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Improving stakeholders participation in the water management process using fuzzy logic and semantic classes.

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Stakeholders participation in the water resource management and planning processes is a key aspect to get a really effective decision-making process. In the Multiple Attribute Value Theory (now on MAVT) approach, an evaluation criterion hierarchy, together with its associated set of indicators, has to be defined in order to select and evaluate efficient alternatives. Each alternative is evaluated against the whole set of indicators via simulation and the effect matrix is obtained. This matrix is then manipulated in the two subsequent steps in order to get informations on the real satisfaction associated to the effects and to let stakeholders state a global satisfaction for every alternative. The first of these steps consists in defining value functions through which the indicators values, as obtained via simulation, are converted into satisfaction values. In the second step, the satisfaction associated to each node in the hierarchy are aggregated level by level. A number of approach have been proposed in the literature for these two steps, however one of the most problematic requirements is the capability of stakeholders to identify the mathematical formulation of value functions for each level of hierarchy and to translate their preferences structure into numeric values, respecting the axioms of completeness, transitivity, consistency, independence. The methodology we propose in this work provides a step forward to a more effective and flexible way to manage the interaction with stakeholders by utilizing fuzzy logic. The values of indicators are associated to one or more semantic classes of satisfaction, whose membership ranges between 0 and 1. Afterwards, the obtained satisfactions are then aggregated recursively, following the hierarchy structure, trough a set of fuzzy expert systems, built with rules defined by the stakeholders, that fix the relations between semantic classes at the various levels. The satisfaction obtained at the end of this process is a fuzzy value, that can be used as it is or can be defuzzified in order to get a normal value, like in the traditional MAVT approach. The proposed methodology has been demonstrated on the Adda river water system, Italy. First results show that the introduction of the semantic classes and the associated membership function allow to simplify and facilitate the interaction with the stakeholders, managing also the uncertainty of their contribution.¬† Nevertheless, some technical challenges still remain to be explored with further reserch. First of all, the defuzzification process always implies a loss of information and could introduce different subjective items according to the applied technique used.¬† Moreover some other technical choices are taken by the analyst: adding these items to the interaction with stakeholders would definitely help in making more transparent the process, but also add much more complexity to the interaction process.