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**Singapore Management University** 

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**Topic**: The Challenges of Quenching Thirst: Emerging Options for Urban Drinking Water Projects- A Case Study from India

# Study Background

### **Objective**

To understand the trends in expenditure in the drinking water sector

### Approach

- Budgets of Government of Karnataka analyzed
  - Period: 2000-2008
- Classification of account heads done
  - Rural & Urban Drinking Water

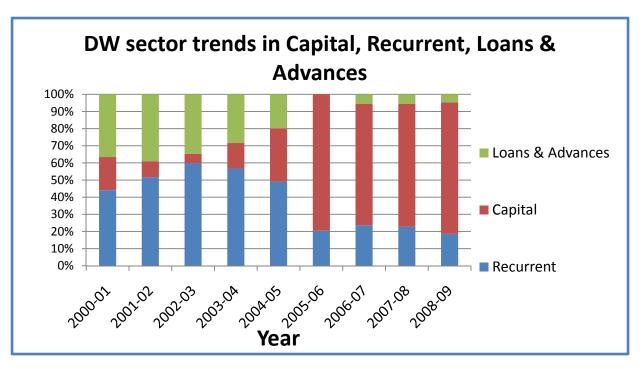
### The Macro Picture

 Average spending on Drinking Water is 0.4% of the GSDP over the period 2005-06 to 2008-09

Sector	Nominal CAGR (2000-2008)	Real CAGR (2000-2008)
Drinking Water Sector	7.64%	3.52%
Rural	-	7.03%
Urban	-	-7.69%

Source: Financing Drinking Water, 2010, CBPS Study

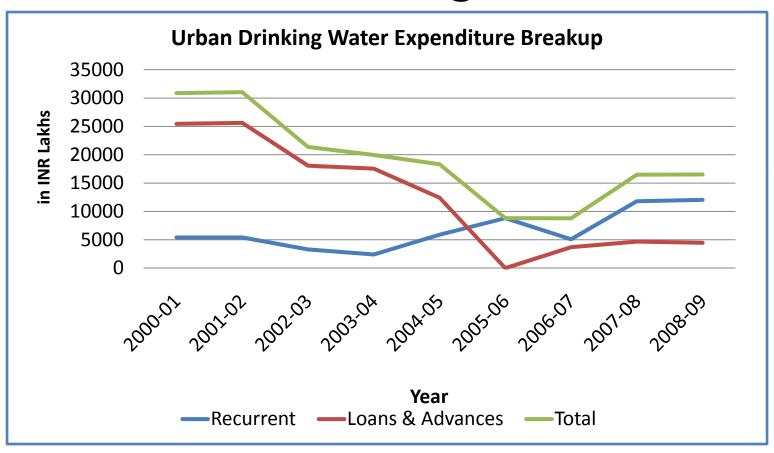
### The Macro Picture



Source: Financing Drinking Water, 2010, CBPS Study

- Expenditure on Capital Works increasing post 2002-03
- Expenditure on Recurrent Works declining

# **Urban Drinking Water**



- •UDW sector has registered a negative growth rate of **7.69**% over the eight year period
  - A worrying trend with increasing urbanization rates

# Cost-Effectiveness Analysis of drinking water distribution systems

Case study of Public and Private
Management of Drinking Water
Supply in Belgaum City Corporation

### The Context

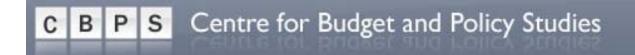
- Dr. Manmohan Singh on the 12<sup>th</sup> Plan: "efficiency of resource use, and also supplement public resources with private investment, wherever feasible"
- Planning Commission encouraging Private
   Sector participation
- Rationale for PSP: Better access to technology and Capital, efficient management practices

