Livelihoods and Natural Resources Management Institute,
IRC International Water and Sanitation Centre,
Centre for Economic and Social Studies and
Watershed Support Services and Activities Network

Sustainable Water and Sanitation Services

The Life–Cycle Cost Approach to Planning and Management



Earthscan Studies in
Water Resource Management

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Sustainable Water and Sanitation Services

Based on the work of the WASHCost project run by the IRC International Water and Sanitation Centre, this book provides an evaluation of the water, sanitation and hygiene (WASH) sectors in the context of developing countries and is the first systematic study of applying the life-cycle cost approach to assessing allocations. It presents unit cost estimates of the WASH sector across geographic locations and technologies, including rural and peri-urban areas, and these are compared with service levels. It analyses detailed data from more than 5000 households across nine agro-climatic zones in Andhra Pradesh State in India. Key issues assessed include poverty analysis of service levels, cost drivers and factors at the village and household level, and governance aspects such as transparency, accountability and value for money in relation to unit costs and service levels.

This is the most comprehensive study of the WASH sector in India and elsewhere that utilises the life-cycle cost approach, along with GIS, econometric modelling and qualitative research methods. Not only does it contribute to research and methodology in this area, but the analysis also provides valuable insights for planners, policy-makers and bilateral donors. The authors show how the methodology can also be applied in other developing country contexts.

Livelihoods and Natural Resources Management Institute (LNRMI) is an independent institution based in Hyderabad, India, aiming at conducting high-quality research and consultancy in the area of human livelihoods and natural resource management.

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Abbreviations

ADB	Asian Development Bank
AFS	Average Family Size
AGESyt	Age of the System
AP	Andhra Pradesh
APL	Above Poverty Line
ARWSP	Accelerated Rural Water Supply Programme
ATI	Administrative Training Institute
BC	Backward Caste/Backward Community
BGs	Beneficiary Groups
BPL	Below Poverty Line
BW	Buying Water
CapExHD	Capital Expenditure (Government + Household)
CapExHrd	Capital Expenditure on Hardware
CapExHrd (Govt)	Per Capita per Year Government Expenditure on Capital Expenditure – Hardware in Rs
CapExHrd (Govt+HH)	Per Capita per Year Total (Govt and household) Capital Expenditure on Hardware in Rs
CapExHrd (HH)	Per Capita per Year Household Expenditure on Capital Expenditure – Hardware in Rs.
CapExSoft	Capital Expenditure on Software
CapManEx	Capital Maintenance Expenditure
CBI	Capacity Building Inputs
CBOs	Community-Based Organisations
CCDUs	Capacity and Community Development Units
CDD	Community-Driven Development
CGG	Centre for Good Governance
CMP	Change Management Process
CoC	Cost of Capital
Congo DR	Democratic Republic of the Congo
CPHEEO	Central Public Health and Environmental Engineering Organisation

CRSP	Central Rural Sanitation Programme
CTZ	Central Telangana Zone
Cum	Cumulative per Capita
CV	Coefficient of Variation
CVS	Clean Village Scheme
DAMT	District Appraisal and Monitoring Team
DANIDA	Danish International Development Agency
DDWS	Department of Drinking Water Supply
DFID	Department for International Development
DFMT	District Finance Monitoring Team
DFT	District Facilitation Team
DISTMRKT	Distance from the market place (km)
DP	Direct Pumping
DP+SVS	Direct Pumping + Single Village Scheme
DP+SVS+MVS	Direct Pumping + Single Village Scheme + Multi-Village Scheme
DPMU	District Programme Management Institute
DTP	Data Transfer Programmer
DWCOST	Drinking Water Cost in village
DWSL	Drinking Water Service Level
DWSLAc	Drinking Water Service Level in Accessibility
DWSLqn	Drinking Water Service Level in Quantity
DWSLqt	Drinking Water Service Level in Quantity (lpcd)
DWSLr	Drinking Water service Level in Reliability
EIEC	Effectiveness of IEC activities
ExDS	Direct Support Costs
ExIDS	Indirect Support Costs
Exp-B	Expenditure on Buying Water
Exp-T	Expenditure on Tariffs
FAO	Food and Agriculture Organisation
FARMSIZE	Farm size
FC	Fully covered
FGDs	Focus group discussions
FLOW	Field level operations watch
FM	Financial management
GDP	Gross Domestic Product
GI	Governance Indicator
GI-CBI	Governance Indicators – Capacity Building Inputs
GI-FM	Governance Indicators – Financial Management
GIS	Geographic Information Systems
GLSR	Ground Level Storage Reservoir

GoAP	Government of Andhra Pradesh
GoI	Government of India
GoK	Government of Kerala
GPs	Gram Panchayats
GPS	Geographic Positioning Systems
GSDA	Groundwater and Survey Development Agency
GWSSB	Gujarat Water Supply and Sewerage Board
GZ	Godavari Zone
HAZ	High Altitude Zone
HHCapExHrd	Household Capital Expenditure on Hardware
HHEXP	Household Expenditure
HHExp-B	Household Expenditure on Buying Water (Bottled)
HHExpBUY	Household Expenditure on Buying Water
HHExp-T	Household Expenditure on Water (Tariff)
HHINC	Household Income
HHOpEx	Household Operation and Maintenance Expenditure
HHs	Households
HP + DP	Hand Pump + Direct Pumping
HPs	Hand Pumps
ICT	Information, Communication and Technology
IDA	International Development Agency
IDWSSD	International Drinking Water Supply and Sanitation Decade
IEC	Information, Education and Communication
IFM	Involvement in Financial Management
INR	Indian Rupee
Int	Intermediate
IO&MS	Involvement in Operation and Management of Systems
IP	Involvement in Planning
IS	Institutional Space
ISL	Individual Sanitary Latrine
IWMP	Integrated Watershed Management Programme
JMP	WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
KL	Kilo Litres
KRC	Key Resource Centre
KRWSA	Kerala Rural Water Supply and Sanitation Authority
KSEB	Kerala State Electricity Board

KWA	Kerala Water Authority
KWSESP	Kerala Water Supply and Environmental Sanitation Project
KZ	Krishna Zone
L	Low Income
LCC	Life-Cycle Cost
LCCA	Life-Cycle Cost Approach
LCS	Low Cost Sanitation
LEdu	Level of Education
Lpcd	Litres per capita per day
LSGs	Local Self Governments
M	Middle Income
M & E	Monitoring and Evaluation
Max	Maximum
MDGs	Millennium Development Goals
MDWSS	Ministry of Drinking Water Supply and Sanitation
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
Min	Minimum
MJP	Maharashtra Jeevan Pradhikaran
MoRD	Ministry of Rural Development
MoU	Memorandum of Understanding
MPWSS	Mini-Piped Water Supply Scheme
MUS	Multi-Utility Systems
MVS	Multi-Village Schemes
MWRRA	Maharashtra Water Resources Regulator Agency
MWSSB	Maharashtra Water Supply and Sewerage Board
NBA	Nirmal Bharat Abhiyan
NCZ	North Coastal Zone
NFHS	National Family Health Survey
NGOs	Non-Governmental Organisations
NGP	Nirmal Gram Puraskar
NNGP	Non-Nirmal Gram Puraskar
Nor	Normative per capita/year
NRDWP	National Rural Drinking Water Programme
NREGS	National Rural Employment Guarantee Scheme
NRWSP	National Rural Drinking Water Supply Program
NRWSS	Nenmeni Rural Water Supply and Sanitation
NS	Non-Summer
NSS	National Sample Survey

NSSO	National Sample Survey Organisation
NTZ	North Telangana Zone
O&M	Operation and Maintenance
OC	Other Caste
OCT	Opportunity Cost of Time (Rs./Capita/Day)
ODF	Open Defecation Free
OLS	Ordinary Least Squares
OpEx	Operational Expenditure
PC	Partially Covered
PCI	Per Capita Income
PCS	Post-Construction Support
Percent HC	Proportion of House Connections
Percent SC/ST	Proportion of Scheduled Castes/Scheduled Tribes (lowest social category) Households
PercentHHBUY	Percentage of Households Buying Water
PHE	Per Household Expenditure
PHED	Public Health and Engineering Department
PMU	Project Management Unit
PPC	People's Planning Campaign
PPCS	Professional Post-Construction Support
PRA	Participatory Rural Appraisal
PRIs	Panchayathi Raj Institutions
PSPs	Public Stand Posts
QIS	Qualitative Information Systems
QPA	Qualitative Participatory Assessments
RCC	Reinforced Concrete Cement
RGNDWM	Rajiv Gandhi National Drinking Water Mission
RSMU	Reforms Support and Management Unit
RSPMU	Reforms Support and Project Management Unit
RWS	Rural Water Supply
RWS Department	Rural Water Supply Department
RWSS	Rural Water Supply and Sanitation
S	Summer
SA	Social Audits
SAC	Social Audit Committee
SC	Scheduled Caste
SC/ST	Scheduled Caste/Scheduled Tribe
SDI	Social Diversity Index
SDMs	Service Delivery Models
SEE	Sustainability Evaluation Exercises

SGBSA	Sant Gadge Baba Swachchata Abhiyan
SHGs	Self Help Groups
SLEC	Scheme Level Executive Committee
SLGB	Scheme Level General Body
SMS	Short Messaging Service
SNCOST	Sanitation Provision Cost
SNSL	Sanitation Service Level
SNSLacc-o	Sanitation Service Level in Terms of Accessibility Measured as % of Households Owning a Toilet
SNSLacc-p	Sanitation Service Level in Terms of Accessibility Measured as Perception of the Household
SNSLuse	Sanitation Service Level in Accessibility (percentage of Households Receiving Above Basic Accessibility)
SOs	Special Officers
SOURCE	Source of Water
SRPP	Sector Reform Pilot Projects
SRZ	Scarce Rainfall Zone
SS	Sub-Standard
SSD	Sustainable Service Delivery
SSL	Sanitation Service Level
SSP	Swayam Shikshan Prayog
SSRs	Standard Scheduled Rates
ST	Scheduled Tribe
STM	Scheme Transfer Memorandum
STP	Sewerage Treatment Plants
STZ	South Telangana Zone
SVS	Single-Village Schemes
SVS+MVS	Single Village Scheme + Multi-Village Scheme
SZ	Southern Zone
TAP	Transparency, Accountability and Participation
TCapExHrd	Total fixed capital expenditure by government and households
TDS	Total Dissolved Solvents
TECH-SVS	SVS technology
TExp (Govt+HH)	Per capita per year total government expenditure (fixed + recurring) per year (observed) in Rs.
TExp-Govt	Total EXPENDITURE – Government
TFC	Twelfth Finance Commission
TFM	Total Family Members
TIME	Time spent in fetching water (minutes/capita/day)
TL	Team Leader
TMC	Transition Management Committee
TNRWSP	Tamil Nadu Rural Water Supply Project
TNRWSPP	Tamil Nadu Rural Water Supply Pilot Project

TotExp (Govt)	Per capita per year expenditure (fixed + recurring) per year (observed) in Rs.
TSA	Technical Support Agency
TSC	Total Sanitation Campaign
TW	Tube well
TWADB	Tamil Nadu Water Supply and Drainage Board
ULBs	Urban Local Bodies
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations International Children Education Fund
US$	US Dollar
UTs	Union Territories
Uvt	Error Term
VAP	Village Action Plan
VIF	Variance Inflation Factor
VP	Village Panchayat
VS	Village Size
VWSC	Village Water and Sanitation Committee
WASH	Water, Sanitation and Hygiene
WASMO	Water and Sanitation Management Organisation
WASMO SDM	Water and Sanitation Management Organisation Service Delivery Model
WATERqnt	Water in Terms of Quantity
WATSAN	Water and Sanitation
WB	World Bank
WCPs	Water Conservation Programmes
WDC	Women's Development Committee
WET	Women's Empowerment Team
WHO	World Health Organisation
WHS	Water Harvesting Structures
WQ	Water Quality
WSP	Water and Sanitation Program
WSSD	Water Supply and Sanitation Department
WSSOs	Water Supply and Sanitation Organisations

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Foreword

India's 12th Five Year Plan draft report recognizes the need for improvement in water and sanitation. The Plan envisages major changes in the way National Rural Drinking Water Programme (NRDWP) is implemented and visualises a major break from the past under Total Sanitation Campaign (TSC). Several measures are listed to improve water and sanitation sectors. Two goals are specified for monitoring during 12th plan. These are: (a) Ensure 50 per cent of rural population has access to 40 lpcd piped drinking water supply, and (b) 50 per cent of gram panchayats achieve Nirmal Gram Status by the end of Twelfth Five Year Plan. On drinking water, the report says that the ultimate goal is to provide safe piped drinking water supply at the rate of 70 lpcd. But, "considering that 40 lpcd has been norm over the last 40 years and there is still large population that has yet to receive this level of service, as an interim measure the goal has been kept at 55 lpcd" (p.301, vo.2). Right now 35 per cent rural population have access to 40 lpcd piped water. By the end of 12th Plan, this is targeted to increase to 50 per cent. One of the improvements in the 12th plan approach is that all "new drinking water supply schemes will be designed, estimated and implemented to take into account **life-cycle costs** and not just per capita capital costs" (emphasis added, p.301, vo.2). The new approach also devised a Management Devolution Index (MDI) in order to track and incentivise more substantial devolution of functions, funds and functionaries to the gram panchayats. It also envisages higher allocations for operation and maintenance. Convergence between drinking water supply and sanitation is also recognised as being important. A holistic aquifer and surface water management approach with active community and PRI participation for convergence in a district vision is advocated. A progressive tariff with different pricing tiers for different classes of consumers and incentives may be adopted by gram panchayats when collecting user charges from the beneficiaries.

With the introduction of Nirmal Gram Puraskar (NGP) in 2005, the total sanitation campaign (TSC) received a major boost. In spite of this program, progress is not satisfactory. It may be noted that according to Census 2011, the percentage of households having access to television and telephone in rural India is more than the percentage of households having access to toilet facilities and tap water. The 12th Plan draft report quotes a World Bank study on water and sanitation programme in five states which shows that only 67 per cent of the toilets even in NGP villages were being used while 46 per cent of the toilets were used in non-NGP villages. Several strategies will be followed to strengthen TCS during 12th Plan period. For example, the APL-BPL distinction and the focus on individual toilets are to be replaced by a habitation saturation approach. It is also necessary to institutionalise the integration of water supply with sanitation in each habitation.

Do the changes of 12th plan on water and sanitation suggest a paradigm shift particularly in terms of water security? Or is it business as usual with few modifications? Do they have interesting inclusions such as source sustainability, climate change, etc? Can India's and South Asia's WASH problems be viewed through an "expenditure" lens and more specifically the often poor value for money of both public and private expenditure and how far this will ensure sustainable and equitable service delivery?

The 12th Plan draft report makes a valiant attempt at instigating paradigm shift in the WASH sector. For example, life-cycle costs for drinking water supply schemes is suggested instead of per capita costs. Decentralized approach for service delivery is also recognised. However, some of the issues such as water security, source sustainability, climate change, sustainable and equitable service delivery are not adequately addressed. The government is still relying more on supply side than following demand side approach. It may be noted that sustainable pro-poor service delivery needs more than financial allocations. Understanding the role of institutions and governance in the provision of sustainable services is critical.

In the above context, the research papers in this volume which have been generated from a five year action research project 'WASHcost project' are timely. It provides a detailed analysis of various aspects of the WASH sector in the three core areas of policy, financing and governance. The action-research is based on intensive field studies following a scientific approach to sampling in rural as well as peri-urban areas. This research is based on cost information gathered from 187 villages along with detailed information collected from 107 villages spread over the 9 agro-climatic zones of Andhra Pradesh (A.P.) in India. Within rural and peri-urban areas, the papers examine various aspects pertaining to disaggregated unit costs, service levels, governance, institutional structures, etc. Although the core research of the study is based in Andhra Pradesh, the coverage of 9 agro-climatic regions of A.P. provides the scientific basis for drawing generic conclusions for other regions of India that have similar agro-climatic conditions. Besides, a comparative assessment of service delivery models in four other states of India and a case study of decentralised service delivery model in Kerala provide a country wide perspective and wider relevance of the findings and conclusions.

The study adopted an innovative methodology of life-cycle cost analysis (LCCA) for estimating unit costs and service ladder approach for assessing the service levels. The research done for this study indicates that the cost estimates using LCCA methodology across agro-climatic regions and technologies revealed that rural drinking water investment requirements are often under estimated. This is mainly due to the reason that the cost norms or the standard schedule of rates used do not include number of maintenance and support components, as they focus mainly on infrastructure. While the cost norms are fixed uniformly across the regions or locations, in reality costs vary substantially across and within agro-climatic zones. In terms of technology choices, the policy is moving towards multi-village schemes as the rural water supply scheme design of choice. Unit costs also vary across technologies, especially between single and multi-village schemes (SVS / MVS). The analysis brings out that multi-village schemes (MVS) may not be the best option for sustainable service delivery. High altitude and remote locations seem to suffer with poorer service levels. In the case of peri-urban water also the situation is similar to that of rural areas, as most of the capital costs are spent on infrastructure and the expenditure on other components is either absent or negligible in all the sample locations.

Public investments have helped creating infrastructure up to the village level. But they fail to ensure equitable services across all households, which is the main objective of the guidelines, i.e., providing water security at the household level. Evidence points out that the service delivery is biased against Scheduled Tribe households who are on the lowest strata of the socioeconomic ladder, though the bias in service delivery against Scheduled Caste households is on the decline. Water security planning and governance at the local level is critical for sustainable and pro-poor (equitable) service delivery. The poor services, slippage and waste of investment in the drinking water sector are often attributed to the lack of governance in the sector. Experience from within Andhra Pradesh and also from states like Kerala has clearly shown that decentralised and effective governance structures could help improving service levels and sustainability of the systems. The nationally scaled up central government's *Swajaldhara* programme has not proved to be effective in providing sustainable services in the rural areas. But there are some state specific models in Gujarat, Kerala and Maharashtra that are more innovative in their design and implementation.

Sanitation and hygiene are the most neglected sub-sectors within WASH at the policy level as well as research priority. There seems to be a policy bias against sanitation. Investments or expenditure on sanitation in rural and peri-urban areas are pretty basic and limited to construction of toilets. Very little investments are observed towards solid and liquid waste management and disposal. Though public expenditure on sanitation has helped in creating the much needed infrastructure, it has not influenced the rate of use of the facilities, which is far below the rate of access. The gap is only marginally lower in the "open defecation free" award winning *Nirmal Gram Puraskar* (NGP) villages and peri-urban areas. The Total Sanitation Campaign (TSC) guidelines emphasize pro-poor service delivery, but these are yet to materialise at the village level. The information, education and communication (IEC) programs designed to raise awareness have not been effective on these communities due to their poor designing to suit the low literacy levels and poor economic well-being. Some important governance indicators that could make the difference in the level of the services delivered include improving the performance of water and sanitation committees, transparency and accountability of functionaries in terms of targeting the subsidies towards the poor, and participation of local communities, particularly women and disadvantaged communities in the process of planning and implementation.

The research findings in this volume reveal that the present policy framework for the WASH sector is clearly not effective in providing sustainable and good quality services. The continuation of supply-sided policies are only effective to the extent of creating infrastructure, which is rarely fully functional in the short run and hardly sustainable in the long run. The investments are not effective because they fail to ensure household water security even in the short run. In this context, the WASHCost action-research in Andhra Pradesh complemented by studies from other states identifies the gaps in the sector and provides policy suggestions for sustainable WASH services.

The policy imperatives given in the volume would be beneficial to policy makers. The authors who have been working on the issues relating to WASH sector for considerable time made sincere efforts in this book to be objective and highlighted both strengths and weaknesses of the policies and programs in this sector. There is much here to inform on the lessons learnt from different experiences in Andhra Pradesh and other states. I have no doubt that this high quality book will be a useful resource on WASH sector for researchers, policy makers, and practitioners.

