

BENCHMARKING OF DRINKING WATER UTILITIES IN RURAL AREAS

DHARMENDRA GILL



**DEPARTMENT OF CIVIL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY DELHI**

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BENCHMARKING OF DRINKING WATER UTILITIES IN RURAL AREAS

by

DHARMENDRA GILL

Department of Civil Engineering

Submitted

**in fulfillment of the requirements of the degree of
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CERTIFICATE

This is to certify that thesis entitled “**Benchmarking of Drinking Water Utilities in Rural Areas**” being submitted by **Mr. Dharmendra Gill**, to the Indian Institute of Technology Delhi, for the award of ‘**DOCTOR OF PHILOSOPHY**’ in Civil Engineering is a record of bonafide research work carried out by him under my supervision and guidance. He has fulfilled the requirements for submission of this thesis, which to the best of my knowledge has reached the requisite standard.

The material contained in the thesis has not been submitted in part or full to any other University or Institute for the award of any degree or diploma.

October, 2017

(Dr. Arvind Kumar Nema)
Professor
Civil Engineering Department
Indian Institute of Technology Delhi
New Delhi- 110016, India

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Abstract

Despite clearly defined constitutional / legal rights and duties, formulation of policies and programs; and installation of a large number of utilities, the rural water supply system in India still suffers from a number of problems. The rural drinking water utilities need to be examined for their existing strengths and weaknesses and to improve their efficiency and effectiveness.

The objectives and design parameters for rural drinking water supply utilities are entirely different from that of urban water utilities; hence these need different set of performance indicators for evaluation study.

The performance of rural drinking water supply utilities has so far not been evaluated. The framework for systematic evaluation of efficiencies and effectiveness of utilities has been developed in this work. Data Envelopment Analysis technique has been employed for efficiency measurements and benchmarking.

A set of appropriate and relevant performance indicators for evaluating the performance of rural drinking water supply utilities has been developed in this work. The work used four DEA models to measure relative efficiency of utilities in four performance areas i.e., service provisions, service operations, service reliability and financial sustainability.

The evaluation framework has been applied to the rural water supply utilities of Himachal Pradesh, a north Indian state. The results reveal that the utilities are performing at very low efficiencies in all the areas of performance. The analysis indicates that there is significant scope for savings in inputs and improvements in performance.

Keywords: Benchmarking, Indian rural drinking water utilities, Performance evaluation, Performance indicators, Data Envelopment Analysis, Himachal Pradesh.

सार

स्पष्ट रूप से परिभाषित संविधान / कानूनी अधिकार एवं कर्तव्य, नीति और कार्यक्रम सूत्रबद्ध होने और बड़ी संख्या में जनोपयोगी सेवाएं स्थापित होने के बावजूद भारत में ग्राम्य जल आपूर्ति प्रणाली अभी भी अनेक समस्याओं का सामना करती है। ग्राम्य पेयजल सेवाओं, इनकी विद्यमान क्षमताओं और अपयप्रिता और उनकी क्षमता तथा प्रभाविता में सुधार लाने हेतु विचार करने की आवश्यकता है।

ग्राम्य पेयजल आपूर्ति सेवाओं के उद्देश्य और डिजाइन पैरामीटर, शहरी जल सेवाओं से बिल्कुल भिन्न है। इसलिए इनके मूल्यांकन अध्ययन हेतु इन्हें भिन्न प्रकार के निष्पादन संकेतों के दृष्टिकोण की आवश्यकता है।

ग्राम्य पेयजल आपूर्ति जनोपयोगी सेवाओं के निष्पादन का मूल्यांकन अब तक नहीं किया गया है। जनोपयोगी सेवाओं की दक्षता एवं प्रभाविता के सुव्यवस्थित मूल्यांकन हेतु ढाँचा इस कार्य में विकसित किया गया है। दक्षता मापन तथा मानक हेतु डाटा एन्वेलोपमेंट अनालसिस (DEA) तकनीक अपनाई गई है।

इस कार्य में ग्राम्य पेयजल आपूर्ति जनोपयोगी सेवाओं के निष्पादन संकेतकों का ढाँचा विकसित किया गया है। चार निष्पादन क्षेत्रों सेवा प्रावधानों, सेवा प्रचालकों, सेवा विश्वसनीयता और वित्तीय संपोषणीयता सेवाओं की तुलनात्मक दक्षता के मापन हेतु इस कार्य में चार माडलों को प्रयोग में लाया गया है।

मूल्यांकन फ्रेमवर्क को हिमाचल प्रदेश, जो एक उत्तर भारतीय राज्य है के जल आपूर्ति जनापयोगी सेवाओं पर प्रयुक्त किया गया है। परिणामों से प्रकट होता है कि जनोपयोगी सेवाएं अपने निष्पादन के सभी क्षेत्रों में बहुत निम्न दक्षता से निष्पादन कर रही हैं। यह विश्लेषण सूचित करता है कि निविष्टि में बचत की और निष्पादन में सुधार की बहुत संभावना है।

संकेत शब्द - मानक, भारतीय ग्राम्य पेयजल जनोपयोगी सेवाएं, निष्पादन मूल्यांकन, निष्पादन संकेतक, डाटा एन्वेलोपमेंट अनालसिस (DEA), हिमाचल प्रदेश।

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LIST OF ABBREVIATIONS & ACRONYMS

ADB	Asian Development Bank
ANOVA	Analysis of Variance
ARWSP	Accelerated Rural Water Supply Programme
BCC	Banker, Charnes and Cooper
CCR	Charnes, Cooper and Rhodes
COLS	Corrected ordinary least squares
CRS	Constant returns to scale
DEA	Data Envelopment Analysis
DMU	Decision Making Unit
GoHP	Government of Himachal Pradesh
GoI	Government of India
HPIPH	Himachal Pradesh Irrigation & Public Health
IB-NET	International Benchmarking Network for Water and Sanitation Utilities
IWA	International Water Association)
LPCD	Liters Per Capita Per Day
MoDWS	Ministry of Drinking Water & Sanitation
MoUD	Ministry of Urban Development
NABARD	National Bank for Agriculture and Rural Development
NGO	Non-Government Organization
OLS	Ordinary Least Square
PI	Performance indicator
PRI	Panchayati Raj Institutions
RGNDWM	Rajiv Gandhi National Drinking Water Mission

SCADA	Supervisory Control and Data Acquisition
SFA	Stochastic Frontier Analysis
TFP	Total factor productivity
VRS	Variable returns to scale
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
WSP-SA	Water and Sanitation Program- South Asia