### The Context

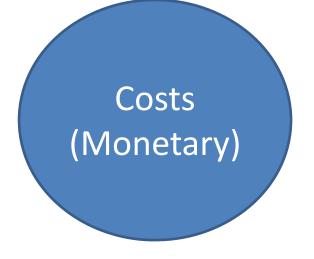
- The debate surrounding provisioning of drinking water is a Rights based issue
  - Right to life, Water is an implied right
- Treatment of Water as an economic good: The World Bank and ADB
  - Anger and angst among citizens and civil society groups
- India perched in that era of provisioning water where middle income Latin American countries and South-east Asian countries were a decade ago
- Estimated \$500 billion potential: Drinking water projects in the coming decade
- 50 towns and cities gone the PSP way: Hubli, Dharwad and Belgaum in Karnataka, more recently Mysore and Mangalore

### The focus of our research

- To find out which is a more cost-effective mode of service delivery: PMWS or CMWS
- To gauge the customer satisfaction under these two service delivery modes
- To assess and compare the management models of the two service delivery systems



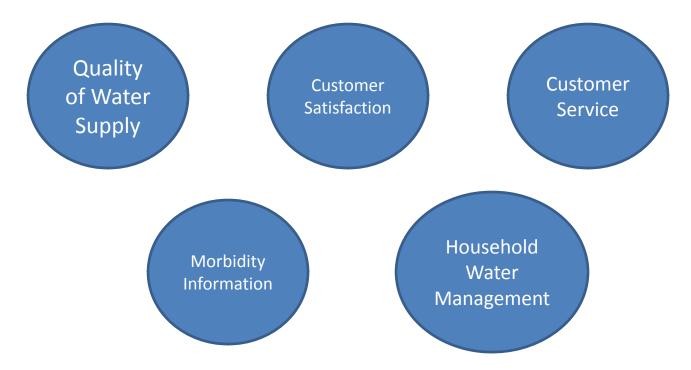
### What we wanted to measure?

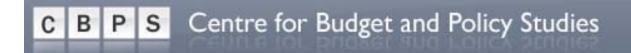


Effectiveness (Non-Monetary)

### How we went about our research

- Household survey covering both Demo and Non-Demo zones
- Information collected on -





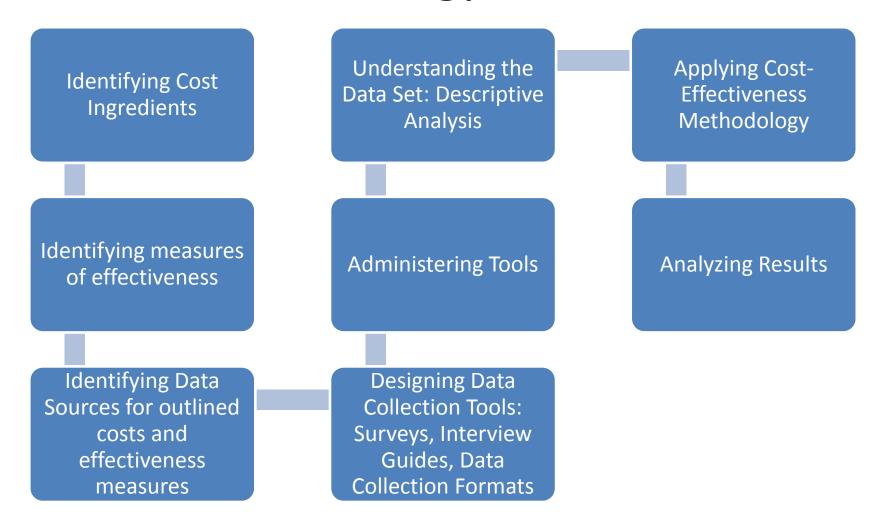
# The two systems of Service Delivery

Management
Contract: Using
24/7 water
supply
technology

Corporation managed water supply

Drinking
Water
Supply

# Methodology overview



### How we went about our research

Stakeholders of both water supply utilities were interviewed

WSDB taking r O&M of BCC	Period of Transition	Period of Implementat ion	Initiation of 24/7 Pilot	Period of Transition	Project Implementat ion
Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
	Stakeholde	er	Phas	es Covered for	Interview
KUWSDB (Exc City)	ecutive Eng	ineer, Belgaum		All Phases	
KUIDFC (Assi PIU)	istant Exec	utive Engineer,		Phases 4,5,	6
Commissione Corporation,		gaum City nts Officer		All Phases	
Fitchner Cons	sultants (File	ed Officer)		Phases 4,5,	6
CGE (Project Demo Zone)	Manager,	North & South		Phases 4,5,	6