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Mumbai
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April, 2013

Foreword

Despite the considerable achievement of meeting the Millennium Development Goal target on access to water already in 2010, five years ahead of the 2015 deadline, much remains to be done both in water and sanitation and the sector continues to be one of the most poorly-managed in many developing countries, including India.

Human rights standards – to which also India is obliged – determine that water and sanitation have to be accessible, affordable, available, of quality and culturally and socially acceptable to all without discrimination. Disparities in access have to be reduced or even eliminated, services have to be sustainable, people must have access to information as well as appropriate mechanisms to hold their governments accountable.

Despite substantial investments, particularly in water services infrastructure, the majority of India's population still receives inadequate standards of services in an inequitable manner. Investments tend to be made in formal, urban areas, and are not allocated to more dispersed rural areas, or to informal or 'illegal' settlements, leaving significant proportions of the population, and particularly poor, marginalized or disadvantaged persons without service provision.

Furthermore, access levels are not equal across locations, or between different socio-economic groups. There is considerable and increasing evidence that despite improvements in access levels across India, those from scheduled tribes and castes, women-headed households, people living with disabilities and other disadvantaged or vulnerable individuals and groups have limited access to adequate water and sanitation services.

Beyond disparities in access, one of the most significant problems for the water and sanitation sectors is sustainability. Due to insufficient resources (financial and human) dedicated to monitoring and maintaining water and sanitation services, as well as promoting proper sanitation and hygiene behaviour, 'slippage' in service levels is all too common. Providing adequate resources for timely maintenance not only reduces long-term costs, but also has a positive impact on service levels. Similarly ensuring continuous water supply at high pressure rather than water services delivery for a few hours every day not only improves service levels, but protects the whole delivery system from the risk of contamination and from the stress on the pipes of increasing and decreasing pressure.

These issues are global problems, but are clearly articulated in the available data from India. Sanitation and hygiene continue to be under-resourced, with lack of clarity and coordination of policy and programmes. While India has tried to focus on these issues with their sanitation programmes, these have yet to reach all of those who are most in need.

Available subsidies need to be better targeted to ensure that they are not siphoned off by the better-off households. This can be achieved by improving access to information about the existing subsidies, such that the intended beneficiaries, who are often living in marginalized areas know their entitlements.

I am delighted to be providing a foreword to this collection of papers that the Indian IRC WASHCost programme has researched and collated, shedding light on the extent of these problems, of the inconsistency of the state and service providers to comprehensively address the issues of disparities in service levels, in the lack of attention paid and resources committed to sustainability of service provision.

These papers demonstrate the desperate need for all those involved in the water and sanitation sectors to reconsider how budgets are allocated, to ensure that those aspects that are essential for ensuring continuity of service provision, and of sustained behaviour change receive a commensurate part of the budget available for water and sanitation service provision. Resources need to be more consistently allocated to source sustainability, capital maintenance, operational maintenance, post-construction support, and continued awareness-raising of the importance of good sanitation and hygiene practices for dignity, for development and for health.

Programmes in India and around the world have consistently shown that focusing on infrastructure above software aspects of awareness-raising and behaviour change only has short-term benefits. A more effective approach includes improving demand for sanitation at the household level, as this is critical for sustaining service levels.

These collected case studies demonstrate the central role that good governance, specifically the human rights principles of participation, access to information, addressing discrimination and ensuring accountability of state institutions have on ensuring sustainable water and sanitation service provision.

I am pleased to be able to introduce these papers, as they make an important contribution to the long-overdue discussion on how we can help to ensure universal and sustained access to water and sanitation services that are affordable, appropriate, safe, and promote a life lived in health and dignity.

Catarina de Albuquerque
United Nations Special Rapporteur on the
human right to safe drinking water and sanitation
May 2013

Preface

Access to at least a basic level of Water, Sanitation and Hygiene (WASH) services is a Human Right and is among the most important drivers for development across developing countries. Improved and equitable WASH services are expected to result in multiple benefits, viz., health, education, socioeconomic welfare, quality of life, etc. It is estimated that US$ 84 billion per year would accrue with a benefit–cost ratio of 7:1 if the developing countries could achieve the Millennium Development Goals (OECD 2012).[1] In the absence of sustainable basic-level WASH services, communities end up paying substantial costs for poor water and sanitation services, many of which are a major burden for poor households and make a dent in the overall development of any country. It is argued that investing in WASH infrastructure, and maintaining it, would provide high economic as well as environmental returns, especially if the poorest are targeted. In India, investments in the WASH sector do take place, but the service levels received are far from satisfactory, especially concerning sanitation. In most cases, after investments are made, water and sanitation infrastructure do not function properly or at all, service levels are not sustainable, and households slip back to previous poor conditions. Apart from the investments in WASH infrastructure, a number of other aspects are important for achieving sustainable services. Most critical among them are the magnitude and composition of public and private investments, as well as good governance and institutional arrangements for managing the services on a regular basis and ensuring that those that most need it, the poorest and discriminated, do benefit from the development efforts.

This volume is a collection of papers dealing with these critical aspects of WASH service delivery. It presents the cumulative outcome of a five-year action research project titled WASHCost (India) that was located in Andhra Pradesh. However, the research team has worked closely with international WASH networks and key stakeholders across the states of India as well as with other countries where the methodology was developed and applied. In order to provide a broader perspective and context, the book includes two papers based on Kerala, Gujarat and Maharastra experiences.

WASHCost (India) is part of a multi-country action research project covering Burkina Faso, Ghana, India and Mozambique. The project (2008–2012) is funded by the Bill & Melinda Gates Foundation[2] and coordinated by the IRC – International Water and Sanitation Centre, The Netherlands. WASHCost India project was led by Centre for Economic and Social Studies (CESS), Hyderabad, in partnership with Livelihoods and Natural Resource Management Institute (LNRMI) and Watershed Support Services and Activities Network (WASSAN), Hyderabad. Apart from the contributors of the various papers in this volume, a number of sector professionals from India as well as partner countries have contributed to the various stages of the research.

Without the time, patience and responses of more than 35,000 households (including over 10,000 detailed household surveys and about 25,000 rapid household surveys) and numerous community groups spread over 118 rural and peri-urban sample locations, the rich analysis presented in these chapters would not have been possible. Despite these households' never-ending struggle to have decent water and sanitation services, they have never disappointed us in answering probing questions, in the hope that the research might contribute to improve their services in future. Our grateful thanks are due to them.

This action research would not have been possible without the innovative, risk-taking and forward-thinking support from the Bill & Melinda Gates Foundation. Our thanks are due to Head Office grant managers and India staff for their generous support. IRC has provided the research guidance, methods and tools necessary for carrying out the research in a meaningful manner. Our special thanks are due to Mr Nico Terra, Director, IRC, Dr Patrick Moriarty; Dr Christelle Pezon; Ms Alana Potter; Mr Rutger Verkerk; Mr Peter Burr; Mr Peter McIntyre, Ms Jeske Verhagen, Ms Audrey Soest, Mr Joep Verhagan, and Ms Deirdre Casella. As part of the review process, a number of people from within and outside India have commented on the earlier drafts of these chapters. They include: Dr Richard Franceys, Dr Kristin Komives, Mr Arjen Naffs, Dr Kwabena Nyarko, Dr John Butterworth, Dr Kattleen Shordt, Dr P. Padmanabha Rao, Prof. Meera Mehta, Dr Vijay Krishna, Dr Rupa Mukerji, Dr Maria Saleth, Dr Dinesh Kumar, Dr Meenakshi Sundaram, and Dr A. Narayanamoorthy. Their critical inputs have helped improve the quality of the papers, and we thank them for their time and insights.

The Department of Rural Water Supply and Sanitation (RWSS) and the Public Health and Engineering Department (PHED) have provided the critical support and cooperation as partners from the beginning of the project. They have provided all the necessary data and helped in sample selection. They provided logistic support for carrying out the fieldwork spreading across the Andhra Pradesh State. We would like to place on record our heartfelt gratitude and sincere thanks to the Principal Secretaries of RWSS Department (Sri Ajay Misra, IAS; Sri Mruthyunjaya Sahoo, IAS; Smt. Chitra Ramachandran, IAS; and

Sri Vikas Raj, IAS) and Engineers in Chief of Rural Water Supply departments (Mr B. Rajeswara Rao and Mr. Chakrapani). Similarly, the Principal secretaries of Municipal Administration Dr Janardhan Reddy, IAS, and Dr Premchand, IAS, for their constant support and cooperation throughout the project.

Prof. Manoj Panda, and Prof. Galab, Directors, CESS, have been very supportive to all the initiatives taken up in the project and our thanks are due to them. Our thanks are also due to Dr M. Rammohan Rao, who was one of the key persons instrumental in setting up the project. Apart from providing the guidance in organising the team, he contributed to the water audit in some selected villages. Prof. V.N. Reddy provided the sampling frame and list of habitations (villages) selected from the entire list of habitations in Andhra Pradesh. This scientific approach provided the basis for drawing some generic conclusions, and we thank him for all the support. We would also like to thank Prof. Ramachandraiah who helped with the research in the peri-urban areas during the earlier stages of the project. Dr Chandrashekar and his team from Geosoft Technologies Ltd helped in preparing the GIS layouts and maps, and we thank them for their support. Our special thanks are due to all the administrative and finance staff of CESS for their support and cooperation for organising workshops and conferences.

Our thanks are due to our Learning Alliance members from various departments, namely: Sri H. Umakantha Rao, Sri V. Vidyanath Sastry, Sri M. Rama Mohan Rao, Sri. M. Narsinga Rao, Sri A. Sateesh, Sri K. Bangaru Raju, Sri S.S.R. Anajaneyulu, Sri Ch. Mallikarjuna Rao, Sri Ram Gopal Reddy, Sri B. Surender Reddy, Sri S. Bhaskar Rao from RWSS department; Prof. Srinivasa Chary Vedala, ASCI; Sri B. M. Murali Krishna Rao, Ground Water Department; Sri Kishan Das, IFS; Dr C. Suvarna, IFS, Special Commissioner, Rural Development; Dr Tirupathaiah, Director General, WALAMTARI; Sri P. Ananda Rao, Central Ground Water Department; Mr M. Kullappa, Water and Sanitation Programme. The World Bank, New Delhi have provided constructive criticism and comments. Our grateful thanks are due to them. Special thanks are due to all the Superintending Engineers and deputy engineers of RWSS department who rendered their cooperation during the regional sharing and learning workshops.

Finally, we thank all the investigators for collecting the data from rural and peri-urban areas living under unfavourable conditions. Their hard work and commitment has helped in completing the task in time. Similarly, data-entry operators have done a great job in tirelessly making numerous corrections at various stages, and their support is gratefully acknowledged.

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1 Introduction

V. Ratna Reddy, Catarina Fonseca and Charles Batchelor

I Background

Water, Sanitation and Hygiene (WASH) services are central to addressing poverty and the livelihoods and health of the people. Water and Sanitation is a Human Right and is critical in addressing the needs of the poorest as well as achieving the long-standing policy objectives set by the Government of India. India has been investing in the WASH sector over the years. The Government of India (GoI) and the local governments (states) together have spent about US$ 35 billion (1$=Rs.45.72) over the last six decades of planning (GoI 2011) to provide adequate potable water to more than 90 percent of rural people in 1.5 million habitations, which is a major accomplishment in terms of coverage. An average of US$ 4 billion per annum was spent during the 11th plan period (2007–2012) alone (GoI 2011). However, the share of rural water supply and sanitation in the total government plan outlays has remained around 2 percent since 1980s. Of this, the share of sanitation is marginal, i.e., less than 10 percent (Reddy and Jayakumar 2011).

The Millennium Development Goals (MDG) target for drinking water is on track, but the target for achieving Open Defecation Free (ODF) status by 2015 is far behind (Figure 1.1). The Indian Government spent 0.57 percent of the GDP on water and sanitation in 2008, which fell to 0.54 percent in 2009, and further to 0.45 percent in 2010 (UNICEF/WHO, 2011). On a per capita basis, this represents a modest US$ 3 per capita or US$ 13 per household per year, when compared to other countries with similar levels of development. Some of the estimates at the global level suggest that the allocations range between 0.03 percent (South Korea) and 6.29 percent (Democratic Republic of Congo) of their respective GDP (Hall and Lobina 2010). For India, the allocation required to achieve 100 percent household coverage is 0.64 percent of its GDP, which is modest given India's current growth rates. However, these estimates take into account only infrastructure requirements, rather than a comprehensive view of the cost of providing sustainable service delivery.

It is also known that lack of adequate sanitation leads to significant losses for the country. As per a recent study carried out by Water and Sanitation Programme (WSP), the economic losses linked to poor sanitation are of the order

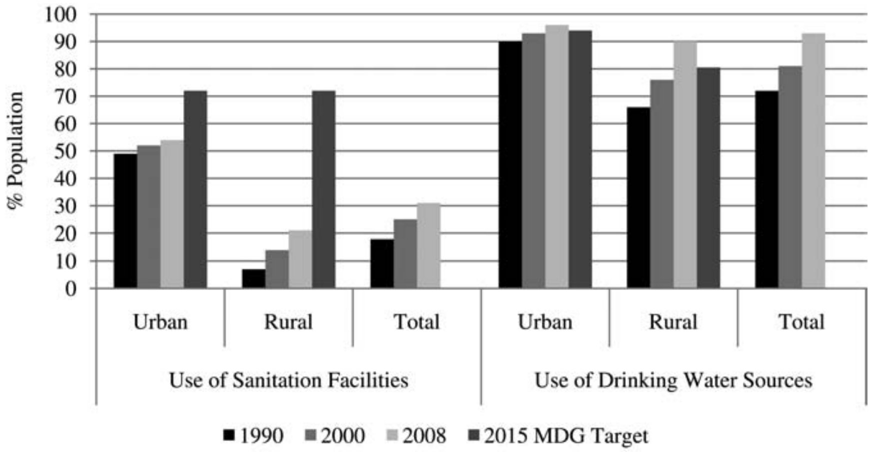


Figure 1.1 Attaining MDGs in sanitation and drinking water in India (Source: UNICEF/WHO 2011)

of Rs.2.4 lakh crores (US$ 53.8 billion), or Rs.2,180 (US$ 48) per person. This amounts to 6.4 percent of the Gross Domestic Product (WSP 2010). While the country has come a long way, the linkage between inadequate sanitation coverage and economic loss is of extreme political, social and economic significance.

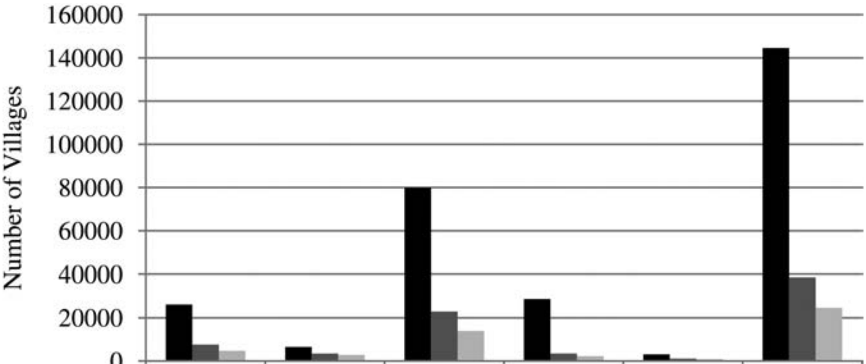
The reasons often identified for poor WASH service levels are many. They include:

- low allocations towards operational expenditure (OpEx) and capacity building (IEC);
- absence of proper governance structures; and
- poor planning and implementation (RWSN 2009 and Jha 2010).

Water quality is another serious problem in a substantial number of habitations (Figure 1.2).

Community-centric institutional delivery models are proving to be unsustainable in the majority of cases on account of complexities in management that require professionalism and improved capacity – technical, financial, as well as managerial (RWSN 2009 and Jha 2010). In the drinking water supply landscape, once the capital investment phase is over, asset management responsibility is transferred to the PRIs[1] and communities, which have never been properly capacitated. To add to the existing complexity and management challenges, the national draft for the XIIth Five Year Plan (2012–17) envisages enhancement of rural service level from 40 to 55 lpcd and a shift to piped water supply with house connections.

While the low allocations towards recurrent maintenance are well recognised, the overall allocations towards the sector for attaining full coverage and



	Fluoride	Arsenic	Iron	Salinity	Nitrate	Total
■ Total	26180	6548	80015	28706	3133	144582
■ Targeted	7613	3477	22936	3507	1134	38667
■ Covered	4724	2818	13975	2226	912	24665

Figure 1.2 Presence of contaminants in habitations across India (Source: UNICEF/WHO 2011)

achieving sustainable service delivery against the real requirements is less explored and understood. These problems are further compounded due to poor efficiency. A study by the World Bank (2008) clearly brings out the inefficiencies in drinking water systems across states in India. Systems are often run below the designed capacities in terms of length of service (number of hours of water supply) and quantity and quality of water supplied. While financial sustainability is widely recognised, source sustainability is less understood at the policy level. As a result, costs of providing water do not take the source protection/rehabilitation costs into account when calculating the unit costs.

In the context of sustainable service delivery, the following aspects are critical:

- environmental, institutional, social, financial sustainability of WASH service delivery;
- equitable access to poor, marginalised and unreached people;
- cost efficiency and/or value for money at each stage of the life-cycle (includes capital, operation and maintenance, capital maintenance costs, etc.).

From a policy point of view, the challenges include:

- how to ensure sustainable WASH services to rural and urban users, and the cost involved;
- identifying the necessary components of such costs and how to finance them; and

- ascertaining the institutional modalities or governance structures required for effective and sustainable service delivery?

Understanding the variations in costs and service levels across locations would help in understanding the specific locational issues, such as technologies, agro-climatic conditions, water sources, etc. Both financial and economic costs need to be assessed in order to realise the extent of household contribution in the sector. Often, households are forced to spend, in terms of money and/or time, to supplement the poor public service levels. Household costs therefore vary according to the service a household receives and the service it requires. Service levels vary across locations and socioeconomic groups.

For sanitation, the extent and effectiveness of subsidies in improving the sanitation service levels is critical to provide policy direction. While public subsidies help in creating infrastructure (toilets) at the household level, the usage of such infrastructure has been observed to be limited. Similarly, sustaining activities promoting sanitation – such as clean village award ('Nirmal Gram Puraskar'), where a village is rewarded with cash for achieving ODF status – has become a major challenge. In the absence of effective implementation of such activities, especially in terms of behavioural change, slippage in sanitation is also becoming common. Hence, understanding the reasons for slippage assumes policy importance.

Sustainable pro-poor service delivery demands more than financial allocations. Effective and efficient use of these allocations, as well as implementing the programmes in the right spirit, needs institutional support. Understanding the role of institutions and governance in the provision of sustainable services is critical. In the context of governance and institutions, important aspects include decentralisation of the existing institutional structures and their effectiveness in terms of transparency, accountability and participation (Takahiro and Imai 2010).

It is often argued that decentralisation of service delivery is more effective. What could be the main bottleneck for decentralisation in the context of WASH services? Under what conditions is decentralisation effective, especially in the changing socioeconomic context? Such understanding and identification of the dynamics that make decentralisation effective is critical for designing effective WASH sector policies.

With this background the papers in this book assess the service levels in comparison with the unit costs, along with a wide range of other issues, in the context of WASH in rural as well as peri-urban areas in India. This collection of papers deals with a wide range of issues pertaining to the WASH sector in rural and peri-urban locations. They cover the three important aspects of costs, service delivery and governance of the WASH sector. The book describes findings by adopting an innovative methodology for estimating unit costs and assessing service levels. All the contributions are interconnected around the broader theme of sustainable service delivery in the context of developing countries in general, and South Asia in particular.

