Water supply decision-making for a sound prioritization of society's limited resources

Sjostrand, Karin
Industrial PhD scholar, RISE Research Institutes of Sweden, United States, karin.sjostrand@ri.se

The main obligation of water utilities is to provide its customers with a continuous supply of safe drinking water. To fulfill their obligation, water utilities need to manage a variety of highly complex issues and future uncertainties. Climate variability, urbanization, ageing infrastructure and economic constraint add to other, ever present, challenges of water supply management. In an effort to meet demands, a growing number of water utilities initiate various forms of inter-municipal co-operations, creating a new regional level of decision-making. The motives for these co-operations include economies of scale of financial, human and technological resources; possibilities of joint source waters; balancing of socio-economic and spatial differences; and enhanced professional capacity. But there are also challenges such as risks of decreased transparency due to increased autonomy, loss of local knowledge and subsidiarity, and risks for increased vulnerability due to dependency of fewer facilities and source waters. So, taking these benefits and drawbacks into account, how do we make sure that decisions on inter-municipal co-operations and regional interventions are sustainable? And what aspects determine water supply sustainability on a regional level? There is a growing international consensus that water supply planning, design and decision-making needs to address sustainability, long term uncertainties, system complexity, stakeholder involvement and coherent comparisons of alternative strategies. However, there is an absence of decision support tools on an inter-municipal, regional, level to compare socio-economic profitability with environmental and social aspects to support decisions with a sound prioritization of society's limited resources. Hence, this paper aims to provide and test a framework for assessing the sustainability of regional water supply interventions by combining cost-benefit analysis (CBA) with multi-criteria analysis (MCA). Specific objectives are to: (1) present a generic framework that incorporates risks and uncertainties and that enables to combine a fully monetized socio-economic analysis with criteria from the social and environmental domains of sustainability; and (2) test the framework in a case study. The framework, with a generic set of sustainability criteria, was co-developed and tested together with stakeholders from water authorities, municipal community planners, municipal environmental professionals, water utility managers, water resource organizations, fishing organizations, local politicians and representatives from the agriculture, transport and hydropower sectors. The Gothenburg region in Sweden, with its 13 municipalities, one million inhabitants and 30 water treatment plants, served as a case study area for which five alternative interventions were evaluated: (1) centralization of water supply production; (2) regionalization of water supply organization; (3) shift of the main source water; (4) maximization of groundwater usage; and (5) use of additional source waters and treatment plants. Each alternative was evaluated with time horizons from the present day to years 2050 and 2100, respectively, by assessing the expected environmental, economic and social effects. Uncertainties were represented by probability distribution functions and analyzed by means of statistical simulation (Monte Carlo). In conclusion, this study provides decision-makers with support to improve their ability to make well-informed, sustainable and transparent decisions to ensure the society a safe and reliable water supply for generations to come.