### How we went about our research

- We calculated the Annual Average Operating Costs for both these utilities
  - Cost data obtained from both the service providers
  - Capital costs were not included because of lack of data

### Measuring Costs

Step1: Identify Cost Ingredients

Step 2: Ascertain Monetary Values for each of these costingerdients

Step 3:If any ingredient is found to have a multi-year effect, calculate effective annual cost

Step 4: Calculate Averge Annual Cost for each ingredient

Step 5: Aggregate Average Annual Costs of all Cost ingredients to arrive at total annual cost for maintaining the water supply system

Annual average cost of maintaining water supply

Number of Connections (in 1000s)

# Measuring Effectiveness

### How we went about our research

• Multi-dimensional **Effectiveness Index** 



### **Computing Effectiveness Index**

Effectiveness Index (EI) = Weighted Sum [Water Supply Quality Index (WSQI) + Customer Satisfaction Index (CSI) - Morbidity Index (MI) - Inequity Index]

Index	Measure
Water Supply Quality Index	Calc[Supply Quality Index + Customer Service Index]
Morbidity Index	Calc[Number of Persons with Disease/Population of Area]
Customer Satisfaction Index	Calc[(Total Score Received / Maximum Total Score) * 100]
Inequity Index	
	Inequity Index = Concentration Index of Out of Focket Expenditive on Water  Concentration Index of Monthly Expenditure
Supply Quality Index	Average Number of Disruptions in a year per Household
Customer Service Index	Average[ Total Number of Complaints Resolved within the prescribed time Total Number of Complaints Logged in year n

### Cost data calculations

Public	2006-07	2007-08	2008-09
Number of Connections	42199	44967	37886
Total O&M expenditure	146.8	165.45	185.3
O&M per Thousand Connections	3.48	3.92	4.40
Annual Average O&M per Thousand Connections		3.93	
Private			2008-09
Number of Connections			8118
Total O&M expenditure			1.62
O&M per Thousand Connections			2.82
Annual Average O&M per Thousand Connections		3.02	

All cost data in INR Lakhs | Source: CBPS Study

### **Effectiveness Measures**

Step 1: Measure	Public	Private	Public	Private
	(Score)	(Score)	(Index)	(Index)
Customer Satisfaction	0.57	0.77	0.493	0.737
Index				
Morbidity Index	0.03	0.4	0.03	0.4
Water Storage Index	163.65	5.03	0.38	0.011
Outage Frequency Index	0.66	0.87	0.66	0.87
Inequity Index	0.201	0.265	0.201	0.265
Customer Service Index	0.98	1	0.98	1
Step 2: Measure	Public	Private	Public	Private
	(Index)	(Index)	(Weighted Index)	(Weighted Index)
Water Supply Quality	0.82	0.935	0.328	0.374
Index				
Morbidity Index	0.03	0.4	0.006	0.08
Customer Satisfaction	0.493	0.737	0.0493	0.0737
Index				
Water Storage Index	0.38	0.011	0.038	0.0011
Inequity Index	0.201	0.265	0.0402	0.053
Aggregate	0.702	0.996	0.2931	0.3136

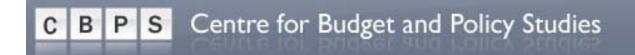
# Cost Effectiveness Analysis

Cost-Effectiveness Ratio =

Cost (monetary)

Effectiveness(non-monetary)

Service Provider	Cost (in INR Lakhs)	Effectiveness	C/E Ratio
Public	3.93	29.31	0.056
Private	3.02	31.36	0.044