II Status of WASH sector in India

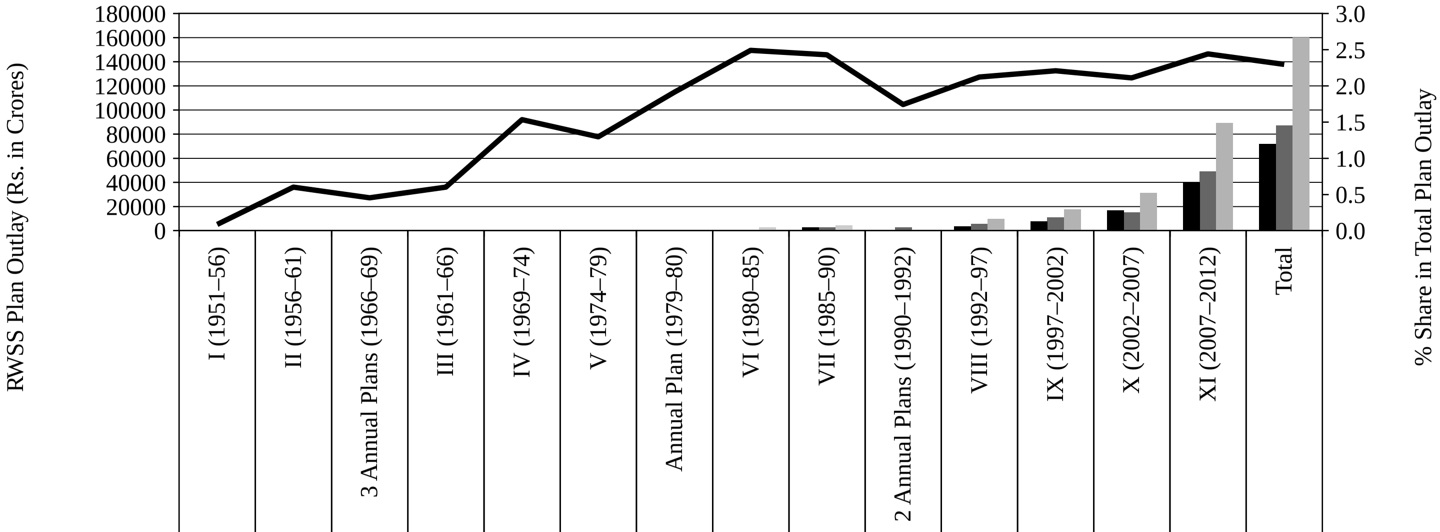
Investments in the Sector and Coverage Achieved

Since 1951, India has invested more than Rs. 1,59,218 crores (i.e. Rs. 1,592,180 million, about US$ 35 billion[2]) in the WASH sector. The investment in the sector have increased substantially after the 8th plan (1992–97) (Figure 1.3). These allocations include contributions from central as well as state governments. Though state governments are expected to contribute matching allocations, their contribution has always been less than that of the central government except during the 11th plan period. Allocations towards rural and urban WASH sectors had an almost equal share till 2007. On a per capita basis allocations towards the rural WASH sector were marginal, as rural areas account for 70 percent of the total population. In terms of WASH sector's share in the plan outlays, it has stagnated at around 4 percent over the last two decades (Figure 1.4) – a substantial portion, if not the entire allocation, of these investments were for creating infrastructure (GoI 2008). Further, there was no specific allocation towards maintaining these infrastructures in the long run. This could be one of the reasons for the poor sustainability of the systems and the slippage experienced at the village level. Though water is a State subject under the Indian Constitution, the Central Government plays a critical role in terms of providing policy guidance and fund allocations. This division of financial management often creates problems in terms of timely release of funds and matching grants from states.

The budgeted unit costs for providing water do not take into account the need for ongoing source protection or system rehabilitation costs. In the absence of appropriate costing and planning for yearly recurrent investments in the water and sanitation sector, slippage has become a common phenomenon.

Water Supply: Coverage and Slippage

Progress made in the WASH sector in terms of service provision (Figures 1.5 and 1.6) is not proportional with the large allocations over the public budget plans or the economic growth India has been recording over the last decade, though there has been a substantial increase in the proportion of villages considered 100% covered with water supply during the last decade (Figure 1.5). The progress in coverage is measured in terms of access to infrastructure (such as overhead storage, distribution systems and household connections), with least concern for the service levels effectively delivered in terms of quantity, quality, reliability, etc. Though Indian national norms and standards for water supply provision specify these attributes, in reality they are not used as indicators for monitoring the real progress achieved. Similarly, investment requirements in the sector are estimated with regard to access to water infrastructure, rather than access to water services (Hall and Lobina 2010).



	I (1951–56)	II (1956–61)	3 Annual Plans (1966–69)	III (1961–66)	IV (1969–74)	V (1974–79)	Annual Plan (1979–80)	VI (1980–85)	VII (1985–90)	2 Annual Plans (1990–1992)	VIII (1992–97)	IX (1997–2002)	X (2002–2007)	XI (2007–2012)	Total
Centre	0	0	0	0	34	107	0	895	1906	0	4140	8455	16254	40150	71991
State	0	30	29	48	208	348	240	1580	2471	2361	5084	10773	15102	49000	87227
Total	0	30	29	48	242	505	240	1425	4377	2361	9224	19228	31356	89150	15921
% Share	0.1	0.6	0.4	0.6	1.5	1.3	1.9	2.5	2.4	1.7	2.1	2.2	2.1	2.4	2.3

Figure 1.3 Investments in water and sanitation in India over the Plan periods (Source: Plan Documents, Planning Commission, Government of India)

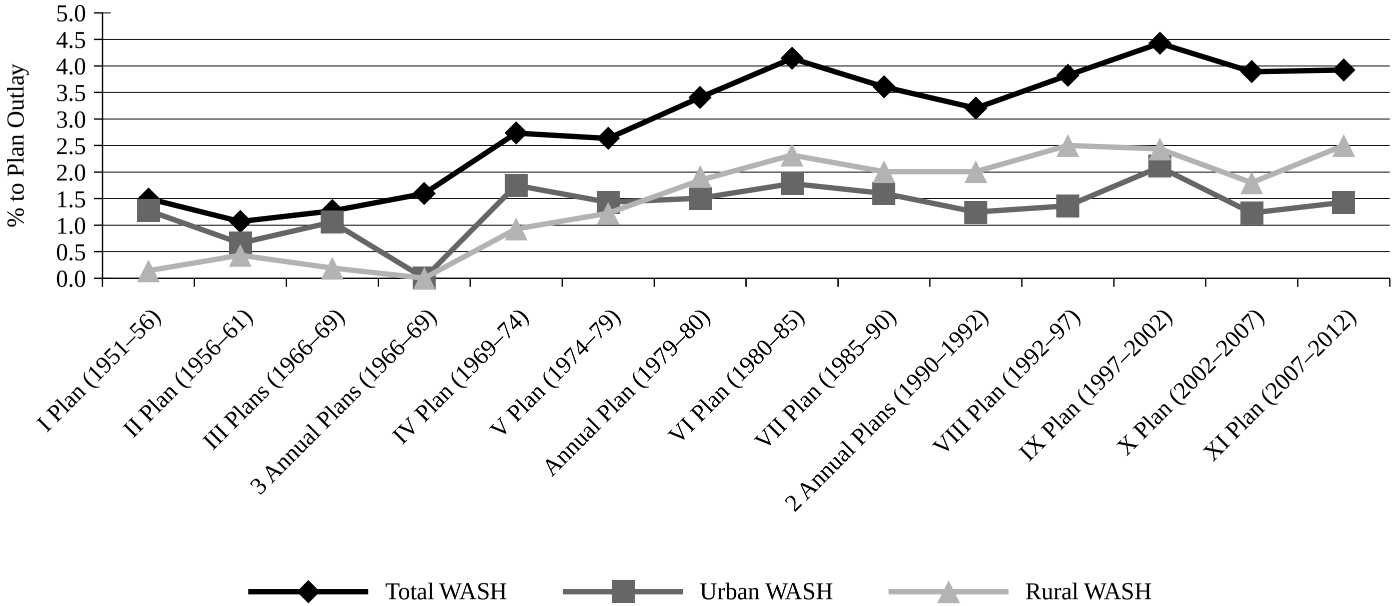


Figure 1.4 Share of WASH sector in the Plan outlays (N.B. The 11th Plan figures are provisional) (Source: Plan Documents, Planning Commission, GoI)

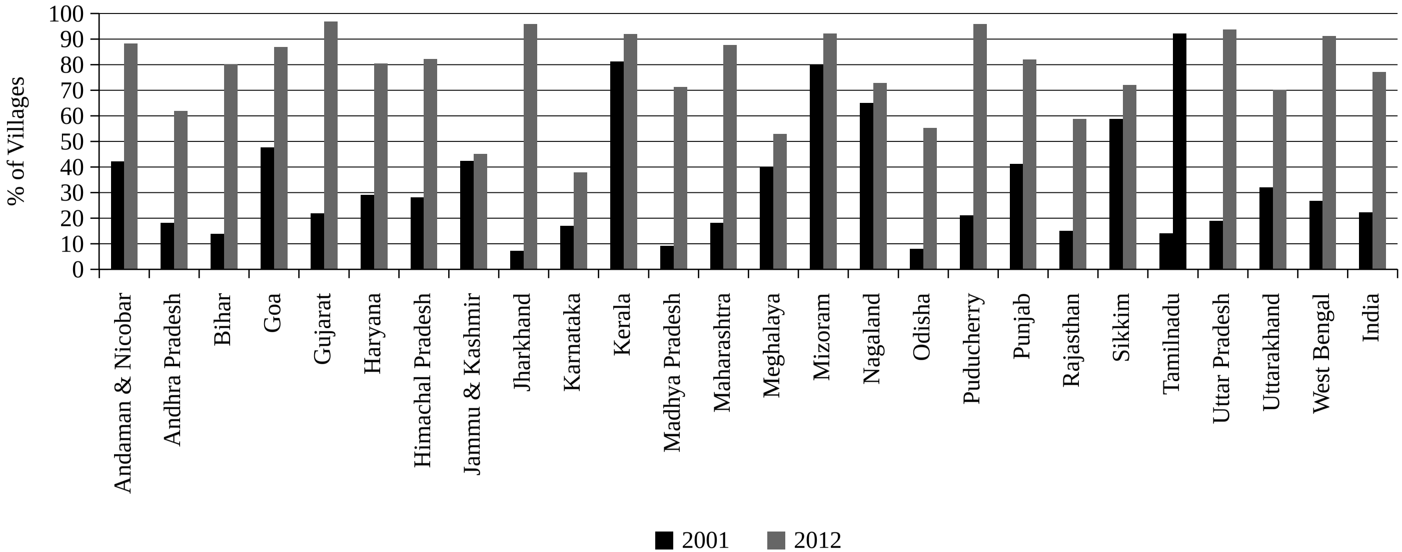


Figure 1.5 Status of coverage of drinking water in rural areas across states in India (% of villages). (Source: Census 2001 and GoI, Department of Rural Water Supply, for the 2012 figures)

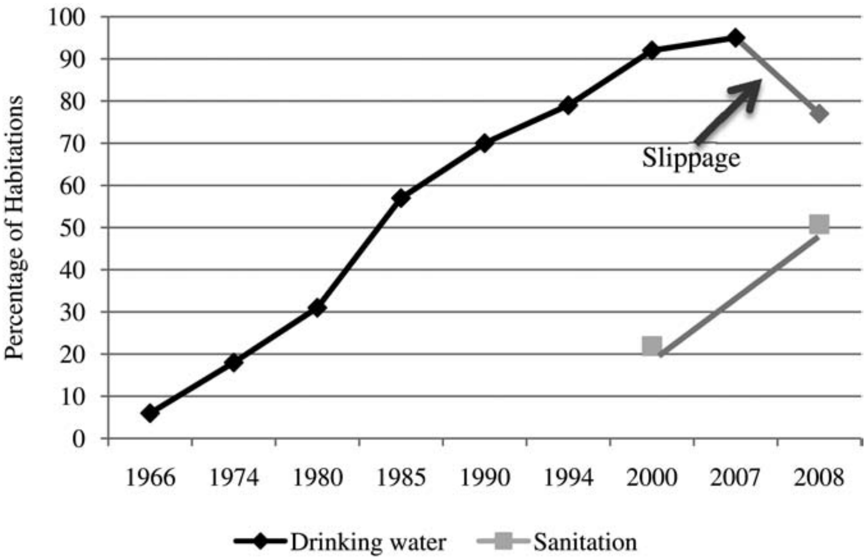


Figure 1.6 Coverage and slippage in drinking water and sanitation in rural India (Source: GoI 2008)

As a result, poor water service levels are evident from the extent of slippage in rural water (Figure 1.6) and the demand–supply gap in urban areas. Slippage means that service levels either deteriorate or fluctuate between full and partial coverage or there are no safe-source situations. As at 1 April 2009, about 5,10,916 (0.52 million) habitations (villages) out of the total 16,59,741 (1.66 million) habitations in India, i.e., 30 percent, have slipped back from full coverage to partial coverage; while another 1,79,999 (0.18 million) habitations (11 percent) were identified as affected in terms of water quality (GoI 2010a). Moreover, these aggregate habitation level figures mask the fact that even in the fully covered (FC) habitations there is a strong possibility that some households, colonies or hamlets will have lower service levels.

In the case of urban areas, 46 percent receive less than the Central Public Health and Environmental Engineering Organisation (CPHEEO) norms, while 77 percent receive less than the city norms based on population (NIUA 2005). The reasons, apart from the changes in the definition of coverage,[3] include source sustainability, poor operation and maintenance, increased population, increased awareness of water quality due to the increased testing facilities, and increased contamination due to intensive agricultural practices and poor environmental management (GoI 2010a).

Sanitation and Hygiene: Open-defecation-free Status and Slippage in the Use of Toilets

Sanitation and Hygiene continue to be a nagging policy issue in India even after a decade of implementing the Total Sanitation Campaign (TSC). Though sanitation coverage has improved over the last two decades, it is estimated that of the 1.2 billion people worldwide who practice 'open defecation', 52 percent or 626 million people live in India according to the 2011 Census (GoI 2011). The sanitation coverage (households having access to a toilet) in India is about 45 percent, doubling from 22 percent in 2001 (GoI 2012). According to the latest population census, 31 percent of the rural households have access to toilets, while 67 percent still defecate in the open; moreover, there are wide variations across the states – access to toilets in rural areas is as low as 8 percent in Jharkhand and as high as 93 percent in Kerala (Figure 1.7).

The GoI target of achieving ODF status at the national level by 2012 is far behind. According to a recent assessment of the TSC, Sikkim had achieved 100 percent ODF status by 2008 (WSP 2010). However, the 2011 Census shows that none of the states have achieved ODF status. As per the 2011 Census, in fact, 11 percent (rural: 15 percent; urban: 2 percent) of the households in Sikkim still practice open defecation, while Kerala has reported the lowest percentage of households (4 percent overall; rural: 6 percent; urban: 2 percent). Thus, there is a wide gap between census (45 percent) and department (68 percent) estimates on sanitation coverage (Figure 1.8). In the case of urban areas, only 34 percent of the population depend on Low Cost Sanitation (LCS), indicating that LCS is not a preferred option. With regard to waste water treatment, only 49 percent of the towns have Sewerage Treatment Plants (STPs), and only 37 percent of the waste water generated is being treated at present (NIUA 2005). On the other hand, 88 percent of the solid waste generated is being collected in the urban areas.

Having access to toilets does not mean that people will use them, and there is a wide gap between access and use of toilets in India, as several recent studies across the country confirm. Only in 109 out of the 162 Gram Panchayats (GPs) surveyed was toilet usage higher than 60 percent (WSP 2010). Another study by the Government of India in 12 states, 56 districts, and 664 GPs also found that toilet usage was 80 percent in the Nirmal Gram Puraskar (NGP) villages at the aggregate level and as low as 45 percent in states like Bihar. Further, Andhra Pradesh and Uttar Pradesh are the other two states reporting above 20 percent slippage among the NGP villages (GoI 2011). The gap between access and use needs to be monitored in a systematic manner.

Both financial and institutional arrangements are observed to be closely linked to the TSC performance (WSP 2010). However, the performance of TSC is measured in terms of ODF status, while monitoring the use of latrines at the household level is quite poor. Differentiating between monitoring access to infrastructure and use appears to be the key to understanding the underlying causes of poor sanitation in rural areas and improving financial and institutional arrangements to address this situation.

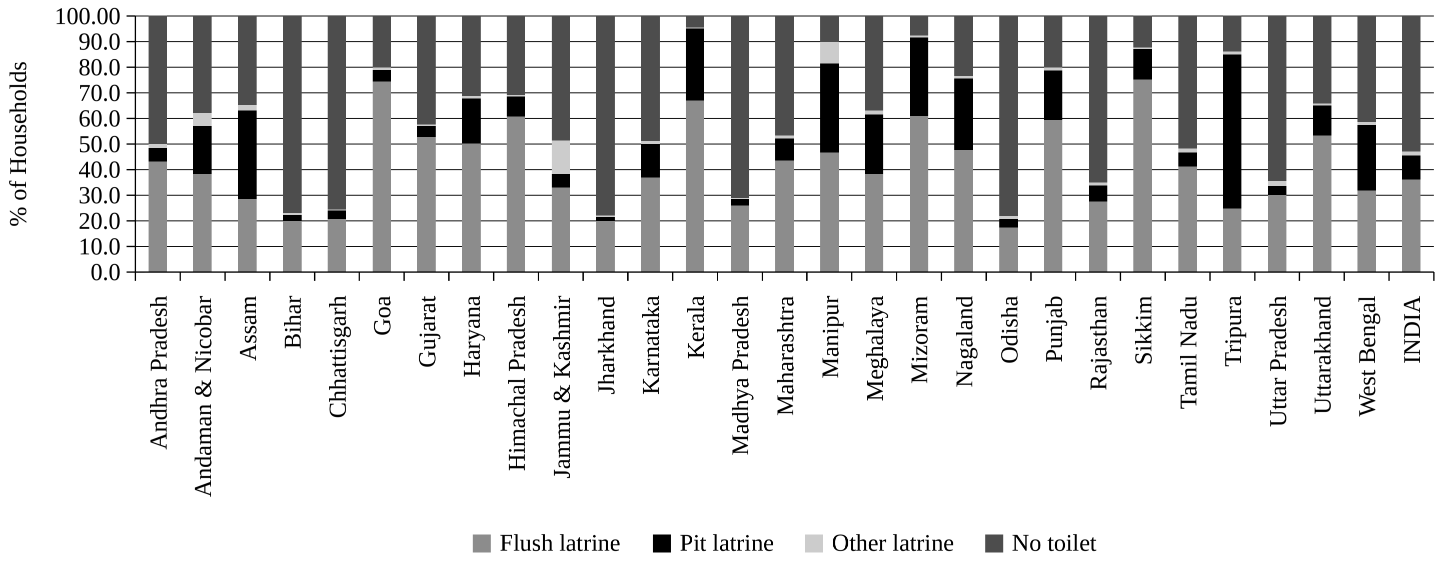


Figure 1.7 Status of sanitation coverage of various types of sanitation (rural and urban) across states in India (% households) (Source: GoI 2011)

