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Abstract

Water is integral to all life on earth. It is not only important for drinking and sanitation, but is also a primary input in agriculture, which constitutes 70 per cent of the world demand for it. However, increasing population, urbanization, industrialization and the accompanying consumerist culture have led to an unchecked growth in water demand, putting a pressure on this renewable, but finite resource. Across the globe, there are now several signs that indicate human use of water has been extended beyond sustainable levels. Low river flows, depleting ground water resources, increasing water pollution and environmental degradation, are some of the main indicators of water stress in the world. With the dimensions of water scarcity becoming large, the way water scarcity is perceived and measured has seen a change since the late 90s. The concept of 'water scarcity' has given way to the more comprehensive term 'water poverty', such that the latter covers all aspects of water scarcity, including physical and socio-economic both. Water poverty is a people centric concept and covers all forms of deprivation of water. Water scarcity, however is a resource centric term, which only covers the physical estimates of resources available per capita. Among the several indicators of water poverty, the one that has received the maximum attention and seen widespread application is the Water Poverty Index (WPI) introduced by Sullivan, and developed by Lawrence et. al. in the year 2002. The WPI aims to bring together physical scarcity of water with the economic, social and environmental aspects to measure water poverty in a region. In this backdrop, our study attempted to construct a State/Union Territory-wise WPI for India for the year 2011-12, with the objective to capture the multiple aspects of water deprivation in each state.

The WPI was based on five core components – Resource, Access, Capacity, Use and Environment. Under the five-component structure of WPI, a total of 18 variables were originally considered,

which were later reduced to 12 variables using 'Jolliffe Method B4'. This method of variable reduction was based on Principal Component Analysis (PCA). Values of the selected variables were normalized based on the 'Min-Max' method of normalization such that the normalized scores for all the variables and for all the states lied in the 0-100 scale. Correlation among variables under each component of WPI was checked using the Bartlett Test of Sphericity and the Kasier-Meyer-Olkin Measure of Sampling Adequacy. Using PCA, only principal variables were retained and aggregated to form the core component scores of WPI. Weights for each component of the index were computed using Eigen Values and Eigen Vectors. The core components were then aggregated using a suitable aggregation technique. WPI scores were also computed using a different aggregation technique and alternative weights, in order to relate it with results of our study. State/UT-wise data on all the variables used in the index was taken from secondary sources.

The results of WPI for India revealed that there were wide inequalities found in water poverty across States/Union Territories. The scores ranged from a minimum of 37.2 to a maximum of 68.9 on the 0-100 scale. The average WPI score for India as a whole was 55. Among states, Jharkhand reported the lowest WPI score (most water poor) and Sikkim, the highest score (least water poor). A case-study of Sikkim vs Jharkhand revealed that Sikkim had a more balanced pattern of development, with special emphasis on increased public sector spending toward health and education, and environmental sustainability, as compared to Jharkhand. It was also found that overall water poverty in India was closely linked to 'income poverty' and 'deprivation of access'. The result also found a significant correlation between the WPI and the Human Development Index (HDI), indicating that states with high HDI scores were more water rich as compared to the ones with low HDI scores. However, states like Kerala and Union Territories like Delhi, despite high HDI scores were found to have low scores on WPI. State-wise WPI scores were also found to be different from the scores of Falkenmark Index, indicating that water poverty was to be understood beyond the volumetric supply of water. This study also brought to light the 'North East Water Paradox' in the India, reiterating the fact there was scarcity amidst plenty in the country. Since water was found to be highly linked to human development in India, the study recommended that water issues, specifically, improving access to water and building social adaptive capacity, be made a part of poverty alleviation programmes.