# Effectiveness scores comparison

Measure	Desirable Value	PUBLIC	PRIVATE	Test for Significant Difference(Indepen dent Samples T test)
Customer Satisfaction Score	Higher value is desirable	0.56	0.77	<b>Not Significant</b> (Sig: 0.435)
Mean household Morbidity Rate	Lower value is desirable	0.02	0.40	Significant Sig: 0.00
Per Capita Water Storage(liters per day)	Lower value is desirable	163.65	5.032	Significant Sig: 0.00
Mean Outage frequency Score	Lower value is desirable	0.66	0.87	<b>Not Significant</b> (Sig: 0.316)
Mean Effectiveness Scores	Higher value is desirable	-1.0481E -08 Not significant	2.77211E -07	<b>Not Significant</b> (Sig: 0.435)

# **Comparing Management Models**

# **Comparing Management Dimensions**

Dimension	Parameter	Public	Private	National Benchmark
Organizational	Labour productivity	4.85	4.58	7.4
Metrics	Performance Based Incentives	No	Yes	NA
Financial Metrics	<b>Operating Ratio</b>	2.88	0.9	1.63
Community Engagement Metrics	Overall Satisfaction Rate (of the Service)	26.2% Rating Good/Excellent	89.5% Rating Good/Excellent	NA
	Water Availability	Once in 3 days for 2 Hours	24 hours	NA
Other Performance Indicators	Connections Metered	19.4	100	NA
	Revenue collection Efficiency	NA	57%	NA

# Through this study we saw that

- The difference in Effectiveness of the two service delivery models aren't statistically significant
- 24/7 technology reduces wastage in water in households
- 24/7 technology employs better management practices
  - Lower cost of operation
  - Better Customer Satisfaction
  - Better Community Engagement

# Explanation of Measures

#### • Morbidity Index

Morbidity Index gives the number of people ill with water borne disease as a proportion of the project area.

#### Customer Satisfaction Index

Customer Satisfaction Index gives an overall score of how satisfied the end users are on various aspects of their water supply system such as Frequency of Supply, Quality of Water, Timing of supply, Affordability of Service, Quantity of Water Supplied, Pressure of Supply and Customer Service. A Likert Scaling approach is used to calculate the satisfaction scores.

#### • Water Quality Index

Both the water supply utilities have a systematic way of measuring water quality. Samples from both the source and consumer end are tested as per a set schedule. Water samples are tested for both biological presence and for chemical balance. Since the same bulk water is supplied to both the project areas, what would be more interesting to see is the water quality at the household level. However, this measure will not be used in the model as there is no comparable data since the water supply utilities use different measures for water quality.

#### Supply Quality Index

Supply Quality Index gives a measure of the adequacy of supply and also factors in the disruptions in supply.

#### • Customer Service Index

Customer service index is summation of average response time index and average resolution time index. This index gives a measure of how efficiently consumer end grievances are being dealt with.

#### Inequity Index

An inequity index represented in terms of a Gini-coefficient would give a measure of how equitable the two water supply utilities are in terms of charging the end users. Ideally poorer households would pay lesser while richer households would pay more. Measured as -

#### Outage Frequency Index

This gives a measure of the average number of disruptions in water supply for a household in a year.

### Comparing Management Indicators



# **Organizational Aspects**

Indicators (Qualitative/Quantitative)	Measure	PMWS	CMWS	Benchmark
Personnel Development	Number of training programs conducted; At which levels and at what frequencies	CGE, the private operator have their own internal training	KUWSDB has on the job training for its employees. But there is no specific training plan.	
Employee Satisfaction	Does the Organization Conduct an Employee Satisfaction survey?	Data Not Available	Data Not Available	
Labor Productivity	Number of Staff per 1000 connections(3 year average)	4.58	4.85	National Average of Major Cities in India – 7.4
Labor ratio	Ratio of Skilled and Unskilled Workers	Data Not Available	Data Not Available	
Performance Based Incentives		Yes, there are defined Service Level agreements between the operator & the Local Government	No performance based incentives	