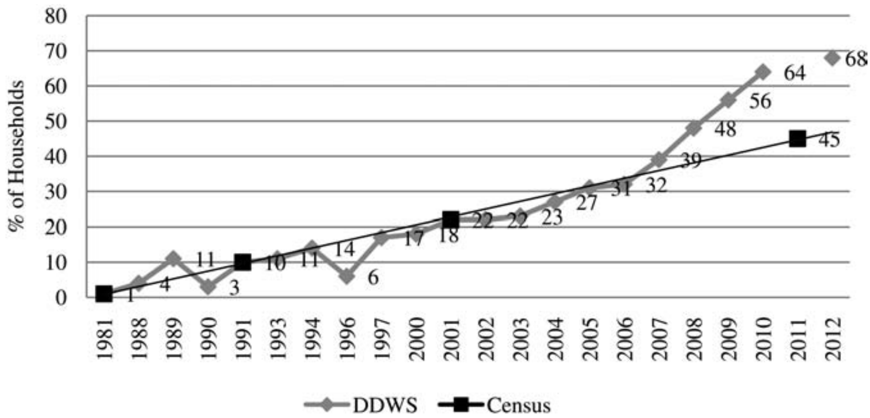


Figure 1.8 Trends in access to toilets in India (Source: GoI 2011)

Water and Sanitation Technologies Used in India

Multiple sources of water are used by households in India. Most important are taps (house connection or public stand post), Hand Pumps (HP)/Tube Wells (TW), and open wells (Figure 1.9). Of these, tap water is the safest source and requires different techno-institutional arrangements – tap water supplies require pumping, treatment, storage, and distribution facilities. Managing these aspects at the local level is complex and costly when compared to other sources. Different institutional models are being adopted over the years and across the states. These include decentralised institutional models, as in Kerala, and autonomous institutional arrangements, as in Gujarat. These models also

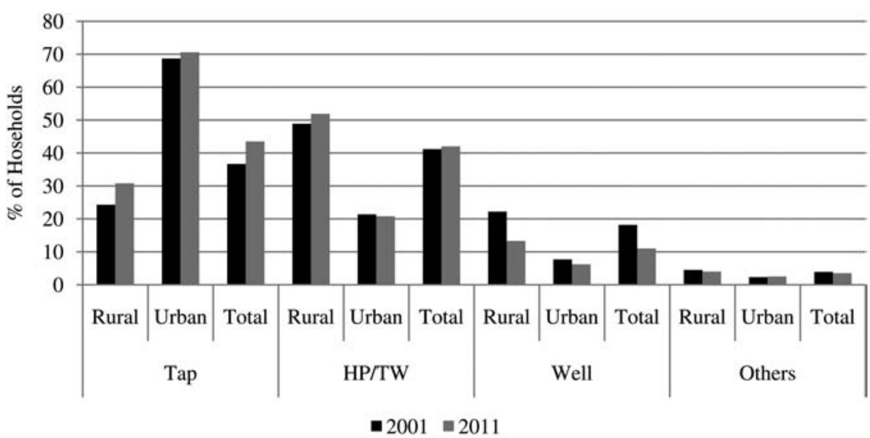


Figure 1.9 Types of drinking water sources used by households in India

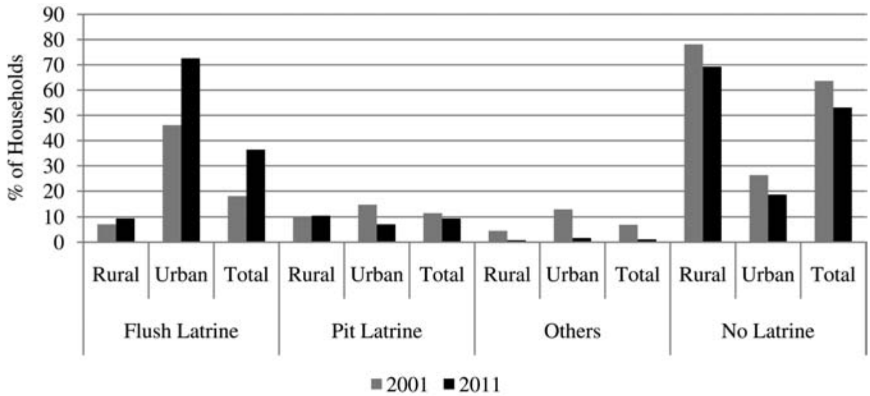


Figure 1.10 Types of latrines used by households in India

adopt different cost recovery approaches as per the central guidelines. The effectiveness of such models is discussed in some of the chapters of this book. In rural areas, hand pumps and wells continue to be the predominant sources of water, as more than 70 percent of the households still depend on these two sources (Figure 1.9).

In the case of sanitation, flush and pit latrines are the major types adopted at the household level (Figure 1.10). Use of flush latrines went up substantially in urban areas between the 2001 and 2011 censuses. The increase in the proportion of households using latrines in rural areas is tardy, and pit latrines are the main type used. Flush latrines require more water, and the sewerage disposal systems require complex techno-institutional systems.

Status of WASH in the State of Andhra Pradesh

In Andhra Pradesh (AP), out of the 72,387 habitations in the state, about 44,463 (61 percent) are fully covered (FC); 27,528 (38 percent) are partially covered (PC), and the remaining 396 are water quality affected habitations as on 1st April 2012. The status of coverage varies widely across the districts. The approximate amount spent in creating rural water supply and sanitation infrastructure, including rehabilitation and extension, between 2004 and 2008 was over Rs.200 million (USD 4.4 million). Groundwater schemes cover about 72 percent of the habitations, while surface water schemes cover the remainder.

It is estimated that about 24,654 habitations slipped from the full coverage category to partial coverage/no safe source (NSS)/no coverage (NC) during the last ten years. This is more than 30 percent of the total number of habitations in the state. However, the official data for the years 2006–2008 indicate that the extent of slippage is about 15 percent (GoAP 2008). Slippage ranges from zero in districts like West Godavari up to over 60 percent in Kadapa

District. And Karimnagar and Guntur districts recorded about 40 percent slippage.

The reasons for slippage include depletion (quantity) and degradation (quality) of groundwater, poor operation and maintenance of the sources and systems, population growth, etc. It is often argued that the high dependence on groundwater (72 percent) for drinking is at the core of the problem. The number of wells increased from 1 million to 2.2 million, and the area irrigated using groundwater increased from 1 million hectares to 2.6 million hectares during the last three decades. Well density increased from less than 5 wells to more than 20 wells per sq km in the last two decades. Yield of dug wells declined from 60–150 cum/day to 20–40 cum/day, while that of bore wells declined from 2.5–10 litres per second (lps) to 0.8–2.5 lps (Jain *et al.* 2009). This reflects the poor water governance in the state, since the situation could have been predicted or avoided through better and integrated planning across different departments that deal with water.

Currently, the focus at the policy level to overcome the problem of groundwater over abstraction is to shift to surface water sources. While this is an easy option, provision of surface water is often difficult, due to natural and geographical reasons (access) and high costs. Moreover, even surface water sources could face the risk of slippage/uncertainty if governance/demand management aspects and climate change are neglected. Besides, the quality of surface water is always questionable. Also, surface water resources in semi-arid areas are under a lot of pressure and, arguably, overcommitted in many areas. Moreover, the efficiency and sustainability of these surface sources have yet to be established in the face of the conventional wisdom that 'groundwater is more reliable and generally of better quality than surface water especially during periods of prolonged drought'. The crux of the problem, therefore, seems to lie not with the source of water *per se* but with the mismanagement of water resources.

The impacts of many water and sanitation programmes are limited in the state, and many systems either break down or are abandoned well before their designed life. The life span norms are often calculated in terms of technical life, economic life and useful life.[4] The technical life span is often much longer than the economic and useful life spans. The average life span for the relevant WASH components ranges between roughly thirty and forty years in terms of technical life span, but works out as 10–30 years in terms of economic and useful life spans.[5] However, such life spans for the components are hardly experienced or observed in real life.

Operation and maintenance of the systems is another critical factor influencing slippage and is also a governance issue. What sort of governance would facilitate sustainable service delivery? Important governance structures in WASH services at the village level include centralised O&M (department), decentralised O&M (gram panchayat), NGO-managed, and privately managed. All these structures have positive as well as negative influences in terms of service delivery. More importantly, some of the structures, especially the decentralised models, are not perfectly operational in terms of devolution of powers and capacities. The challenge is to identify appropriate governance structures and develop appropriate information, education and communication (IEC) systems for enhancing the capacities of the community as a whole and to inculcate the necessary stewardship at the local level (Merrey and Cook 2012).

The sustainability of water supply, in the sense of continued delivery and uptake of services, is threatened by numerous technical, attitudinal, institutional and economic factors. Therefore, supply-sided, demand-sided or community participation approaches on their own are no guarantee of success. There is need for a comprehensive understanding and management/governance of water resources in an integrated manner, incorporating supply, demand and institutional approaches. Lessons from across the country in this regard would be helpful in formulating generic policies (RWSN 2009 and Jha 2010).

Changes in the Policy Context in India: From Infrastructure to Services

The latest Government of India guidelines on rural water supplies (GoI 2010a, p. 7) emphasise a shift away from the conventional approach of normative service levels measured only in litres per capita per day (lpcd) and towards water security at the household level. This means an intention to provide every rural person with adequate safe water for drinking, cooking and other domestic basic needs on a sustainable basis. This basic requirement should meet minimum water quality standards and be readily and conveniently accessible at all times and in all situations. Additionally, equity in terms of access, quantity, quality and reliability across socioeconomic groups and geographical locations needs to be ensured in line with the Human Rights Declaration for Water Supply and Sanitation.

The 2010 guidelines, in order to ensure water security across locations and socioeconomic groups, recognise the importance of source sustainability by recommending that States allocate 20 percent of the funds to that end. Substantial allocations are also stipulated for water quality (20 percent), operation and maintenance (10 percent) and to mitigate the impact of natural calamities/climate changes (5 percent), alongside the allocation for increasing coverage (45 percent at the state level). The guidelines also propose the devolution of resources and responsibilities to local bodies (gram panchayats, the lowest level of local government in India) with the line departments playing only a facilitating role.

In the case of sanitation, the new guidelines for TSC envisage a community-led and people-centred strategy for sanitation by adopting a demand-driven approach (GoI 2010b). As per the guidelines, subsidies for individual household latrine units have been replaced by incentives to the poorest of the poor households such as better targeting and improved demand. Sanitation is characterised by substantial private investments at the household level, especially for the construction of toilets.

School sanitation in rural areas is a major component and an entry point for wider acceptance of sanitation by the population. IEC is given a high priority in order to generate demand for individual sanitation. Eight components have been identified for achieving total sanitation. These include:

- start up activities (5 percent);
- IEC (15 percent);
- rural sanitation marts (5 percent);
- revolving funds (5 percent);
- subsidies for individual household toilets[6] and community toilets (60 percent);
- institutional sanitation for schools and *anganwadis* (day care centres);
- ecological sanitation; and
- solid and liquid waste management (10 percent).

While the new guidelines for water and sanitation attempt to deviate from the earlier approach which focus mainly on infrastructure construction, they do not provide a framework for operationalising these guidelines. The guidelines do not provide any realistic assessment of funding requirements though they provide relative allocations for each component. Often, unit costs are estimated using norms based on the normative life of the systems and the standard schedule of rates. For instance, the cost estimates suggested in the case of household toilets are much below the market rates. Therefore, unit cost based on real expenditure would help to make these guidelines effective. Disaggregated unit costs not only help to provide an estimate of funding requirements but also to set realistic service delivery targets. The Life-Cycle Cost Approach (LCCA) provides an appropriate framework for arriving at disaggregated unit costs of various components that are part of the new guidelines.

LCCA provides the real disaggregated costs in the life-cycle of water and sanitation service delivery to the poor and non-poor in rural and peri-urban areas involving decision-makers and stakeholders at every level. LCCA also seeks to influence sector understanding of why life-cycle cost assessment is central to improved service delivery and to influencing the behaviour of sector stakeholders, so that life-cycle unit costs are mainstreamed into WASH governance processes at all institutional levels (Salem 1999; Lundin 2002; Barringer 2003; McConville 2006).

A fully developed life-cycle cost model will include various components that represent acquisition as well as sustainability costs (Barringer 2003, Fonseca *et al.* 2011), which are termed as fixed and recurrent costs. The LCCA cost components include not only the construction and operational costs but also the rehabilitation and IEC costs. The cost components include: capital expenditure on hardware (initial construction cost, CapExHrd); capital expenditure on software (CapExsoft); capital maintenance expenditure (rehabilitation cost, CapManEx), cost of capital (CoC), expenditure on direct support (ExDS), expenditure on indirect support (ExIDS), and operation and maintenance costs (OpEx).

III About the Book

This book compiles the action-research undertaken by the WASHCost India project over a period of five years. The action-research was based on cost information collected from 187 villages along with detailed household information gathered from 107 villages spread over the 9 agro-climatic zones of Andhra Pradesh State in Southern India. On the whole, the research is based on primary data collected from more than 10,000 households. The sampling approach and the representation of various agro-climatic regions make the analysis and results applicable across various parts of India. The research was grounded in Andhra Pradesh; however, due to the interactions of a multi-country, multidisciplinary group of researchers and the interactions with stakeholders both at national level in India as well as other countries and international learning events in South Asia, the research findings acquired more of a regional nature.

This book is divided into seven parts, consisting of 14 chapters. The chapters cover both the rural and urban WASH sectors in India. Within each sub-sector, the papers examine various aspects pertaining to disaggregated unit costs, service levels, governance and institutional structures, etc. Experiences in other parts of India, such as Kerala and other states, are also drawn in order to provide a country-wide perspective.

Outline of the Book

The policy environment provides the basis for appropriate service delivery in any sector. India has more than five decades of WASH policy implementation and evaluation. A critical review of policies and their evolution puts the present WASH policy in perspective (Chapter 2). Identifying the policies is essential for making them effective at the implementation level. The review brings out the policy biases between urban and rural on one hand and urban and peri-urban on the other, and also highlights the bias against sanitation. The review questions the basic premises of dealing with sanitation in India and the rationale and effectiveness of subsidies to rural households for construction of toilets. Further, the feasibility of achieving water security at the household level in the context of the existing overall water policy and other related policies is explored. It is pointed out that the challenges faced by the peri-urban locations are bypassed in the policy discourse.

Assessing the life-cycle costs of service provision is expected to provide the basis for policy formulation and budget allocations. In India, normative unit costs are used to arrive at budget or financial allocations to the WASH sector. These norms are based on the technical life span of the systems and do not take into consideration all the cost components that are required for sustainable service delivery. In order to arrive at a more realistic cost estimate, a life-cycle cost approach is used. The theoretical framework of the LCCA used, its relevance to the WASH sector, and its practical adaptation in the present study context forms the core of Chapter 3. The framework provides a detailed account of various components of the LCCA and how they were measured in the present study. Limitations and practical problems associated with the approach are also discussed.

Using the life-cycle cost methodology, disaggregated unit costs are estimated across agro-climatic regions and technologies (Chapter 4). The estimates highlight inter- and intra-regional variations in unit costs and compares them with normative costs fixed by the government. It is observed that unit costs vary widely across regions and villages. Similarly, there are variations in costs across technologies, but cost ranges can be established as benchmarks. Altogether, eight technologies for supplying water have been identified across the sample villages. Since Multi-Village Schemes (MVS) are being promoted instead of Single Village Schemes (SVS) at the policy level, cost comparisons between these two (SVS/MVS) have been made. These costs are then compared with the service levels achieved to show that higher costs and more sophisticated technologies are not necessarily associated with better service levels.

Detailed analysis of factors influencing variations in costs and service levels across the sample villages provides valuable insights for understanding the cost drivers as well as service bottlenecks. A number of cost and service level indicators, along with the factors influencing them, have been identified using statistical analysis. Regression analysis is used to identify and estimate the parameters influencing cost and service levels across villages. The analysis provides the basis for setting policy priorities for cost-effective service delivery. It argues that while unit costs are driven by various demographic and socio-economic factors, service levels at present are not driven by unit costs, especially given the limited government expenditure towards recurrent costs (Chapter 5).

Similarly, life-cycle costs, along with service levels and the factors influencing them, are examined for sanitation (Chapter 6). The detailed analysis of factors influencing access to and use of sanitation infrastructure helps us understand the slow progress in service levels. At the same time, the performance of recent interventions such as the *Nirmal Gram Puraskar* (clean village award or NGP) under the total sanitation campaign needs critical evaluation. An attempt is made to present evidence on the slippage issues even in the case of villages that have claimed to have achieved Open Defecation Free (ODF) status (Chapter 7). The analysis shows that, despite the best efforts towards achieving ODF in villages, sustaining the status has become a major challenge. The rationale and effectiveness of such promotional activities at the policy level is examined, and the missing links in the process of achieving total sanitation are identified.

The peri-urban analysis of the costs and service levels across 18 peri-urban locations has shown that high costs are not necessarily associated with better service levels (Chapter 8). The analysis compares the financial and economic costs of provision of WASH services. The nature of household expenditure in the peri-urban context is examined; further, a regression analysis is done for the factors influencing household costs and service levels using the household data.

Equity in the distribution of services is critical for sustainability in the long run. Equity in the WASH sector can be analysed within communities and across communities, viz., across space (horizontal) and across communities (horizontal). Access to and distribution of WASH services across communities with varying socioeconomic attributes, such as income and social groups, gender differences and spatial (location) variations, are important for equity analysis. It is observed that service levels are biased against socioeconomically disadvantaged populations: one reason is their location relative to the distribution system and lack of power in decision-making (Chapter 9).

How the current policies and practices result in unintended consequences for the water services of poor and marginalised social groups within and between villages is shown using advanced mapping techniques (Chapter 10). It is argued that the 'source protection' or 'water conservation' measures that are promoted as a major component of water security plans can, and often do, intensify agricultural water use, rather than improving the security of rural or municipal supply.

Over the last decade, policies have promoted different Service Delivery Models (SDMs) in the rural drinking water supply sector in India. These include the national demand-driven *Swajaldhara* programme of the Government of India; the WASMO programme of the Government of Gujarat; and the World-Bank-supported schemes in Maharashtra (*Jalswarajya*) and Kerala (*Jalanidhi*). A comparative study of these innovative approaches to service delivery at national, intermediate and system levels finds that the government's *Swajaldhara* programme has the least potential for sustainability, even though it has been scaled up nationally (Chapter 11). On the other hand, other approaches that are smaller in scale and scope have greater potential for sustainability and subsequent scaling up. Despite the absence of any formal assessments, an overview suggests that the smaller SDMs may be cheaper and provide more benefits than the national *Swajaldhara* model. The key success factors behind the spread and sustainability of the smaller SDMs and challenges for future scaling up are also explored.

Though investments in WASH sector are necessary for improved access to infrastructure, they may not ensure sustainable service delivery, especially in terms of equity. WASH governance plays an important role in providing the appropriate institutional structure that helps to improve pro-poor service delivery. The linkages between governance and service delivery are explored using the framework of Transparency, Accountability and Participation (TAP) and a set of indicators pertaining to various aspects of governance in the sample villages (Chapter 12). It is observed that the absence of governance systems is a visible reason behind the low services levels and the presence of strong local institutions could make a difference. Insights from the decentralisation case study from Kerala (Chapter 13) help in designing programmes for inclusive and sustainable service delivery.

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2 WASH Sector in India: The Policy Context

V. Kurian Baby and V. Ratna Reddy

I Background

India has been making water policies and programmes for drinking water and sanitation since its independence. Though recent policies have evolved from various policies over the years, they make a marked difference and are set to tread a new path towards water security and sustainable service delivery. Some of the important issues in this regard include:

- How are the new guidelines different from the earlier policies?
- How are these policies and guidelines going to impact unit costs and service levels? and
- How far could these guidelines be operationalised, and what could be the institutional requirements?

Such an assessment calls for a review of the new policies, the existing institutional arrangements, and their potential in achieving the policy objective of water security 'for all and forever'. This chapter aims to help identify the gaps in the policy as well as institutional requirements. It is mainly based on a review of policies over the years in India with the main focus on the new guidelines pertaining to water in general and drinking water, sanitation and hygiene in particular. A critical assessment of these guidelines in achieving the policy objectives is taken up for water and sanitation.

