Evaluation of a smart water system based on fit-for-purpose concept

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Abstract: The multi-faceted review and evaluation of the system is an important part for its smooth application and roll-out, equally so for smart water systems. As a key component in the building process of smart city, smart water systems greatly contribute to relieving the pressure of monitoring and maintaining water resource systems as well as improving allocation rationality. At present however, smart water systems are highly dynamic and uncertain, coupled with the information cocoon of end-user's awareness of an unfamiliar supporting tool. How to evaluate smart water systems more accurately has become a dilemma that lies on the road of its development and promotion.

In previous studies, the evaluation of smart water systems generally relies on a broad range of indicators, while neglecting the relations between overall and specific objectives which is necessary when evaluating system performance. In this study, we proposed to use the Fit-for-Purpose (F4P) concept for such an evaluation. This conceptual framework was first presented by Hamilton in the field of environmental flow models (Hamilton et al. 2022). Briefly, the F4P concept requires that a system in its optimum state should achieve the specified purpose and that state should be sufficiently reflected in the actual application of the system, for facilitating to generate information relevant to user, management, or policy requirements.

The new F4P-based evaluation approach for smart water systems judges the usability from the smart water system and the model itself; the reliability of the system in terms of simulation results; the feasibility from the interaction between the system and multiple realistic constraints, and then obtaining an overall quantification of the system's performance by weighting and integrating different layers of criteria. We applied the approach to a smart water scheduling problem in Fuzhou city of China. The features demonstrated by China's smart water systems, such as "multi-resources", "multi-users" and "multi-purposes", match exactly the issues targeted by F4P concept. We use this framework to evaluate and advise on this system and incorporate its feedback for further refinement of the evaluation framework in turn. Ultimately, the study looks forward to future Iterative updates and application & dissemination of this new evaluation method. Our ultimate goal is to build a more localized, yet dynamic framework for optimal evaluation, thus satisfying the smart water systems with infinite possibilities under constantly changing environmental conditions.

REFERENCES

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