



## **Assessing the Capital Portfolio of Urban Water Supply Security under Global Change**

Elisabeth Krueger (1,2), P. Suresh C. Rao (2), and Dietrich Borchardt (1)

(1) UFZ - Helmholtz Centre for Environmental Research, ASAM, Leipzig, Germany (elisabeth.krueger@ufz.de), (2) Lyles School for Civil Engineering, Purdue University, West Lafayette, IN, USA

Multiple dimensions of global change, such as population growth, socio-economic transformations, and climate change, challenge the sustainable supply of water, food and energy, which are provided to a growing urban population through critical urban infrastructure systems. These Coupled Natural-Human-Engineered systems (CNHE) ensure the functioning of, e.g., urban water supply services, including the socio-economic systems that manage them. The Capital Portfolio Approach (CPA) presented here quantifies the five elements, making up this "portfolio of capitals". It includes: (1) the natural resources supplied to citizens; (2) infrastructure to extract, treat, store, transport and distribute the resource; (3) financial capital for the operation and maintenance of the infrastructure; (4) management power to regulate, manage and operate the system; and (5) the response of the community to insufficient supplies.

Based on empirical utility and research literature data, we apply the CPA to the water supply systems of seven case study cities, representing a wide range of geographic and socio-economic conditions: Chennai (India), Singapore, Ulaanbaatar (Mongolia), Amman (Jordan), Berlin (Germany), Melbourne (Australia), Mexico City (Mexico). We find significant variation across these cities; distinctions marked by the level of infrastructure services and capital ratios indicate constraints (rigidity versus poverty traps), and transition pathways towards sustainable development. Our analysis suggests that the proposed method is useful for the identification of bottlenecks and vulnerabilities for urban water security, as well as quantitative, comparative assessments across different contexts.