In order to improve the sector efficiency and sustainable service delivery, the Government of India in April 2010 has issued a set of comprehensive and purposive guidelines (GoI 2010a). These guidelines indicate a marked shift towards addressing key sector concerns in line with the principles of sustainability – in quantity and quality – adequacy, convenience, affordability and equity. Recently, the Ministry of Drinking Water Supply and Sanitation (MDWSS) has presented its long term strategic plan (2011–2022) for ensuring drinking water security to all rural households (GoI 2011). The strategic plan aims to cover 90 percent of households with piped water and at least 80 percent of households with tap connections during the period. The strategy emphasises achieving water security through decentralised governance with oversight and regulation, participatory planning, and implementation of improved sources and schemes. Sustainable service delivery mechanisms are a central feature of the programme, with state institutions or Zilla Panchayats implementing and managing large multi-village schemes, delivering bulk water to villages in water stressed areas, and GPs implementing and managing in-village and intra-Panchayat schemes. The strategy highlights source sustainability measures, water quality safety, monitoring and surveillance, convergence of different development programmes, and building professional capacity at all levels. Thirdly, the GoI has released a new National Water Policy 2012 (GoI 2012) to take cognisance of the existing situation and propose a framework for creating an overarching system of laws and institutions along with a plan of action with a unified national perspective.

On the sanitation front, central guidelines were released in June 2010 (GoI 2010a). The Total Sanitation Campaign (TSC) and the *Nirmal Gram Puraskar* (NGP) – clean village award – as an incentive programme with awards for 'open defecation free' (ODF) villages, is an effective step by the GoI to promote sanitation facilities and eradicate open defecation practices through information and awareness-raising campaigns. Under the *Nirmal Bharat* Vision (GoI 2010b), the strategy is to:

- create totally sanitised environment by 2017 through achieving ODF and a clean environment, where human faecal waste is safely disposed of;
- adopt improved hygiene practices by 2020 through adopting safe hygiene practices by all at all times; and
- effectively manage solid and liquid waste by 2022, so that the village environment is kept clean at all times.

Important challenges in the case of sanitation include:

- low usage of toilets; and
- slippage among NGP villages.

Both financial and institutional arrangements are observed to be closely linked to the TSC performance (WSP 2010).

As stated, in conjunction with the new strategic plan 2012–22, the Water Policy 2012, the National Rural Drinking Water Programme (NRDWP) and sanitation guidelines 2010 mark a set of overarching policy guidelines to act as a sector road map. However, the policies have seldom been implemented fully and monitored effectively with rigour and commitment. Water being a state subject in federal India, the impact of GoI guidelines on states is limited, though central allocations and grants are substantial. Notwithstanding the basic question of the relevance of GoI guidelines in creating a Procrustean bed, the political imperatives of discretionary allocations widen the policy-implementation gaps. The institutional dichotomy between *de jure* responsibilities with Panchayati Raj Institutions (PRIs) that are financially, technically and managerially weak, and *de facto* powers with Government departments/water boards, poses a serious threat to operationalising the guidelines in letter and spirit. Here we explore the implementation gaps and attempt to recommend modalities for better operationalisation in order to achieve sector strategies and goals.

II Policy Evolution

WASH policies in India were initiated way back in 1949 immediately after independence, with the setting up of the committee on Environment and Hygiene (Bhor Committee) (see Table 2.1 below). A nominal allocation of Rs.3 crores was provided towards rural drinking water and sanitation during the first plan period (1951–6); whereas urban water supply and sanitation was allocated Rs.43 crores. The first ever National Rural

Table 2.1 Drinking water supply programmes and policies at a glance

Year	*Policy Event*
1949	The Environment Hygiene Committee (1949) (Bhor Committee) recommends the provision of safe water supply to cover 90 percent of India's population in a time frame of 40 years.
1950	The Constitution of India specifies water as a state subject.
1969	National Rural Drinking Water Supply Programme launched with technical support from UNICEF, and Rs.254.90 crores is spent during this phase, with 1.2 million bore wells being dug and 17,000 piped water supply schemes provided.
1972–3	Government of India introduces the Accelerated Rural Water Supply Programme (ARWSP) is to help states and union territories accelerate the pace of coverage of drinking water supply.
1981	India, as a party to the International Drinking Water Supply and Sanitation Decade (1981–1990) declaration, sets up a national-level Apex Committee to define policies to achieve the goal of providing safe water to all villages.
1986	The National Drinking Water Mission (NDWM) launched under the Technology Mission to accelerate country-wide provision of drinking water services.
1987	The First National Water Policy drafted by the Ministry of Water Resources giving first priority to drinking water supply.
1991	The NDWM renamed Rajiv Gandhi National Drinking Water Mission (RGNDWM).
1993	The 73rd Constitution Amendment makes provision for responsibility for providing drinking water to be assigned to the Panchayat Raj Institutions (PRIs).
1999	Formation of separate Department of Drinking Water Supply (DDWS) in the Ministry of Rural Development, Government of India. To ensure sustainability of the systems, steps are begun to institutionalise community participation in implementing rural drinking water supply schemes through sector reform. Sector reform ushers in a paradigm shift from

Year	*Policy Event*
	the 'Government-oriented, supply-driven approach' to 'people-oriented, demand-driven approach'. Government's role reoriented from that service provider to facilitator. As a part of reform principles Total Sanitation Campaign (TSC) is initiated to ensure sanitation facilities in rural areas with the specific goal of eradicating the practice of open defecation. TSC gives strong emphasis to Information, Education and Communication, capacity building, and hygiene education, for effective behaviour change with the involvement of PRIs, CBOs, and NGOs.
2002	Scaling up of sector reforms initiated in the form of *Swajaldhara* programme. National Water Policy revised; priority given to serving villages without adequate sources of safe water and improving level of service for villages classified as only partially covered. India commits to Millennium Development Goals to halve (from 1990 levels) the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015.
2005	Government of India launches the *Bharat Nirman* Programme, with emphasis on providing drinking water within five years to 55,069 uncovered habitations, habitations affected by poor water quality and slipped-back habitations, based on 2003 survey. Revised sub-mission launched as component of ARWSP for focused funding of quality-affected habitations.
2007	Pattern of funding under *Swajaldhara* changed: 50:50 centre–state share.
2009	National Rural Drinking Water Programme launched from 1 April by modifying ARWSP and subsuming earlier sub-missions and miscellaneous schemes and mainstreaming *Swajaldhara* principles.
2010	Department of Drinking Water Supply renamed Department of Drinking Water and Sanitation. New Guidelines for drinking water (NRDWP) and sanitation issued along with strategic plan.
2011	Department of Drinking Water and Sanitation upgraded as separate Ministry of Drinking Water and Sanitation (MDWSS).
2012	Draft new water policy.

Source: Adopted and updated from Twelfth Five Year Plan – 2012–2017: Report of the Working Group on Rural Domestic Water and Sanitation, Ministry of Drinking Water and Sanitation Government of India, September 2011.

Drinking Water Supply Programme (NRWSP) was launched in 1969 with technical support from UNICEF. The sum of Rs.254.90 crores was spent under this programme on digging 1.2 million bore wells and on 17,000 piped water supply schemes. The history of planned investment in rural water sector in independent India started in 1972–3 with the launch of the Accelerated Rural Water Supply Programme (ARWSP). Under this (1972–86), the thrust was to ensure provision of adequate drinking water to rural communities through the Public Health Engineering (PHE) system. The second-generation programmes were started with the commencement of the Technology Mission in 1986–7, renamed in 1991–2 the Rajiv Gandhi National

Drinking Water Mission. During this period attention was given to water quality, technology intervention and human-resource development support. The year 1987 saw the first water policy in India that set drinking water as its first priority.

From the governance and institutional perspective, the 73rd Constitutional Amendment of 1993 created the basis for decentralisation of WASH services by putting the management responsibilities in the hands of PRIs at the village level. In the same vein, to ensure sustainability of the systems, steps were initiated to institutionalise community participation in the implementation of rural drinking water supply schemes through sector reforms. The year 1999 could be considered another landmark year for the WASH sector, with the formation of a separate Department of Drinking Water Supply in the Ministry of Rural Development. In addition, the WASH sector became subject to sectoral reforms, emphasising investment sustainability – both technical and financial, progressively moving towards a decentralised institutional framework. These ushered in a paradigm shift from the 'government-oriented, supply-driven approach' to 'people-oriented, demand-driven approach'. The role of the Government was reoriented from that of service provider to facilitator. The same year also saw a special focus on sanitation for the first time. The Total Sanitation Campaign (TSC), part of the reform principles, set out to ensure sanitation facilities in rural areas with the specific goal of eradicating the practice of open defecation. It laid strong emphasis on Information, Education and Communication (IEC), capacity building, and hygiene education for effective behaviour change with the involvement of PRIs, CBOs, and NGOs.

The start of the third-generation programmes (1999–2000) was marked by sector reform projects involving the community in the planning, implementation and management of drinking-water related-schemes; these were later scaled up as *Swajaldhara* in 2002. Under this programme, flexibility was given to the states/UTs to incorporate the principles of decentralised, demand-driven, area-specific strategy, taking into account all aspects of the sustainability of the source, system, finance and management of the drinking water supply infrastructure. The National Water Policy was revised in 2002 with priority to underserved villages in terms of quality and quantity. India has expressed its commitment to the Millennium Development Goals (MDGs) of by 2015 reducing by half (from 1990 levels) the proportion of people without sustainable access to safe drinking water and basic sanitation.

During 2005 the GoI launched the *Bharat Nirman* Programme, with emphasis on providing drinking water within a period of five years to 55,069 uncovered habitations, habitations affected by poor water quality, and slipped-back habitations, based on 2003 survey. Then 2009 saw the merger of all the existing programmes and missions under the uniform programme of National Rural Drinking Water Programme (NRDWP), mainstreaming *Swajaldhara* principles.

In 2010 came another milestone in the history of WASH policies in India. The Department of Drinking Water Supply was renamed the Department of

Drinking Water and Sanitation, and more importantly new guidelines for drinking water and sanitation (GoI 2010a) were introduced which mark a clear shift from the earlier policy guidelines. For the first time, the guidelines moved away from the conventional approach of normative service levels measured in litres per capita per day (lpcd) and towards water security at the household level, which includes equity aspects. In order to ensure water security across locations and socioeconomic groups, they recognised the importance of source sustainability, allocating 20 percent of the funds to it. Substantial allocations were also made for water quality (20 percent), operation and maintenance (10 percent), and to mitigate the impact of natural calamities/climate change (5 percent), in addition to the allocation for coverage (45 percent at the state level). The guidelines also proposed the devolution of resources and responsibilities to local bodies (Gram Panchayats, the lowest level of local government in India), with the line departments playing only a facilitating role.

The new guidelines for the Central Rural Sanitation Programme (CRSP) were also issued in June 2010 (GoI 2010c). These guidelines have emphasised a move towards a 'demand-driven' approach named 'Total Sanitation Campaign (TSC)'. This puts more emphasis on IEC, human resource development, capacity development activities to increase awareness among the rural people, and the generation of demand for sanitary facilities. This will also enhance people's capacity to choose appropriate options through alternate delivery mechanisms fitted to their economic condition. The programme is being implemented with a focus on community-led and people-centred initiatives.

The TSC also intends to tap children's potential as the most effective advocates of good sanitation practices in their own households and schools. The aim is also to provide separate urinals/toilets for boys and girls in all the schools/*anganwadis* in rural areas, and the strategy is to create demand for sanitation through promotional activities and technology options that suit the people's requirements. Subsidy for individual household latrines has been replaced by incentives for the poorest of the poor households. Rural school sanitation is taken up as an entry-point activity for creating awareness. The IEC campaign is to be made specific to the location (region). A decentralised approach is being adopted by involving PRIs, co-operatives, SHGs, NGOs, etc. Intensive IEC activities, along with entry-point activities, are expected to bring about behavioural changes and affect demand for sanitation facilities. Alternative delivery systems, proper technical specifications, designs and quality of installations are provided to effectively fulfil the generated demand for sanitary hardware. The cost composition includes: start-up activities (5 percent); IEC (15 percent); market support (5 percent); infrastructure – subsidies on ISLs, schools and *anganwadi* sanitation, etc. (60 percent); solid and liquid waste management (10 percent), and administrative costs (5 percent). Following the new guidelines, the Department of Drinking Water and Sanitation was upgraded as a separate Ministry of Drinking Water and Sanitation in 2011, and in 2012, the new water policy is being introduced.[1]

III WASH Policies: Critical Issues for Operationalisation

This section contains a brief review of the recent guidelines in conjunction with the new Draft National Water Policy 2012 and the strategic plan 2012–17, set against the vision and the policy goals outlined therein. The idea is to look at evidence of how well the guidelines have been actually translated into action and what the implementation gaps are. It also examines whether or not the key processes and methodologies that are prerequisites for achieving policy goals have been set in motion, monitored and progressed. This analysis would support a set of recommendations that could accelerate the pace of operationalisation. An assessment of the policy guidelines highlight three policy/operational concerns:

- water security issues;
- institutional and governance issues; and
- policy paradigm.

Water Security and Holistic Approach

The guidelines stress the value of a holistic approach. However, there is very little that the guidelines can do to promote this, on account of the institutional and budgetary fragmentation. The most critical concern, source sustainability, needs a more holistic approach that takes into account competing uses, along with conservation and savings in agriculture. An analysis of the relationship between rainfall runoff and groundwater/stream flow levels over a period of time shows that groundwater depletion enhances rainfall infiltration, but reduces runoff yields. Similarly, aquifer depletion also brings down groundwater outflow, thereby reducing stream flows. The complexity of environmental flow dynamics has never been understood scientifically (Batchelor *et al.*, 2012). The political economy of water makes the analysis difficult. Rigorous analysis and studies are required to incentivise and regulate intersectoral prioritisation and transfer of water on the basis of differential incremental value.

Additionally, though the NRDWP guidelines provide for earmarking funds for source sustainability, most of the investments are engineering-driven, like check dams; this may only encourage shifting water resources from downstream/environmental/agricultural, etc. purposes, to drinking, without augmenting resources to compensate for the incremental demand (Batchelor *et al.*, 2012). We need a fundamental U-turn to shift the emphasis from production-storage-distribution to source sustainability. Nor are the committees constituted to vet proposals driven by environmental sustainability considerations. And the states use the source sustainability window as yet another hardware funding stream. The same is true of sanitation, where infrastructure allocations are as high as 60 percent, despite the reduction in household subsidies. Though IEC activities get reasonable allocations, the actual expenditure is quite low in most cases. Similarly, allocations towards solid and liquid waste management are either inadequate or not spent. Therefore, the actual funding requirements on ground need to be properly estimated, and the expenditure needs to be monitored.

Poor governance has resulted in weak convergence at policy, programme and institutional levels and has consistently undermined efforts to achieve water safety and security. The GoI, as part of its initiatives in operationalising 2010 NRDWP guidelines, has now identified about 10 districts in different agro-climatic zones to pilot the concept of village water security. However, the programme is partial, as its focus is restricted to 'drinking water security', and does not address the critical factors of sustainable convergence and governance. Moreover, the water security plans are carried out at the village level instead of focusing on water security at the basin, watershed or aquifer level. A minimum requirement for a water security plan is to prepare the plan at the hydrological unit level or sub-watershed level.

Approaches towards sustainable WASH service delivery and most of the action research programmes hitherto have been largely focused on improved system performance without adequately addressing the fundamental question of source sustainability, which is an integral part of water security at micro, meso and macro levels, both in the medium and the long run. Undoubtedly, research and experiments on improved hardware performance in developing context have generated global best practices; however, critical issues of the sustainability of such models at scale have remained as elusive as ever on account of:

- institutional fragmentation and convergence challenges;
- weak process of decentralisation and poor capacities of PRIs; and
- unsustainability of source and related trade-offs, legislation and regulatory frameworks that are either weak or virtually impossible to implement, given the nature of India's huge informal water economy.

The GoI has constituted a committee for convergence in the context of the MGNREGA, but at the field level, various operational issues still impede progress. The states have very little incentive to utilise MGNREGA as a potent instrument towards water security by adopting location-specific interventions. MGNREGA needs to be suitably modified and implementation streamlined, as this is an open-ended opportunity for water security once the operational field-level issues are ironed out and technical quality and transparency ensured. Water security and sustainable service delivery is also critically linked to other related sectors, such as agriculture, rural development, groundwater, and energy. The externalities arising from these interlinked sectors could strengthen or subvert water security at the community as well as household level.

Institutions and Decentralised Governance

Despite all their good intentions, the guidelines are weak in effectively addressing the critical issues of institutional and legal reforms essential to create an enabling environment for sectoral change. The drinking water crisis is manifested mainly in terms of poor coverage, inefficient service delivery, exclusion and unsustainability, which are largely managerial issues. Asset management, fundamental to O&M efficiency and improved service level, has been entrusted to weak PRIs/communities. Until the country has resolved the decentralisation conundrum, rationalised institutional mandates, and capacitated the PRIs, there is no clear solution for operation and maintenance (O&M) unsustainability (GoI 2010b). Alternatively, every state should be allowed to develop contextualised O&M mechanisms. In order to achieve source sustainability, conjunctive use and the question of water rights should be much more holistically addressed, delinking land and water rights within a workable regulatory and enforcement model.

Drinking water and sanitation is a state subject. Though India has a constitutionally decentralised governance structure, in practice, it is only deconcentrated. The decentralisation process has been implemented in varying degrees, and in most states, the devolution has been limited to transfer of O&M responsibility (GoI 2010d). Most of the states have created Village Water and Sanitation Committees (VWSC) under the sectoral reform programme (*Swajaldhara*), but none of the states can boast functional VWSCs. Thus, PRI-centric decentralised governance is still evolving or stagnating.

Local government institutions need comprehensive support to carry out their mandates for ensuring service provision. Increasing capacity and competence as part of mainstream public sector reforms is badly needed if the local government is to play this role fully. Local private sector provision needs to be stimulated and supported to help deliver more professional services and higher (more complex) levels of service. NGOs should be encouraged to transform themselves from service providers into professional support agencies to PRIs. They should support community mobilisation and advocacy/demand generation, especially in the case of sanitation, on a competitive basis. Though the guidelines have emphasised the decentralised governance and community participation, the mainline investments are still heavily supply-driven engineering solutions. In order to operationalise the guidelines, clarity of mandates, roles and responsibilities and building capacities are required.

As the PRIs do not have adequate capacities, technical and financial and sector allocations are managed by line departments – they mostly perform agency functions without much ownership. The twin processes of decentralisation and sector reform have often orphaned the rural water sector, while the more obviously 'influential/visible' urban utilities and comprehensive schemes are being managed by Public Health and Engineering Departments (PHEDs). Even in relatively well-established states where comprehensive frameworks have been established, the local government is often weak, ill-equipped, and poorly resourced to carry out the mandate of ensuring water (or indeed any) services. Structured support for local governments is seldom in place, and normally not adequately budgeted for. Lack of meaningful fiscal decentralisation remains a core barrier to sustainability. The options are either to decentralise and capacitate, or mandate the builder/provider to be accountable for maintenance as well.

The major reason for sector failure is weak management and institutional capacities. Given the constitutional mandate of decentralised governance for the country, the options are:

- to make water boards/departments autonomous corporate entities and enable them as technical service providers on a competitive service contract;
- to integrate the lower functionaries of water departments with PRIs; and
- to allow water boards to bid for service provision on a competitive basis.

There is evidence that the role of the public sector in supporting PRIs in improving service delivery has a significant edge over the private corporate sector.

One of the key factors inhibiting sustainability is weak yet rigid institutions. Significant investments are required to initiate and sustain the change-management process and to build capacities and reorientation. The GoI has made commendable beginning in earmarking component-wise allocation; however, at the implementation level, the spirit is diluted, and mechanisms for tracking deviation are inadequate. Fundamental to change management is clarity in accountability, which is not fully reflected in the operational guidelines.

