up survey (Fig. 11). Acceptance was found to be quite high, in part due to the simplicity of the method and its clear understanding by the stakeholders, what is in agreement with other authors findings (e.g. Marttunen et al., 2013). The involvement of stakeholders at the beginning of the planning process, especially in setting the objectives, is considered fundamental for gaining high acceptance. It is important to weigh the necessary complexity of the model with the comprehensibility. Stakeholders have to be chosen carefully in terms of their knowledge of the issue, and they should have a good overview of the problem. If not, the valuations will be made without basing them on facts. If the stakeholders understand the method, the acceptance of the results will be higher, as well as their contribution to conflict resolution. All the stakeholder also agree in the importance of the method for fostering the stakeholder cooperation, and the aptitude of the MAVT for conflict resolution has been also positively valued by most stakeholders (Fig. 11).*

**(3) The paper highlights the need to balance complex evaluation methods with the need to ensure that the method is suitable for the stakeholders. The paper explores the value of one method (MAVT), however it would be useful, if feasible, to compare two or more methods from the stakeholder perspective. This approach would seek to obtain feedback from stakeholders on the transparency and usefulness of the alternative methods. I recognise however that this is likely beyond the scope of the paper.**

This is a very interesting suggestion. Unfortunately in the context of this study it was not feasible to test other methods. But this could be an excellent issue for a continuation of the research.

## **SPECIFIC COMMENTS**

**1. “In addition to the elicitation of the value function and weights, stakeholders we requested some general qualifying hits, to capture the interviewee’s holistic preferences.” Is ‘qualifying hits’ a typo? Were the holistic preferences evaluated iteratively through interview questions or were the stakeholders asked to document their holistic ranking of all options?**

This has been now written. It referred to interview questions:

*“In addition to the elicitation of the value function and weights, some general questions about the aquifer management were asked. Through the interview questions the interviewee’s holistic preferences were evaluated”*

**2. “Other measures just showed efficiency if there were no additionally increase of the water use.” The meaning of this sentence is not clear to me.**

The impediment of a further increase of the water demand was fundamental for a high ranking of alternatives. This has been now written as:

*“The impediment of a further increase of the water demand by legal instruments was fundamental for a high ranking of alternatives. It can be reasoned, that any other measures will be declined, if there will be no restriction to water access. Such measures are a reduction of the irrigated agricultural area, the reduction of the water allotment in drought periods, restrictions for high water needing crops, the improvement of extraction controls and the improvement of the irrigation efficiency. Alternatives 1-9 do not include such measures to limit the water access and received consequently a low ranking. ”*

**3. “For instance, ecologists neglect a full implementation of groundwater substitution, which is preferred by agricultural representatives and some administrations, if there is no impediment of further extension of irrigation water use by water use re-striations.” Based on my interpretation of what is meant here I suggest the**

**following: For instance, the option of full implementation of groundwater substitution is assigned a low ranking by ecologists unless the option also includes water use restrictions to prevent an overall increase in irrigation.**

Thanks for this suggestion. The sentence has now rewritten as suggested:

*"The option of full implementation of groundwater substitution is assigned a low ranking by ecologists unless the option also includes water use restrictions to prevent an overall increase in irrigation."*

**4. "Static external variables (Scenario 1) give results more accurately, but maybe do not represent the future reality." I suggest that it would be more appropriate to use the term 'precisely' rather than 'accurately'.**

Thanks for this suggestion. The sentence has been rewritten as suggested:

*"Static external variables (scenario 1) provide more precise results, but they might not represent the future reality"*

**5. "Figure 7 shows changes in ranking for the three best evaluated scenarios 1." Please clarify how the three best options were chosen. The chosen options do not appear to be logical to me based on my interpretation of Figure 5. For example, why has 24a been chosen when 24b appears to be superior on the basis of Figure 5?**

This was an error in figure 7. It is definitely 24b. This is now corrected (now figure 8). The best overall alternatives were chosen in two steps. First, all dominated alternatives were eliminated. Secondly, the sum of the stakeholder rankings was calculated for every alternative. The lower the sum, the better the overall evaluation.

**6. "However, a further aggravation of the water problem would question the obtained results." The meaning of this sentence is not clear to me.**

This sentence has now been deleted, as it is not important and certainly confusing.

**7. “The big advantage of the MAVT method is the possibility to create a complex structure of measures and objectives. This allows a more detailed analysis of the alternatives, not reproducible by holistic rankings and consequently giving much better information.” Creating a complex structure does not sound like an advantage. I suggest the following type of change may be a more concise conclusion: In comparison to a holistic ranking of options, the MAVT method has the advantage of creating a more detailed evaluation framework which enables more informative analysis to be undertaken. This includes a more detailed analysis conflict potential and the ability to undertake uncertainty and sensitivity analysis.**

Thanks for this suggestion. The sentence has been rewritten as suggested:

*"In comparison with a holistic ranking of options, the MAVT method has the advantage of creating a more detailed evaluation framework, which enables more informative analysis. This includes a more detailed analysis of conflict potential and the ability to undertake uncertainty and sensitivity analysis."*