

**BENCHMARKING FRAMEWORK FOR SUSTAINABLE
URBAN WATER SUPPLY SERVICES IN INDIA**

By

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Submitted

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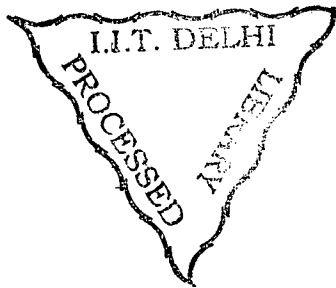
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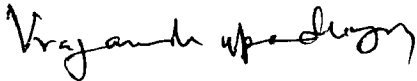
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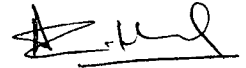
CERTIFICATE

Certified that Ms. Mamata R. Singh, was permitted to work for her Ph. D. Degree at IIT, Delhi on the problem entitled 'Benchmarking Framework for Sustainable Urban Water Supply Services in India'. She has faithfully carried out her study under our guidance and supervision and the accompanying thesis is her genuine and original work.

Ms. Mamata R. Singh has completed necessary coursework and was regularly interacting in the Department.



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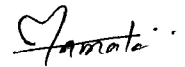
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I am solely responsible for the errors, if any, in this study.



Mamata R. Singh

ABSTRACT

The concept of Benchmarking & Efficiency Measurement of Water Supply Services has so far not been explored in India. The present work intends to examine and establish the need for efficiency measurement in urban water supply sector. The work begins with the investigation of existing status of urban water supply sector, reform needs, benchmarking and efficiency analysis and identifies the important parameters of water supply services (such as service sufficiency; service reliability; environmental resource conservation through water loss control and electricity savings; staff rationalization, business viability etc.) that lead to its sustainability and concerned stakeholders' satisfaction. The work endeavors to develop a framework for aggregate efficiency estimation of 18 urban water utilities for water supply services provision.

Data Envelopment Analysis (DEA) has been employed for efficiency measurement. The methodology for efficiency estimation of urban water supply services identifies six separate sets of input & output variables for six different DEA models that are formulated for the six important parameters of water supply services. These parameters address the key sustainability dimensions (social, environmental and financial) which in turn satisfy the concerned stakeholders' (consumer, environment and utility) interests. The six technical efficiency scores obtained from these six DEA models for each utility are then integrated together as their weighted sum to obtain aggregate efficiency score. Weights for six DEA models are derived through the consumer survey questionnaire using Delphi technique. Apart from calculating efficiency scores and identifying suitable benchmarks, the results of the model has also been used to arrive at potential for reduction in staff and unaccounted for water; cost saving potential due to electricity savings and overall cost saving potential. These results have been discussed in the context of policy imperatives and related issues in the Indian urban water supply sector.

Two levels of sensitivity analysis to check the robustness of DEA technique and consistency of the data employed for DEA for the 18 urban water utilities have been attempted in this study. The study also demonstrates the concept of cost efficiency estimation using cost efficiency DEA model for 18 urban water utilities. The exercise on

cost efficiency DEA is illustrative in nature with limited scope for applicability of its results (due to data constraints particularly for resources and its prices).

Performance of utilities, in general, are lower for service sufficiency, service reliability and business viability parameters but relatively better for environmental resource conservation (through water loss control and electricity savings) and staff rationalization parameters. Medium sized utilities were found to have higher technical efficiency (*te*) whereas small sized utilities have higher scale efficiency (*se*). The study also showed significant scope for reduction in unaccounted for water (UFW) i.e. water loss, staff size and electricity expenditure. Overall, the result of Aggregate Efficiency Analysis indicates sub optimal aggregate performance of most of the urban water utilities and therefore suggests the significant scope for performance improvement with respect to the best practices (efficient) utilities.

This work would be of most use to the regulatory authorities (or higher tier of government), funding institutions and development institutions to devise performance linked incentives which in turn would induce competition amongst water utilities. This work would also be useful for the utilities to assess their own performance and to determine action plans for further improvement. The efficiency ratings of the utilities, when published would keep the consumers informed about the utilities relative performance status who in turn would act as pressure groups and make the utilities continuously improve their performance. The proposed benchmarking scheme, if followed in practice would eventually lead to sustainable urban water supply services.

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