Participation and volunteerism are key assumptions for stronger and more effective institutions under the guidelines. However, the broad contours of the concept need to be redefined in the changing socio-economic fabric of rural India. The assumptions need to be recast based on rational economic behaviour by individuals/communities and the shifting dynamics of social capital. A major reason for unsustainability is the absence of professional/quality technical and other support services to communities and PRIs at affordable rates. The scope to move from volunteerism to more professionalised management is evident globally. There are excellent models within the country that facilitate the formation of federations of Beneficiary Groups (BGs) and support WASH-centric micro-enterprises. The separation of service (maintenance) authority from provision functions (building infrastructure) is essential. At present the Rural Water Supply and Sanitation Department assumes both roles. Communities retain the ultimate management and decision-making power, through their elected representatives (either in local government or in water boards). However, they are equally able to separate out specific tasks, or all of the operation and maintenance, to entrepreneurs. An adequate framework for regulating such functional specialisation, and service provision needs to be fostered for a vibrant private sector that competes with public utilities.

Policy Paradigm

The guidelines and draft water policy have an indicative bias towards privatisation. However, contextualised privatisation models globally show only mixed results. An ideal framework would be selective market participation subject to the capacity of regulatory governance. The water sector being a state subject, and due to the varying ideological frames and governance capacities, India needs a very cautious and balanced approach on merit. The best-intentioned and -designed reforms in the water sector may be frustrated if key partners (state governments) work against them. In India, where water has become a scarce factor of production, action in the water sector should be consistent with other key economic factors.

The new GoI policy emphasises a shift towards piped water supply plus house connections. The shift is perfectly in accordance with the demand drivers, such as rate of economic growth, rising expectations, growth in rural populations, and trends towards more densely populated rural villages and small towns moving up the ladder from basic point sources to reticulated systems with street or household connections. At the same time, there remain a significant and growing number of people in rural areas relying on point sources, particularly for the poorest and most scattered populations. Studies have shown that typically for every comprehensive scheme, around 30 percent of the households are excluded from services on account of technical and other challenges. Moreover, the guidelines appear to be regressive and biased against scarce-rainfall regions. Moving away from lpcd norms and towards water security, the guidelines provide flexibility in fixing the norms. That is, a lower norm is acceptable for scarce regions due to supply constraints. However, this goes against the inclusiveness principle across regions, when the aggregate norms are being raised from 40 lpcd to 55 lpcd. Hence, the core objective of public provision is to ensure adequate and reliable access to quality services and not piped connection *per se*.

In India, it is ironic that water sector reforms are largely in rural areas, leaving the urban and relatively rich sectors untouched. Further, while the rural poor are expected to pay full or partial cost recovery, the urban rich are heavily subsidised. Many peri-urban settlements are not served, and the households pay heavily in a vendor-controlled water market. This dichotomy needs to be addressed seriously in order to ensure effective reforms. The main challenge is switching from a build-and-rebuild approach to a build-and-expand approach, where the Gram Panchayats (GPs) maintain their facilities, and the states invest in expanding systems to meet the demands of the growing population aspiring for higher and sustainable services. The real choice is political – whether, as a nation, we need satisfied people with sustainable services, or short-term political gains derived from harbouring utilities and providers that are accountable to political leaders, and not directly to the people. Once that choice is made, then the going is easy – make utilities and providers autonomous and accountable contractually where the weaker sections of the population are subsidised and not the bad utilities.

Though the guidelines emphasise the importance of inclusion, equity and gender, specific measures to ensure inclusive and equitable service delivery have not been spelled out for operationalisation. Most often, the poor are excluded from service delivery and also they are ill-served. Specially targeted approaches giving appropriate and affordable technology options must be offered. Specific strategies are needed for last-mile coverage in drinking water and sanitation, and to generate demand for improved access and coverage. More clarity is required for subsidies, targeting and analysis of real outcomes and inter-generation equity. A special indigenous people component plan should be built into the allocations and monitored by independent agencies and results should be published in order to ensure compliance of the implementing agencies.

For the policy guidelines to be effective, there must be the right mix of incentives and disincentives structure embedded – positive or negative, market or non-market. Water is a socio-economic good; but the approach towards tariffs, cost recovery, subsidies, and cost efficiency are not clear in the guidelines. Sheltered under this ambiguity, institutional inefficiencies thrive, and there exist very weak accountability structures. Basic reforms to alter and ensure provider accountability are not visible in the guidelines. Water tariffs are also to be seen as a way of actively managing demand, setting prices according to long-run marginal costs. There is evidence of enough elasticity of demand in the household sector to make tariffs an effective instrument for water demand management. Additionally, central allocations could be used as a powerful tool to incentivise efficiency; instead it is seen that profligacy and waste get incentivised. Utility level subsidisation of inefficiency always leads to poor performance, as evidenced by the abnormally high (35–40 percent) amount of unaccounted water. For communities, there are new opportunities for construction, and no one is accountable for the cost of failures – as if the schemes are designed to fail.

There are contradictions in priorities and policy elements at the national and state levels. These policy gaps and inconsistencies often create serious practical issues in operationalisation and implementation. The Government of India should invest in inventorising policies and legislation and create an appropriate institutional framework for vetting and auditing policies for harmonisation and alignment with the National Water Policy. For instance, the role of the regulatory framework in the rural sector is under debate; however, clear relations of accountability between consumers and service providers are critical, and over time could develop into a formal and more structured regulatory framework. The PRIs should have an overarching role both in monitoring service delivery and supporting community-based surveillance of service levels, reliability, quality and demand management.

The creation of regulators in India has not been accompanied by critical reflection on their role or attention to the political, legal and institutional contexts within which they operate, separated from the executive branch of the Government to make them function independently. A water regulator was set up by Maharashtra in 2005, and legislation to introduce water regulators is under way in states like Arunachal Pradesh, Gujarat, Delhi, Kerala. The Maharashtra Water Resources Regulator Agency (MWRRA) was constituted as part of a World Bank's larger programme 'Maharashtra Water Sector Improvement Programme'. By determining entitlements and regulating water trading, the MWRRA has to ensure that water goes to the highest-value user, which will have significant social consequences (Dharmadhikary 2007). Braithwaite (2005) argues that developing countries with regulatory capacity problems are ripe for responsive regulation in a model of networked governance where the state relies heavily on non-state actors to participate in the task. Regulation would have to be guided by a larger substantive framework that makes the consideration of social goals an integral part of regulatory objectives, and communities will have clear decision-making and conflict-management roles.

Historically, investments in the water sector in India have largely revolved around the concept of Multi-Utility Systems (MUS), whether in public or in the community/household domain. Analysis of the trajectory of sector investments revealed that traditionally, household/community investments have been dominant and focused towards water conservation, harvesting, source augmentation, and sustainability – all directly or indirectly reinforcing the concept of MUS. However, during the period of exponential expansion of government functions, post-independence India has witnessed three distinct features:

- vertical fragmentation of functions and a multiplicity of departments and agencies dividing water into industrial, agricultural, drinking/domestic, environmental, etc.;
- fragmentation of budgets and allocations in line with the above process;
- water quality deterioration and environmental pollution of sources.

Empirical studies in recent years have corroborated significant externalities and incremental benefits of investments in MUS, when compared to single-use service delivery models. The linkages have been proved to be significant by way of improved health, poverty reduction, and welfare gains. It has also been proved that communities meet water requirements from multiple sources as well. Hence, the reality of MUS and multiple sources needs to be adequately recognised.

The guidelines speak of convergence; however, there is no clear-cut process/framework to enforce and monitor. Fragmented bureaucracies make uncoordinated decisions, reflecting individual agency responsibilities that are independent of each other. Too often Government planners develop the same water source in an interdependent system for different and competing uses.

This project-by-project, department-by-department, and region-by-region approach is no longer adequate for addressing water issues. At the operational level, convergence is critical in achieving source sustainability, water security and prioritised allocations for sustainable service delivery.

There are critical gaps in data collection, analysis and monitoring. Externally-funded programmes design independent monitoring systems that are rarely harmonised and institutionalised. The sector contradictions are best reflected in the coverage and service level data provided by different sources, such as the Ministry of Drinking Water Supply and Sanitation (MDWSS), Census, National Family Health Survey (NFHS), and National Sample Survey Organisation (NSSO). India needs to renounce normative indicators based on information management systems that serve only to harbour inefficient public utilities and support a political agenda. The set of policy guidelines does not offer much clarity on this count. Being futuristic, the guidelines should also look forward to a post-MDG scenario by developing innovative indicators that capture truthfully the real-time field realities. Excellent data-capture systems using hand-held devices in a cloud-computing environment embedded in GIS make a lot of sense in developing a water sector based on scientific decisions. Packages such as FLOW, which uses Android handsets (now acquiring Windows compatibility as well), SMS and web entry to feed a comprehensive, cloud-based GIS-aware data-analysis and mapping platform, can help to track and analyse the operational status of water and sanitation projects around the world.

IV Conclusions

The new guidelines for both water and sanitation could provide a fillip to the WASH sector in India if implemented in word and spirit. These guidelines give to the sector a new direction in terms of moving towards sustainable service delivery. However, they need further strengthening to make water security at the household level a reality. Sector financing is an important tool for sector efficiency. Getting the unit costs right and getting the right balance among different cost components for sustainable service delivery is the starting point for policy formulation. The situation is rather alarming as far as sanitation is concerned. Though separate guidelines are issued for sanitation, it is dovetailed to water for all practical purposes. The need of the moment is to mainstream sanitation with sufficient allocations and planning. This is possible not only through creating awareness but also through creating the necessary facilities and infrastructure for safe disposal and management of solid and liquid waste. This calls for a total shift away from the subsidy-driven provision of household toilets to creating demand for private sanitation.

Post-Construction Support (PCS) is another major concern. Allocations to the sector should include capital maintenance on a regular basis so that *ad hoc* allocations towards major breakdowns would not be diverted from the O&M allocations. The impact of this imbalance between capital and other recurrent expenditures becomes increasingly critical when coverage rates start to climb. The result is that water supply systems continue to fall out of service as fast as new ones are constructed. Though the approach has gained dominance as a rural service delivery model in progressively enhancing rural coverage, recent evidence suggests critical second-generation sustainability concerns. The PRIs/communities require professionalised, market-driven PCS for sustainability. A standard O&M and asset-management guideline is to be designed, tested and adopted into operating procedures and to support the states to get them implemented.

The assumption of community management has failed to work on account of lack of ownership, poor cost recovery, and inadequate technical and managerial capacities. Both the VWSCs and GPs are weak in discharging the mandate. Over the years it has become evident that Professional Post-Construction Support (PPCS) is necessary for replacing volunteerism and rigid concepts of participation. The Local Self Governments (LSGs) could play a key role in regulation, quality assurance, oversight and coordination. Considering the capacity variations of PRIs in India, different models could be evolved to support the process.

Important aspects of an approach to service delivery include, among other things: support to rural operators (i.e., community management entities or local private sector), professionalisation of community management, greater attention to investment planning for longer-term capital maintenance, and asset renewal. To support the more positive trends, there is an urgent need for the GoI to reassess roles, investment decisions and sector status in terms of service levels in the states. The key focus of policy should be to incentivise states to shift from a project towards a service delivery approach (SDA), benchmark utilities and services, and make managers accountable in an autonomous decision-making environment. A common and critical weakness is the lack of reliable data, and/or multiple and competing monitoring systems and data sets, at a fairly disaggregated level to facilitate analysis and to support decision-making. There is an urgent need to encourage upgrading and migration towards new platforms and national-level systems that can serve both the upward demand for strategic planning and the downward demands for operational planning and decision-making at the local level, ensuring both vertical and horizontal flow of information. Some of these issues pertaining to costs, service levels, governance, etc., are being dealt with the help of scientific data generated at various levels.

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3 Life-Cycle Cost Approach: An Analytical Framework for THE WASH Sector

V. Ratna Reddy, Catarina Fonseca and Charles Batchelor

I Introduction

Most of the chapters in this book are based on the research that has adopted a clear analytical framework and scientific approach for assessing costs and service levels in the WASH sector. It is necessary to spell out the aims of the research and the framework and approach adopted. The aim of the WASHCost research is to help better planning and designing for the provision of sustainable WASH services equitably in a cost-effective manner. In the context of WASH Cost, the concepts used are defined in the following manner:

- *Life-cycle assessment* follows a systems approach. Life-cycle costs cover not only the cost of constructing and providing infrastructure but also of ensuring the long-run sustainability of the service and equitable service delivery. Real life-cycle costs of equitable and sustainable WASH service delivery can be disaggregated into a number of categories, including the capital costs, recurrent operational costs, capital maintenance costs, and direct and indirect support costs.
- *Sustainability* means environmental, institutional, social and financial sustainability. Environmental sustainability mainly deals with source protection and safety in the long run (10–15 years).
- *Equity* means service delivery to poor men, women, children, marginalised and unreached sections of the community; that is, ensuring equity in access and delivery through appropriate system design.
- *Cost efficiency* means providing WASH services in the most cost-effective manner: i.e., so that investments are optimum and ensure value for money.

II Life-Cycle Cost Approach (LCCA) and Sustainable Service Delivery

Life-Cycle Cost Approach (LCCA) is a comprehensive tool that is often used in project evaluation of various investments leading to products or services. Though the basic principles of LCCA are nearly a century old, its systematic use is only about 25–30 years old (Salem 1999). LCCA is an economic assessment or project appraisal tool that can be applied at any phase of the project life-cycle. LCCA includes the whole chain and spread of activities including the externalities. Such a systems perspective is valid not only for the environmental dimension but also for social and economic dimensions. LCCA is widely used in infrastructure projects, such as roads, power, etc., while its use in the WASH sector is limited. Even in developed countries like the USA the adoption of LCCA to the WASH sector is limited to 30 percent of the systems (Arditi and Messiha 1996, as quoted in Salem 1999).

LCCA provides the real disaggregated costs in the life cycle of water and sanitation service delivery to poor people, involving decision-makers and stakeholders at every level. LCCA goes beyond achieving the technical ability to quantify and make costs readily available. It seeks to influence sector understanding of why life-cycle costs assessment is central to improved service delivery and to influence the behaviour of sector stakeholders, so that life-cycle unit costs are mainstreamed into WASH governance processes at all institutional levels from local to national (Lundin 2002, Barringer 2003, McConville 2006). The objective of using LCCA in the WASH sector is to increase the ability and willingness of decision-makers (both users and those involved in service planning, budgeting and delivery) to make informed and relevant choices between different types and levels of WASH service. A significant element of the LCCA is an understanding that costs can only be compared and properly assessed when they are related to particular levels of service.

The Framework

LCCA analyses the aggregate costs of ensuring the delivery of adequate, equitable and sustainable WASH services to a population in a specified area. The costs assessed here cover the construction and maintenance of systems in the short and long term, taking into account the need for hardware and software, operation and maintenance, the cost of capital, source protection, and the need for direct and indirect support costs, including training, planning and institutional pro-poor support (Fonseca *et al.* 2011). The delivery of sustainable services also requires that financial systems are in place to ensure that infrastructure can be renewed or replaced at the end of its useful life and to extend delivery systems in response to increases in demand (Reddy *et al.* 2009).

The comprehensive nature of LCCA limits the practicability of its application. It is therefore necessary to define the system boundaries in order to reduce the complexity. The choice of system boundaries depends on the nature and type of project; this has been shown to have important implications on the results (for a review, see Lundin 2002) and needs to be carefully considered. The life-cycle (or functional) boundaries define the processes to be included in the system, i.e., where upstream and downstream cut-offs are set.

For the rural and peri-urban water systems, four sets/levels of boundaries can be identified (Plate 1). Resource boundaries (Level 1) are defined to ensure resource sustainability and aim to provide sustainable service delivery.

Assessment at this level elucidates the potential environmental benefits and costs and is limited to understanding the environmental sustainability of a water system.

The second set of boundaries pertains to infrastructure usually linked to the management agency/institution/organisation. This provides a more complete view of the system in terms of technologies, design efficiencies, planning (viz., linking drinking water and sewage), etc. Often the agencies, though aware, are constrained by financial and legislative obligations and tend to override options that allow a move towards environmental sustainability. Such a perspective may limit the potential of the agency to identify major environmental impacts or improvements through the life cycle.

The third set deals with the demand/access issues that are often dealt with at the community/institutional/household level. These pertain to access, competing demands (domestic, agriculture, industry, etc.), water use practices, sanitation and hygiene practices, etc. Often this set gets marginal attention at the project-planning level, if it is not ignored entirely. This set reflects and determines the system in terms of capacities (technologies), affordability (finance), awareness (quality, health, etc.), attitudes (cultural), etc.

The fourth set represents the externalities of/to the system that are closely linked to each other as well as the surrounding main system, but are beyond the scope of any LCCA – as capturing these aspects complicates the assessment. The surrounding systems interact with and are critical for the functioning of the water systems. Energy consumption/supply is crucial for water pumping, treatment and distribution. Agricultural production or farming systems determine not only the demand for water but also affect the quality of water: i.e., livestock-based systems or intensive agricultural practices (chemical use).

In the context of Andhra Pradesh it exacerbates the scarcity of groundwater. Similarly, implementation of soil and water conservation programmes (WCP) in rural areas would have a discernible impact on the quantity and quality of water in the system. On the other hand, disposal of treated/untreated water or storm/flood water outside the system would also result in upstream/downstream externalities. Some of these externalities can be internalised with judicious planning. However important these aspects are, we are not considering them in the present context.

III Adapting LCCA to the WASH Sector

Unlike the conventional LCCA, the LCC assessment adopted here does not address project evaluation, but adopts a service delivery approach: i.e., it assesses the costs of providing a certain level of service in a sustainable manner. It looks at the costs that have gone into service provision rather than incorporating all the costs that are demanded in a project evaluation frame. The costs assessed here cover the construction and maintenance of systems in the short and long term, taking into account the need for hardware and software, operation and maintenance, source protection, support costs, and pro-poor support (Fonseca *et al.* 2011). The delivery of sustainable services also requires that financial systems be in place to ensure that infrastructure can be renewed or replaced at the end of its useful life and to extend delivery systems in response to increases in demand (Reddy *et al.* 2009).

The main purpose for adopting LCCA in the WASH sector in the Indian context is to arrive at disaggregated unit costs and identify the gaps in terms of different cost components. A fully developed life-cycle cost model will include various components that represent acquisition as well as sustaining costs (Barringer 2003). The cost components include not only the construction and operational costs but also the rehabilitation and IEC (Information, Education and Communication) costs. These are: Capital expenditure on hardware (initial construction cost) (CapExHrd); capital expenditure on software (CapExSoft); capital maintenance expenditure (rehabilitation cost) (CapManEx); Cost of capital (CoC); direct support costs (ExDS); indirect support costs (ExIDS), and annual operation and maintenance cost (OpEx). These are broadly grouped under fixed and recurring costs (Box 3.1).

Apart from public investments, households also invest to complement the service levels. Such contributions could be in respect of infrastructure costs, such as for wells, storage, toilets, etc., and operational costs, such as minor repairs, cleaning, etc. These costs are incurred in order to overcome reliability and convenience issues related to water services. Along with these expenditures, households also spend time in fetching water and money towards buying water;

Box 3.1 Cost components

Fixed Costs

CapExHrd: Includes government expenditure on infrastructure, such as water sources, pumps, storage, filters, distributions systems, etc.

HHCapExHrd: Includes household expenditure on infrastructure, such as water storage, toilets, wells, pumps, etc.

CapExSft: Includes government expenditure on planning and design costs of the schemes

Recurring Costs

CapManEx: Includes capital maintenance, such as rehabilitation of sources, systems, etc.

CoC: Includes the interest paid on the borrowed capital for investment in the WASH sector

ExDS: Includes staff salaries, and post-implementation activities, such as IEC, demand management and training of mechanics

ExIDS: Includes costs of policy planning at the macro level, i.e., central and state

OpEx: Includes regular operation and maintenance of the systems, such as energy costs, minor repairs, filtering costs, salaries of water men, etc.

HHOpEx: Includes household expenditure on operation and maintenance of water systems, sanitation facilities, etc.

these outlays are incurred to overcome access and quality problems. While public expenditure alone is considered in the case of financial analysis, economic analysis includes both public and household expenditure. The time spent by households is converted into its monetary value, using the opportunity cost of time. In the case of drinking water, household and public investments can be analysed separately, as they are mutually exclusive in terms of service provision (since household expenditure on drinking water is only an addition to improve the service levels). Some studies treat household expenditure on drinking water as support costs (World Bank 2008). On the other hand, in the case of sanitation, public and household expenditure are mutually inclusive, as household expenditure is a necessity and mandatory for construction of household toilets. Hence, both public and household expenditures are analysed together for sanitation.

All the fixed capital investments are made over the years and hence are accumulated over the years after converting them into their current values using the National GDP inflator for the specific years and converted to US dollars using the average 2010 exchange rate (US$ 1=INR 45.72). In order to arrive at the unit costs per year, all the capital costs (CapExHrd) are annualised using the normative and actual life spans of the systems (the actual life span is the observed life of the systems during which service was provided).

For the purpose of assessing the service levels for the households, the service ladder approach (Moriarty *et al.* 2010, Potter *et al.* 2011) is adopted. In the case of drinking water, four indicators are used for assessing the service levels: quantity, quality, accessibility and reliability. The level of service for each indicator is categorised as no service, sub-standard, basic, intermediate, and high (Table 3.1), and each level of service is defined separately for each indicator. While the quantitative measure of litres per capita per day (lpcd) is used for defining quantity indicators, the service level is assessed in terms of quality accessibility and reliability by means of the qualitative perceptions of the households. In the case of sanitation, four indicators are used – access, use, reliability and environmental protection – and four service levels – no service, limited/sub-standard, basic, and improved (Table 3.2). From the policy point of view, the proportion of households receiving below basic service level could be termed poor in the Indian context, as 40–55 lpcd is the basic norm used.

Table 3.1 Overall water service levels including all the parameters

Service Level	*Quantity*	*Accessibility*	*Quality*	*Reliability/Dependability*
High	80 lpcd +	0–10 mins to collect water per day	In addition, water quality has been tested independently, using a water quality test kit	Intermediate level + : a system for handling breakdowns exists and functions well
Intermediate	60–80 lpcd	10–20 mins	Users are aware RWSS officials have certified that there are no water quality problems	Basic +: a system for handling breakdowns exists but is not functional
Basic	40–60 lpcd	20–30 mins	No complaints by users	Network supply according to an agreed schedule and duration. Hand pumps are dependable. But there is no system for handling breakdowns
Limited	20–40 lpcd	30–60 mins	Water used for drinking by humans but there are complaints of bad smell, and bad taste, colour, or appearance	Network supply has scheduled times and duration of delivery, but supply is still haphazard. Hand pumps not dependable because recharge rates are low
No service	Less than 20 lpcd	60 + mins	Water is unfit for drinking by humans or animals	Network supply is haphazard. Hand pumps not dependable because groundwater is exhausted

Source: Adopted, with modification, from Moriarty *et al.* (2010).

IV Approach and Methodology

As part of the research, a number of tools were developed and tested in testbed villages and peri-urban locations on a pilot basis. Based on the responses during the piloting stage, these tools were modified for the large-scale sample locations. A number of criteria were identified and discussed with the stakeholders (advisory and working groups, which included line departments, NGOs, etc.) during meetings. These criteria include: rainfall, water quality, water scarcity, water source, type of scheme, village type, management and

Table 3.2 Overall sanitation service delivery

Service Level	*ISL Access*	*ISL Use*	*Reliability*	*Environmental Protection*
Improved	Sufficient number of toilets proportionate to the number of family members (or more than one toilet)	All family members use toilets and infant faeces is also disposed into the toilet	Rs.1000 + spent on O&M	Waste water reused. Solid waste is composted and reused
Basic	One ISL	All the members of family use the toilet	Rs.500 + spend on O&M	Drains are well maintained. Dumps used for solid waste disposal
Limited/ Sub-standard	Shared	Some family members use the toilet	Rs.1–500 spent on O&M	Drains are there but poorly designed and maintained. Dumping area for solid waste exists but not used
No service	No ISL	All family members follow open defecation	Households did not spend any amount	No solid or liquid waste management

Source: Adapted, with modification, from Potter *et al.* (2011).

coverage of sanitation, hygiene levels, etc. However, reliable data at the village (habitation)[1] level on most of these criteria are not available. It is proposed to select the sites on the basis of agro-climatic zones, as these zones reflect the natural criteria such as rainfall, water quality, water source, and scarcity to a large extent.

Andhra Pradesh is divided into nine agro-climatic zones (see Plate 2). A Stratified Sampling Design is adopted for the selection of sample units for the survey in each Agro-Climatic Zone. Village (habitation) is considered as a sampling unit for the survey. Depending upon the status of WASH (Water, Sanitation and Hygiene) services, each village is classified as either Fully Covered (FC), Partially Covered (PC), or No Safe Source (NSS) due to water quality problems.

The village (habitation)-level data revealed that inter-village variations are high across the agro-climatic zones. In order to capture these variations in unit costs, it is proposed to cover a greater number of habitations: i.e., 187. Given the time and cost constraints, only the cost data from the line departments and

Table 3.3 Sampling frame

Stage I	*Stage II*	*Stage III*	*Stage IV*
Agro-Climatic Zones	Villages-Level I	Habitations-Level II	Households
Nine	Rural: 187 Peri-urban: 18	Rural: 107 Peri-urban: 11	Rural: 4,500 Peri-urban: 450
	• Secondary data on unit costs from the line departments and PRI	• GIS mapping • Listing of households • Detailed information at village and community levels using qualitative techniques	• Detailed quantitative and qualitative information at the household level

gram panchayats were collected from all these 187 habitations (Level 1). A sub-sample of 10–12 habitations from each agro-climatic zone was selected for detailed analysis. About 50 households representing various socio-economic sections and other disadvantaged groups were selected from each sample village. In the case of peri-urban locations, 18 sample towns were selected at Level 1, and 11 sample locations were selected at Level 2 (Table 3.3).

For selecting the sample villages in each agro-climatic zone, the following procedure was adopted:

- All the villages were classified into three strata namely FC, PC and NSS.
- Villages in each stratum were arranged in the increasing order of population size.
- Circular Systematic Sampling was adopted to select the desired number of habitations in the form of two independent sub-samples from each stratum.

Thus, the sampling design to select the sample villages in each agro-climatic zone is 'Stratified Systematic Sampling/Simple Random Sampling without Replacement'. Wherever the population size has relevance for the study, we have used Simple Random Sampling without Replacement instead of Circular Systematic Sampling for selecting the sample in that stratum. The sample size and composition of the sample across strata may vary depending upon the composition of habitations in each stratum.

Methods and Tools

Both qualitative and quantitative research methods were used for eliciting information at secondary as well as primary level. Qualitative and quantitative methods were used as complements rather than substitutes. For this purpose, a number of formats and checklists were developed and used. Qualitative methods such as Participatory Rural Appraisal (PRA), Qualitative Information Systems (QIS), etc., were adopted. Quantitative information was collected using the questionnaires and other formats.

Secondary information, such as the scheme details, cost structure of the scheme, source details, and operation and maintenance information were obtained from various sources: line departments (RWSS in the case of rural water supply and sanitation), gram panchayats, etc. This information was validated wherever possible using qualitative techniques such as Focus Group Discussions (FGDs), etc. Primary data was generated using the questionnaires/formats at the household level and also through qualitative methods at the community level. Various tools and methods were adopted for the purpose of accountability and transparency-related issues. All these methods and tools were tested and modified, fine tuned, and adopted as per the requirement. These methods are presented in detail in the respective chapters.

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4 Unit Costs and Service Levels by Region and Technology

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I Introduction

Allocations towards rural water supply are based on norms fixed using the Standard Scheduled Rates (SSRs) and one-time investments with annual allocations towards the operation and maintenance of the systems. State-level norms are arrived at using the average of the administrative regions of the state. Often, the differences between regions mostly pertain to labour costs, and these norms are estimated for each technology, i.e., Single-Village Schemes (SVS), Multi-Village Schemes (MVS), and Hand Pumps (HPs). These norms – one norm for each technology – are used for fixing the allocations for rural water supply systems across Andhra Pradesh. The expenditure is assumed to last for a fixed number of years, ranging from 10 to 30 years, depending upon the component (see Appendix Table A4.1): i.e., a normative life span of the systems, which is based on technical assumptions made by the Rural Water Supply and Sanitation (RWSS) Department. Similarly, operation and maintenance allocations are fixed for each technology and allocated annually. Operation and maintenance expenditure is often met with the help of the resources generated through water charges paid to the village panchayat, which is responsible for the management of the systems, and the allocations from the Department of RWSS.

In reality, most villages use more than one scheme or source at any point in time, in order to ensure water supplies. Technology has become critical for better service delivery of drinking water at scale. Technologies have evolved over time to meet the service demands of quantity, quality, accessibility and reliability. While hand pumps were introduced initially to meet the quantity demands, especially during scarcity periods, later technologies – such as mechanised pumping, storage, distribution systems, etc. – have helped in reducing the drudgery for the households of fetching water. Some of the technologies, such as deep bore wells, have adversely affected the water quality in specific regions (Reddy and Kullappa 2008). These technologies, ranging from direct pumping to single-village schemes, are localised with limited scale, often covering one village. Besides, there are water purification plants established by private agencies and Non-Government Organisations (NGOs) that are becoming part of supply sources along with informal sources such as streams, local tanks, private wells, etc., which are not connected to any scheme. This is an accepted policy norm in India, as there is no fixed delivery model for service provision. This could be termed a service delivery model, i.e., a combination of different technologies and sources.[1] The actual cost of service delivery should include all the public systems that are providing services presently, while the informal sources may not be included, as no costs are available.

This chapter compares the normative allocations with the actual expenditure across the nine agro-climatic zones and the different technologies that are being used in Andhra Pradesh. The actual costs are estimated based on the data collected from 187 habitations spread over the nine agro-climatic regions in the state. Though agro-climatic zones do not reflect the hydro-geology, they do consider a number of aspects that influence the use of drinking water. Hence, this categorisation is considered the best proxy for capturing the variations in the absence of such data at the village level. Similarly, costs and service levels are compared across technologies.

Specific research questions include:

- Cost of service provision across agro-climatic zones and technologies in Andhra Pradesh and compare them with agency (RWSS) norms.
- Cost of provision in terms of cost per year for the actual life of the system and the normative life span.
- Relative expenditure on different cost components in reality against the agency norms.

II Approach

The Life-Cycle Cost (LCC) approach[2] is adopted to estimate the actual component costs of service provision. The costs assessed here cover the construction and maintenance of systems in the short and long term, taking into account the need for hardware and software, operation and maintenance, cost of capital, source protection, and the need for direct and indirect support costs, including training, planning, and institutional pro-poor support (Fonseca *et al.* 2011). Only financial costs (i.e., public expenditure) are included in the analysis, though households also invest in water infrastructure to complement the service levels, in order to make it comparable with agency (RWSS Department) norms. The analysis is carried out using data collected from 187 sample villages spread over the nine agro-climatic zones in Andhra Pradesh. Cost data were obtained from the official records of the RWSS Department at the district level and triangulated or cross-checked with the help of data generated from the village panchayat (local government). The data on operation and maintenance were obtained from the village panchayat records.

Cost Components and Calculations

Capital expenditure has two components, hardware (CapExHrd) and software (CapExSft). Establishment of water infrastructure – water extracting elements, purification equipment, storage reservoirs, distribution systems, etc. – is part of capital expenditure on hardware, while capital expenditure on software includes the costs of planning and designing the water schemes at the village level. The capital costs, hardware as well as software, are one-time costs.

For the purpose of the present analysis, we have considered only investments in infrastructure that are still functional. In most cases, the system or infrastructure is non-functional when the source fails beyond rehabilitation, for example, when a bore well dries up or collapses. All the capital investments are cumulated over the years. Capital maintenance expenditure (CapManEx), another major expenditure, funds the renewal and rehabilitation of the systems: the replacement of major equipment, such as pump sets, bore holes, plant equipment, distribution systems, etc. Capital maintenance expenditure is also summed up over the years.

Operational expenditure (OpEx) for the regular maintenance of the systems is incurred annually, and hence we have considered the average of the years for which data are available after converting them to current-year values.

Expenditure on direct support costs (ExDS) covers salaries to staff, IEC activities, demand management initiatives, etc., while expenditure on indirect support costs (ExIDS) are the costs associated with macro-planning and policy-making at the national and state levels. These costs are estimated based on the data from the planning and budgetary documents with the help of some assumptions and expert opinions (see Appendix).

Since capital and capital maintenance expenditure are one-time investments, in the past they were converted to current values (2010) using the National GDP inflator for the specific years and converted to US dollars using the average 2010 exchange rate (US$ 1=INR 45.72). These costs are annualised using the normative life span and observed life span of the systems. The data on normative life span (which is nothing but the expected life span of a specific component) are provided by the department. The observed life span is the actual number of years the system (major component) lasts.

In the case of departmental cost figures we have considered the latest (2010) estimates for different systems. Estimates are provided for single- and multi-village schemes separately. Since the actual costs include both these sources, in most cases, we have taken the average of both. The official cost estimates do not include the salary component of the direct support costs (ExDS) and the indirect support costs (ExIDS). These two components, which are estimated using budget data, are added to the official norms in order to make them comparable with the actual costs based on our estimates.

III Cost of Provision: Analysis by Zone

The total cost of provision is estimated in terms of per capita cost per year after converting the past capital investments (CapEx) to their current value and then annualising them. These are fixed costs. Recurring costs, such as capital maintenance (CapManEx), direct and indirect support costs (ExDS and ExIDS) and operation and maintenance costs (OpEx), are added to the fixed costs. These costs pertain to different technologies and do not represent any specific technology. These estimates are based on the actual data collected from 187 sample habitations spread over nine agro-climatic zones. The cost estimates are made by zone as well as at the state level. While in the case of agency or departmental (RWSS) norms, there is only one figure for the entire state, separate norms are fixed for the single- and multi-village schemes (see Appendix Table A4.4). We have taken the weighted average (on the basis of their numbers, i.e., 70 percent of schemes are single-village, while 30 percent are multi-village) of both to arrive at a comparable figure. The estimates are carried out for both normative and observed life spans. While the normative life span is worked out on the basis of technical, economic and useful life of the systems, observed life span is the life of the systems on ground or in reality. Future service delivery requirements and their cost norms are arrived at by the department on the basis of the normative life span of the systems.

More details of these zones in terms of coverage of districts and sample habitations are provided in Appendix Table A4.4.

The observed life span of the systems at the aggregate (state) level is 8.2 years, as against the normative life span of 12.7 years (Table 4.1); while the normative life span across the zones does not vary much, the observed life span varies between 3.7 years in the Godavari Zone and 10.9 years in the Krishna Zone. However, the observed life span could be lower, because the systems frequently break down due to lack of maintenance or to the hydro-geology of the region (bore well failure). Similarly, in the case of new systems where breakdowns are few, the observed life span could be lower. Very few sample habitations fall in the latter category, as the average age of the systems ranges between 6 and 18 years across the zones, with a state average of 14 years (Table 4.1). The High Altitude Zone (HAZ) has the youngest systems with an observed life span of 7.9 years, which is close to the state average. These are mainly hand-pumps and mini-piped water supply systems. The reason for the low observed life span in the Godavari Zone could be due to the frequent breakdowns, which is reflected in the lowest range figures when compared to the other zones. Moreover, the extent of the system and source failure is also the highest at 41 and 72 percent respectively in the Godavari Zone, compared to 12 and 24 percent respectively at the state level (Table 4.2). This is mainly due to the quality of water. Turbidity levels in water are quite high in this region, leading to choking of water filters and pumps. Sea water intrusion or salinity ingress is another reason for abandoning the sources in parts of the zone. On the other hand, the Godavari Zone has also shifted to surface water sources, as the river and canal network is quite good here.

Fixed Costs (CapEx)

As explained above normative life span is defined by the RWSS according to the technical details of the components. When it is assumed that the systems

Table 4.1 Observed and normative life spans of the rural water systems across agro-climatic zones of Andhra Pradesh

Zone	*Observed life span*★			*Normative life span*†			*Average age of systems*‡	
	Average	*Range (min–max)*	*CV +*	*Average*	*Range (min–max)*	*CV +*	*Average*	*Range (min–max)*
HAZ	7.9	1.0–40.0	69.9	11.2	10.0–30.0	19.1	06	0–11
NCZ	9.8	1.0–49.0	95.6	11.6	10.0–30.0	23.3	09	3–20
GZ	3.7	1.0–31.0	21.9	14.1	10.0–30.0	55.2	10	2–24
KZ	10.9	1.0–49.0	127.9	11.8	10.0–30.0	26.9	11	1–28
SZ	8.4	1.0–45.0	86.9	12.5	10.0–30.0	34.5	18	0–39
SRZ	8.6	1.0–40.0	72.9	13.9	10.0–30.0	56.0	14	1–25
STZ	7.3	1.0–36.0	52.9	13.0	10.0–30.0	44.1	16	1–30
CTZ	7.5	1.0–40.0	54.8	12.7	10.0–30.0	39.4	15	4–32
NTZ	8.4	1.0–40.0	66.8	12.8	10.0–30.0	44.2	18	7–29
AP State	**8.2**	**1.0–49.0**	**74.5**	**12.7**	**10.0–30.0**	**39.8**	**14**	**0–39**

Source: Data for villages collected from the RWSS Department at the District level.

★Estimated using the observed data from the 187 sample habitations spread over nine agro-climatic zones.

†Based on the data provided by the Department of Rural Water Supply and Sanitation, Government of Andhra Pradesh.

‡Average age of the functional systems, which is calculated from the number of years the systems have been functioning since the first scheme was introduced.

CV + = Coefficient of variation of the sample habitations in the respective zone.
HAZ = High Altitude Zone
NCZ = North Coastal Zone
GZ = Godavari Zone
KZ = Krishna Zone
SZ = Southern Zone
SRZ = Scarce Rainfall Zone
STZ = South Telangana Zone
CTZ = Central Telangana Zone
NTZ = North Telangana Zone

and sources would work to their full normative life span, the cost of provision for the per capita fixed costs are US$ 50 in the sample villages, as against the US$ 32 per capita of the state government norm (Figure 4.1). While the RWSS unit costs are almost uniformly allocated across the state by the RWSS Department, the unit costs in reality vary between US$ 30 in the Godavari Zone and US$ 77 in the South Telangana Zone.

When these costs are annualised, the unit cost is US$ 3.4 per capita per year at the state level in terms of normative life span (Fig 4.2), which is lower than the norms fixed by the RWSS Department (US$ 4). Across the locations, eight out of the nine zones have shown that unit costs are below or equal to the departmental norms, while one zone (STZ) has costs higher than the norm

Table 4.2 Functionality of water supply systems and sources across agro-climatic zones

Zone	*Systems (HPs, PSPs, pumps, storage, etc.)*			*Sources (open and bore wells, tanks, etc.)*		
	Total	*Functioning*	*% failure*	*Total*	*Functioning*	*% failure*
HAZ	98	95	03	27	21	22
NCZ	164	162	01	36	30	17
GZ	125	74	41	29	8	72
KZ	265	258	03	43	37	14
SZ	189	170	02	70	63	10
SRZ	218	190	13	44	36	18
STZ	358	307	14	92	82	11
CTZ	328	278	15	85	60	29
NTZ	389	339	13	96	62	35
AP State	**2,134**	**1,873**	**12**	**522**	**399**	**24**

Source: Village-wise data collected from the RWSS Department at the district level.