# **Financial Aspects**

Indicators (Qualitative/Quantitative)	Measure	PMWS	CMWS	Benchmark
Operating ratio	Ratio of Operating expenses as a percentage of Revenue	0.9	2.88	National Average of Major Cities in India – 1.63
Return on Assets	Net income divided by total number of assets	Data Not Available	Data Not Available	
Operating Revenue versus budget	Projected operating revenue/Plan budget	Data Not Available	Data Not Available	
Debt Ratio	Total liabilities/Total Assets	Data Not Available	Data Not Available	

# **Functional Aspects**

	•				
Indicators (Qualitative/Quantitative)	Measure	PMWS	CMWS		
Control Aspects	What are the kinds of control used? What are the control mechanisms?	Organizational Control through formal hierarchy	Organizational Control through formal hierarchy. Also, processes in place depending on the local context.		
Job Charts/Roles	Are there Job Charts for every post?	Yes, roles are defined	Yes, roles are defined		
Reporting	What is the reporting structure?	Water Supply Core-Committee and internal meetings, reporting on hierarchical lines	Monthly meetings between the Executive Engineer & Commissioner of the City Corporation, Hierarchical reporting		
Decentralization	Role of Local Governments	Setting Water Tariffs, Commissioner of the City Corporation is the chairman of Water Supply Core-Committee, Commissioner reports to the Local Council	Setting Water Tariffs		
Problem Escalation	What is the mechanism of problem escalation?	Issues pertaining to the operation are discussed in the weekly meetings of the core-committee	Follows the hierarchical line of control again.		

# **Community Engagement**

Indicators (Qualitative/Quantitative)	Measure	PMWS	CMWS
Water Adalat	Are there public water forums? What is the frequency and output of such forums?	No	No
Customer Grievance Handling	Average number of households serviced by one Customer care centre	10421	1627
Community Outreach	Number of Educational presentations in a year	Social Intermediary & Communications Strategy, Facilitating NGO	None. Not much of consumer/community outreach. No public presentations.
Community Opinion	What is the level of engagement of the community when it comes to decisions like revising water tariffs?	Not Consulted, but informed post revision	Informed through notices and pamphlets.
Overall Customer Satisfaction	Number of customers who rate the water supply as good/excellent (through the household survey)	488	145

### Other Performance indicators

Indicators (Qualitative/Quantitativ e)	Measure	PMWS	CMWS
Water Availability	Number of hours per day	24 hours	Once in 3 days for 2 Hours
Consumption Per Capita	Liters per Capita Per day	90-135	110
Connections Metered	Total Number of Connections as a percentage of total number of connections	100	19.4
Revenue collection Efficiency	Total Annual Collections/Total Annual Billings *100	57%	NA

### **Discussions**

- PMWS more cost-effective than CMWS
- PMWS management aspects better than CMWS
- Scalability issues
- Correct need assessment

### Policy pointers and Questions

- 24/7 Water supply also implies 24/7 electricity supply, is such an energy-hungry technology viable in the Indian context?
- Are we missing out on a more basic issue of a Reliable Water Supply?
- If the intent is to provide 24/7 safe drinking water to households, should this option be explored for lower-income (slums) settlements where the problem of access to clean, sustainable source of water is a greater issue?
- What can Municipalities learn from the Private Sector?

# Policy pointers and Questions

- Declining allocation towards Recurrent expenditure for Rural Drinking water sector
  - What does this mean for sustainability of drinking water projects?
  - Will involving local councils in a monitoring capacity ensure sustainable implementation?
- While Urbanization rates are increasing, there is a negative growth rate in investments in Urban Water supply sector
  - What does this mean, especially for the vulnerable migrant population in urban areas?
- Expenditure on Drinking Water at 0.4% of the GSDP
  - Is this enough?

# Thank you for your time



#### **Urban Drinking Water: A Summary**

#### •Millennium Development Goals

☐ Target No. 10: To halve, by 2015, proportion of people without sustainable access to safe drinking water and basic sanitation.

