Indian megacities face severe water supply problems owing to factors ranging from growing population to high municipal pipe leakage rates; no Indian city provides 24/7 water supply. Current approaches to addressing the problem have been “utility centric,” overlooking the significance of decentralized activities by consumers, groundwater extraction via private wells, and aquifer recharge by rainwater harvesting. We propose a framework that makes it possible to evaluate a wider range of centralized and decentralized policies than previously considered. The framework was used to simulate water supply and demand in a simulation model of Chennai, India. Chennai suffered from a severe drought in 2003 and 2004, followed by the heaviest rains in its recorded history in 2005. In 2004–2005, Chennai’s reservoirs went completely dry; water available from all sources combined was insufficient to deliver water via a piped system, resulting in the shutdown of piped supply. The entire city became dependent on “mobile supply”.

The integrated model was constructed to simulate all the components of the Chennai water system. Three very different policies, supply augmentation, efficiency improvement, and rainwater harvesting, were evaluated using the model.
This research proposes a framework to simulate water supply and demand in a simulation model of Chennai, India. Three very different policies, supply augmentation, efficiency improvement and RWH were evaluated using the model. The model results showed that none of the three policies perfectly satisfied the criteria of efficiency, reliability, equity, financial viability and revenue generation. Instead, a combination of RWH and efficiency improvement best meets these criteria.

This integrated model was constructed to simulate all the components of the Chennai water system.

The following analysis evaluates the model:

- Considering four dimensions of water supply relevant to consumers: Modes of supply accessed by consumers; investments made by consumers in acquisition, storage and treatment of water; quality of water and time periods in which consumers make decisions.
- Distinguishing between short-run decisions (by solving the consumers’ cost-minimization problem assuming a fixed set of options in a given time period) and long-run decisions (by accounting for consumers’ coping mechanisms and thus the choice set available to them).
- Establishing consumer surplus as a common measure of consumer well-being making, regardless of the type of consumer or modes of supply.
Features

- The research presents an integrative framework uniquely suited to evaluating both centralized and decentralized policy solutions.
- By applying this framework, this research was able to come up with new policy insights.

Results/ Observations

The results suggest that having a reliable source of non-potable supply will boost consumers’ willingness to pay for high quality, reliable piped supply and make demand more manageable. However, a transitional solution that employs a combination of rooftop RWH and tariff increases can provide the necessary transition in a manner that is cost effective.

Key Learnings

- This study is unique in considering jointly centralized and decentralized supply.
- Three very different policies: supply augmentation, efficiency improvement, and rainwater harvesting were evaluated using the model. However, none of the three policies alone perfectly satisfied our criteria of equity, efficiency, revenue generation and financial viability in addressing Chennai’s water problems.
- The policy simulations suggest that expanding centralized supply is not always the least cost option; instead combination of efficiency improvement and rainwater harvesting may be optimal.

Further information:

References and Sources: