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A framework for developing simple adaptive indicator-based water treatment decision support systems

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Abstract: A number of indicator-based decision tools have been developed to help select optimal water or wastewater treatment technologies. Water treatment is an inherently dynamic process that is influenced by constantly changing external factors, such as: deteriorating source water quality, changing regulations, and uncertain economic situation. Thus, decision support systems developed to select among alternative water treatment technologies should be adaptive to such changes. However, many of the developed tools still follow the traditional route of assigning fixed values and weights for the used indicators. Moreover, existing attempts to make the decision logic more adaptive often comes at the expense of limiting the indicators used to those which could be quantitatively modelled or simulated. This paper proposes a framework to develop simple adaptive indicator-based water treatment decision support systems. The framework focuses on simple methods to incorporate complex and often dynamic relations in estimating indicator values and in indicator weighting and aggregation. The methods discussed include: value functions, rule-based adaptation, adaptive weighting, and drill-down capabilities into decision data. The added value of adaptive decision logic is demonstrated through application to a simple household water treatment selection problem. The demonstration shows an improvement in the decision logic, which in turn increases the usability of the decision support system and the scope of application. Moreover, the data input required to make the decision tool adaptive increases user interactivity and helps in identifying and reducing possible biases that are otherwise obscured in traditional decision support systems.

Keywords: adaptive; decision support systems; indicators; water treatment