☐ This indicator, which rose from 68.5% in 1990 to 74% in 2001, would need to improve to 86.5% by the end of the 12th five-year Plan (2017) if India is to meet the MDG target.

☐ Meeting the MDG target in urban areas would require investment of about Rs 425 billion and Rs 500 billion (US\$10 billion and US\$11.8 billion) for the 11th and 12th Plans, and recurrent expenditures of the same order of magnitude of about Rs 390 billion and Rs 505 billion (US\$9.2 billion and US\$11.9 billion).1

☐ Access provided to 90 % of the population by 2001 as per the Govt



#### The Challenges posed by World Bank

- □ Access to reliable, sustainable, and affordable water supply and sanitation service is lagging behind.
  □ Reliable?
  □ Financially sustainable?
  □ Environmentally sustainable?
  □ Affordable?
- □ So the true challenge is not to increase access to infrastructure to almost 100% of the population—but to increase access to reliable, sustainable, and affordable service. India is unlikely to be able to meet this objective unless it adjusts policies, institutional arrangements, and financial incentives to help improve service delivery . . .
  - ☐ The water supply in most Indian cities is only available for a few hours per day, pressure is irregular, and the water is of questionable quality.
  - □ No major Indian city has a 24 hour supply of water, with 4 to 5 hours of supply per day being the norm. This compares to the Asian-Pacific average of 19 hours per day supply.



#### The Challenges posed by World Bank (contd)

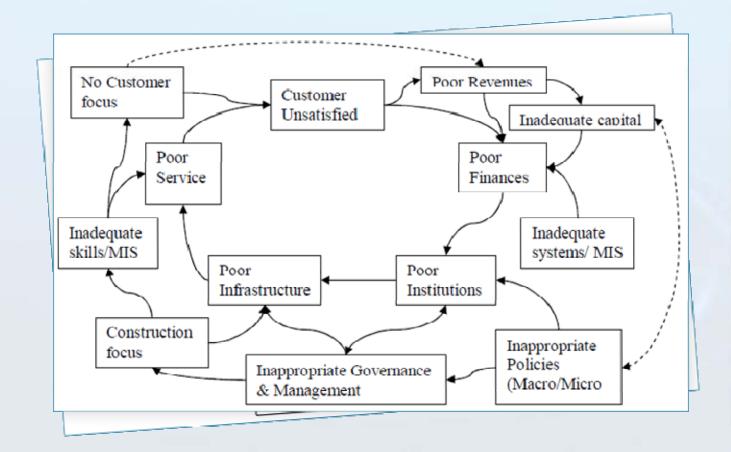
☐ Based on a survey conducted in Delhi in 1995, Zérah (2000) estimated that each household on average spent around 2000 Rupees annually in coping with unreliable supply of water, which is 5.5 times as much as they were paying their municipality for their annual water consumption.

☐ Other studies indicate that the poorest segments also spend a substantial amount on private water supply.

o\* Latest census data indicates that the urban population has increased rapidly to 31.2 %-the fastest rate of urbanization..377 million reside in urban India, 200 million more will be added in the next 5 years.



#### **The Vicious Circle of Urban Water Sector**







#### Infrastructure shortfall

Infrastructure shortfall - The growth of urban areas has vastly outpaced the State's efforts to develop infrastructure to serve the growing needs of cities. There is now a substantial deficit of infrastructure in several key areas - roads and transport (both within cities and between important cities in the State), housing, drinking water supply, domestic sanitation, sewage treatment systems, solid waste collection and management, storm water drains, lakes in urban areas, and domestic energy. In all these cases, the gap between demand and supply is very large, affecting millions of families, with consequences for the quality of life in urban areas across many measures. (Urban Development Policy Report, GOK, Nov 2009).



### **Private participation**

#### **Private participation**

- □ Problematic : Negative experiences from several countries
- ☐ Models without financial participation offer some promise.
- ☐Municipal systems inadequate on several dimensions : Quality,

Customer Satisfaction, reliability key issues.