(Figure 4.2). This indicates that there are variations in unit costs even when normative life span is assumed.

However, this is different from the reality, as the observed life is 35 percent less than the normative life span, and the unit cost of provision has gone

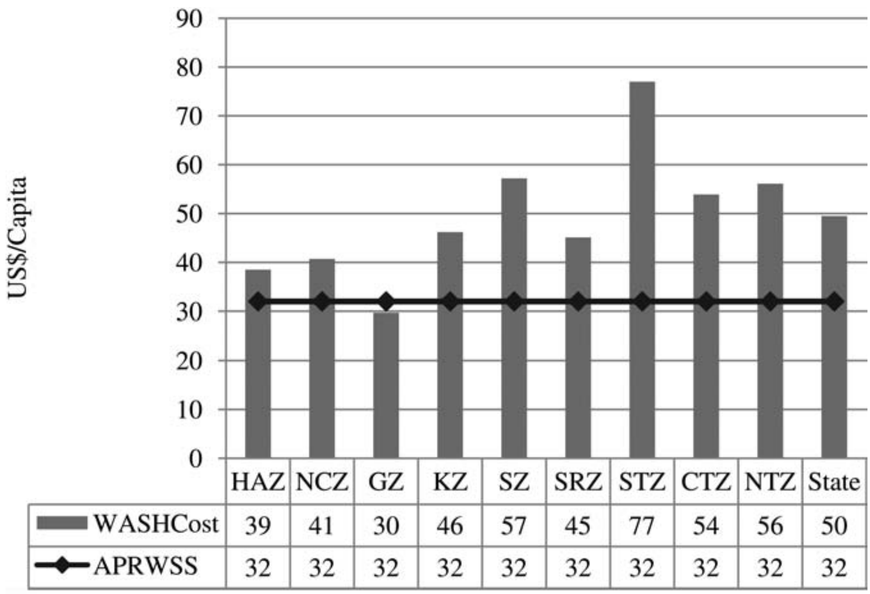
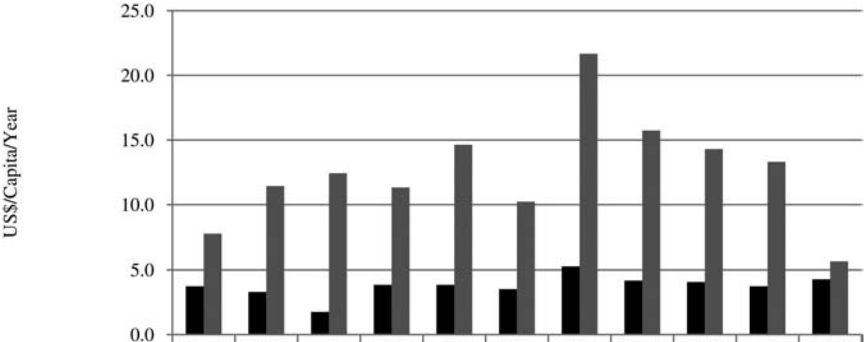


Figure 4.1 Cost of provision across agro-climatic zones (CapEx per capita in US$)



	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP	RWSS
■ CapEx-Normative	3.7	3.3	1.8	3.9	3.9	3.5	5.3	4.2	4.1	3.7	4.3
■ Capex-Observed	7.8	11.4	12.4	11.3	14.6	10.2	21.7	15.7	14.3	13.3	5.7

Figure 4.2 Fixed costs per capita per year with normative and observed life spans

up from US$ 3.7 (normative) to US$ 13.3 (observed) per capita per year, i.e., 259 percent higher (Figure 4.2). Under the existing observed life span the departmental norm goes up from US$ 4.3 to US$ 5.7 per capita per year, assuming that all other criteria for costing remain the same. This implies a straight increase of 33 percent in the cost of provision or budget allocations. However, the life span could be improved with investments or allocations towards capital maintenance, which are currently absent. The real unit costs are above the departmental norms (observed) in all the agro-climatic zones. Further, intra-zonal (inter-village) variations are much higher than inter-zonal variations (Table 4.3). The difference between zones is statistically significant in a number of cases (see Appendix Table A4.5). The high intra-zonal variations could be one of the reasons why the differences between the zones are not significant in every case. Moreover, the intra-zonal variations are substantially higher in the case of the observed unit costs when compared to the normative unit costs.

The analysis brings out two important issues:

- the real unit costs are substantially higher than the normative unit costs fixed by the department using the Standard Schedule of Rates (SSRs) even though they are adjusted to market prices regularly; and
- there exist substantial variations in unit costs within and between zones.[3] This is mainly due to the differences in the observed life span of the systems across the villages (and zones) consequent to the variations in the functionality of the systems.

This calls for a revision of unit costs reflecting the reality, especially in terms of the life span of the systems or allocations towards capital maintenance that would increase the life span of the systems. For instance, the high unit costs in

Table 4.3 Variations in fixed costs across the agro-climatic zones (in US$ per capita/year)

Zone	*Observed life span – CapEx*				*Normative life span – CapEx*			
	Mean	*Median*	*Range (min–max)*	*CV*	*Mean*	*Median*	*Range (min–max)*	*CV*
HAZ	7.8	5.5	1.1–23	87	3.7	3.1	0–9.9	66
NCZ	11.4	5.4	1.1–42	122	3.3	2.5	1.1–7.7	54
GZ	12.4	8.3	0.3–32	91	1.8	1.8	0.0–5.5	96
KZ	11.3	8.8	2.2–29	77	3.9	3.0	1.1–9.9	59
SZ	14.6	14.8	4.4–37	57	3.9	4.0	0.3–9.5	53
SRZ	10.2	8.3	0.2–33	84	3.5	2.8	0–7.7	59
STZ	21.7	15.3	3.3–63	61	5.3	3.6	2.2–13.4	67
CTZ	15.7	9.7	4.4–55	86	4.2	3.5	2.4–10.7	43
NTZ	14.3	12.3	0.2–56	87	4.1	3.5	0–8.8	58
State	**13.3**	**9.5**	**0.2–63**	**92**	**3.7**	**3.1**	**0.0–13.2**	**65**

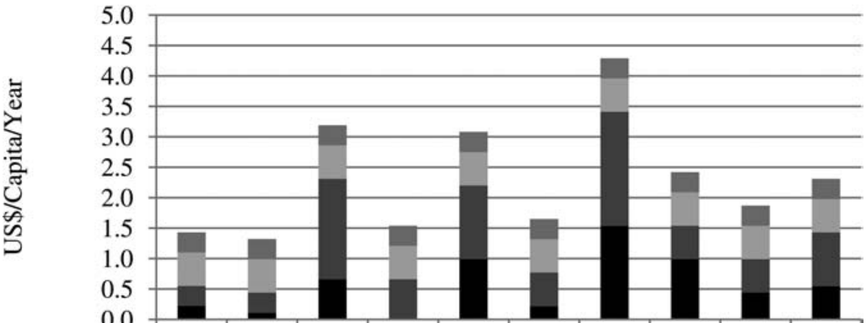
the South Telangana Zone could be attributed to frequent failure of wells, though a more detailed analysis would be taken up separately. Besides, there is a need for differential allocation of resources in order to address the differences in unit costs across the zones or locations. Apart from fixed costs, recurrent costs also influence service levels, as discussed in the following section.

Recurrent Costs (CapManEx, OpEx, ExDS, ExIDS)

While capital or fixed costs are one-time investments, recurrent costs are incurred on a regular basis in order to maintain the systems. These costs include capital maintenance (CapManEx), direct and indirect support costs (ExDS and ExIDS), and operation and maintenance costs (OpEx). These costs are also annualised on per capita basis. At the state level, these costs are US$ 2.4 per capita per year (Figure 4.3). Across the zones, they range between US$ 1.3 in the North Coastal Zone (NCZ) and US$ 4.3 in the South Telangana Zone (STZ). The STZ has high capital costs as well as recurrent costs. Of the recurrent costs, OpEx takes a major share, followed by CapManEx, ExIDS and ExDS at the state level, though the cost composition varies across zones.

Cost Composition

The latest guidelines (GoI 2010) emphasise the shift away from the conventional approach of normative service levels measured in litres per capita per day (lpcd) and a move towards water security at the household level, which includes equity aspects. In order to ensure this, the guidelines accorded importance to allocating resources to various components, such as source sustainability



	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	State
ExDs	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
ExIds	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Opex	0.3	0.3	1.7	0.7	1.2	0.6	1.9	0.6	0.6	0.9
CapmanEx	0.2	0.1	0.7	0.0	1.0	0.2	1.5	1.0	0.4	0.6

Figure 4.3 Recurrent costs across zones

(20 percent), water quality (20 percent), operation and maintenance (10 percent), and to mitigating the impact of natural calamities/climate change (5 percent), along with the allocation for access, i.e., capital expenditure on hardware and software (45 percent). Here we examined how various cost components account for in the real expenditure. Though the earlier guidelines have also suggested allocations for each component, they are hardly followed in reality. Moreover, these allocations are often followed at the sector level and not at the scheme level.

At the state level, the cost components are assessed for normative as well as observed life spans. It may be noted that support costs (ExDS and ExIDS) are estimated using the state-level and national level budgetary data, and these costs are assumed to be constant across zones. These costs, which are not included in the official cost norms, are added to official cost data, as they are already incurred at the state and national levels. Another component not part of the official norms is capital maintenance (CapManEx), which also came up in the WASHCost data. In fact, capital maintenance does not figure even in the new guidelines, though it finds mention under operation and maintenance. This could be the reason why budget allocations do not have provision for depreciation.

Capital expenditure on hardware gets higher allocations even as per norms, i.e., above 50 percent, when compared to new guidelines (Figure 4.4). In reality, it gets as much as 85 percent of the total expenditure. Support costs get about 5 percent – that, too, mainly in the form of salaries and macro planning. It may be noted that presently 72 percent of the executive and superintendent

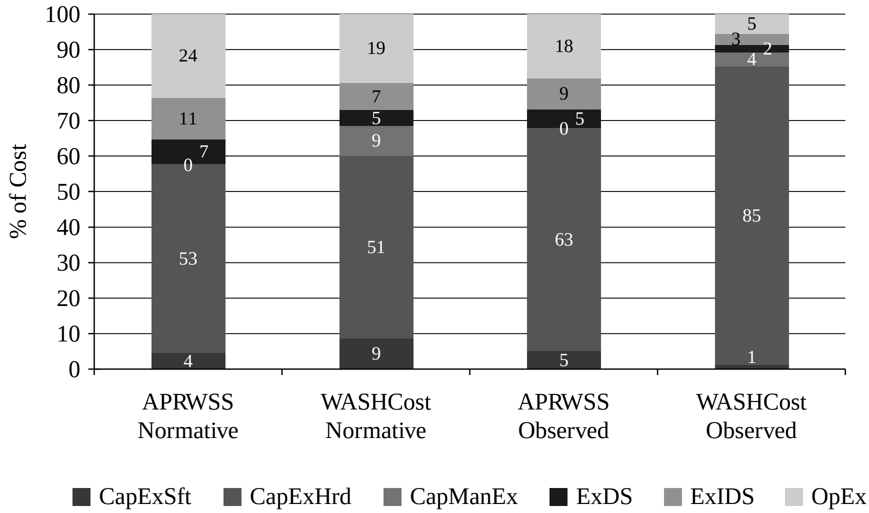


Figure 4.4 Composition of unit costs (in percent) for normative and observed life spans in Andhra Pradesh

engineer posts are vacant, indicating poor support services at the district and sub-district levels. At the state level, capital maintenance (CapManEx) accounts for 4 percent of the total expenditure, though these costs are not part of the norms. Capital maintenance expenditure is *ad hoc*, i.e., as and when the need arises. Even the annual budget allocations reveal that the preference is for creating new infrastructure, rather than maintaining the old (Reddy and Jayakumar 2011). Operation and maintenance costs account for 5 percent in reality, compared to 10 percent in the guidelines. A comparison of the cost allocations between normative life span and observed life span indicates that most of the operation and maintenance costs might have been diverted to capital expenditure on hardware. That is, when unit costs are worked out in accordance with the actual life of the systems or separate allocations are made towards capital maintenance, allocations towards operation and maintenance would actually be utilised for that purpose and not diverted to other purposes.

It is observed that the unit cost composition varies across zones. While capital expenditure on hardware takes more than 80 percent of the share in all the zones, the shares of the other components vary more (Figure 4.5): Support costs vary between 3 (STZ) and 9 (HAZ) percent; capital maintenance varies between 0 (KZ) and 6 percent (CTZ, STZ and SZ); and the share of operation and maintenance varies between 2 (NCZ) and 11 (GZ) percent of the total costs. Incidentally, the North Coastal Zone (NCZ) has the highest share of capital expenditure on hardware (89 percent), while the Godavari Zone (GZ) has the lowest share (80 percent). These variations in cost components and

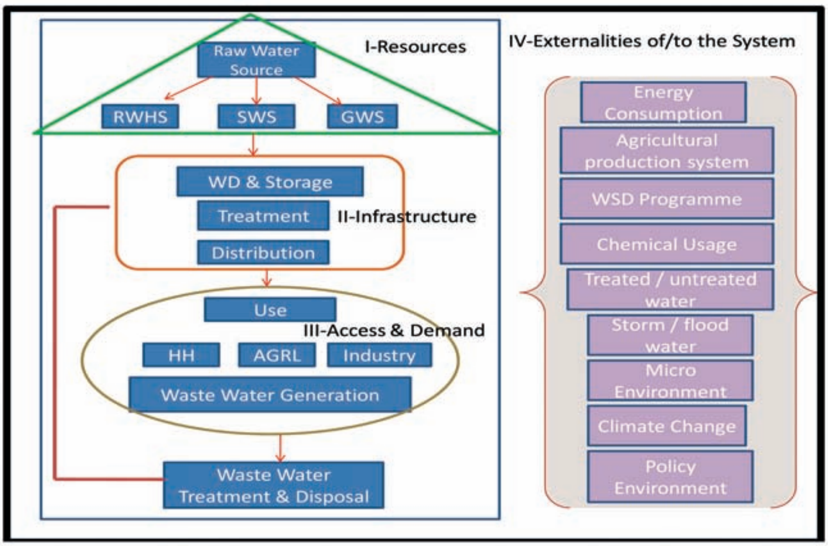


Plate 1 LCCA system boundaries for WASH supplies

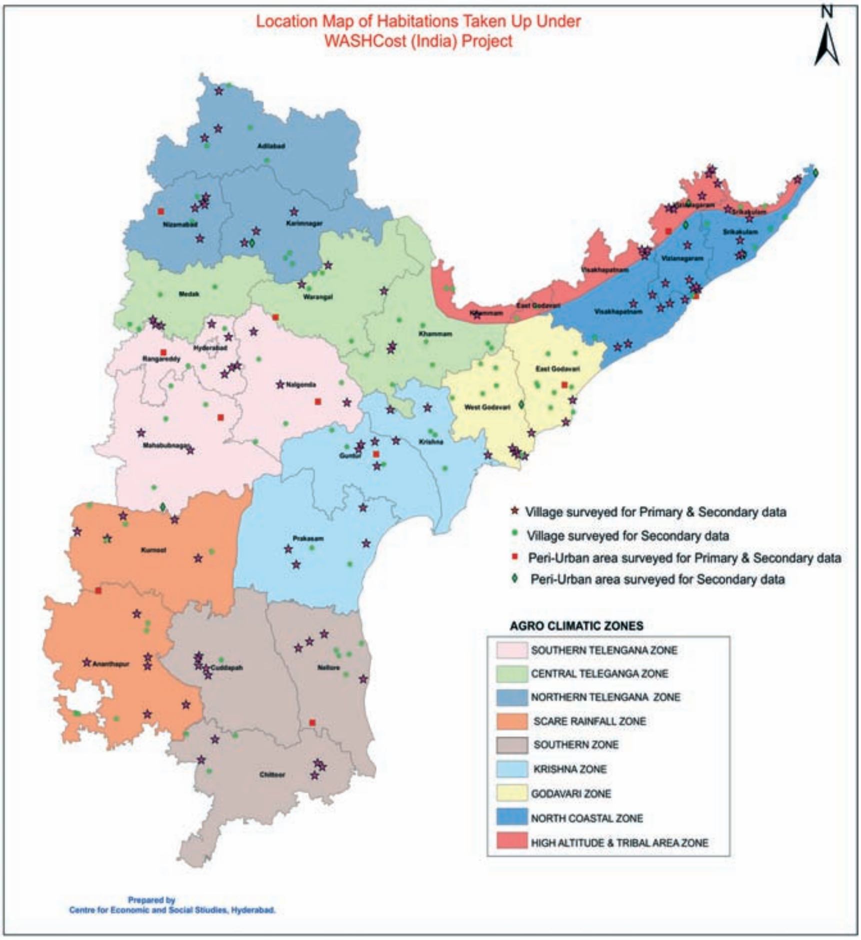


Plate 2 Location map of habitations taken up under WASHCost (India) Project

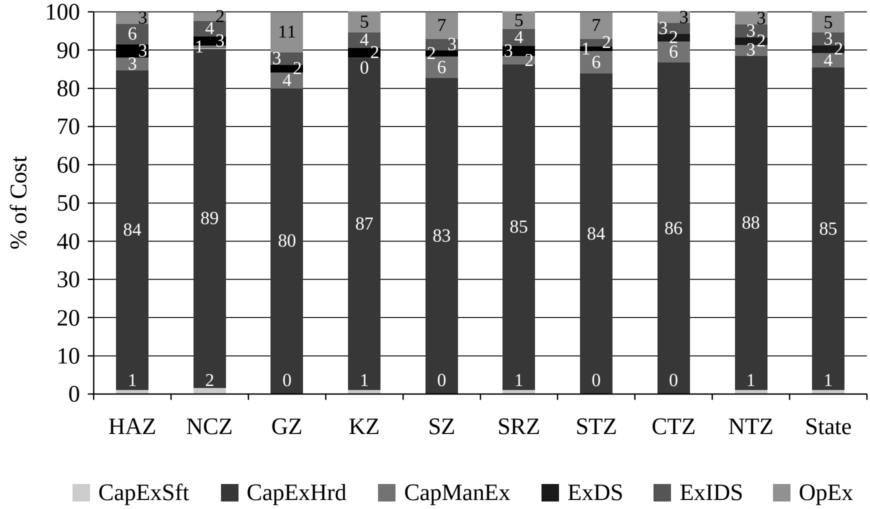


Figure 4.5 Composition of unit costs of observed life span across agro-climatic zones (percentages)

composition emphasise our argument that adopting uniform unit costs and blanket allocation of funds may not be effective in achieving sustainable service delivery. Such variations need to be taken into account while fixing the norms for fund allocations across, as well as within, the zones.

Household Costs

Apart from public expenditure on drinking water, households also invest substantial amounts, in order to supplement the service levels. These investments include both fixed costs (HHCapExHrd), such as investments in overhead or ground storage or pumps/motors and wells (open or bore well), and recurring costs, such as operation and maintenance (HHOpEx) costs incurred on the household investments, and expenditure for buying water (HHExpBUY). These investments vary across households and mostly depend on the economic status of the household. In some cases the households buy water, due to the poor quality of the supplied water (i.e., it is not safe to drink). But household investments may not simply reflect investment to supplement below normative service levels; they may be made to achieve higher service levels. Households spend time fetching water due to poor service levels in terms of access. This time is spent in walking varying distances and waiting in long queues for water. Given the poor access levels in the sample villages, the time the households spent fetching water was expected to be substantial. We have converted this time into money using the opportunity costs of time:

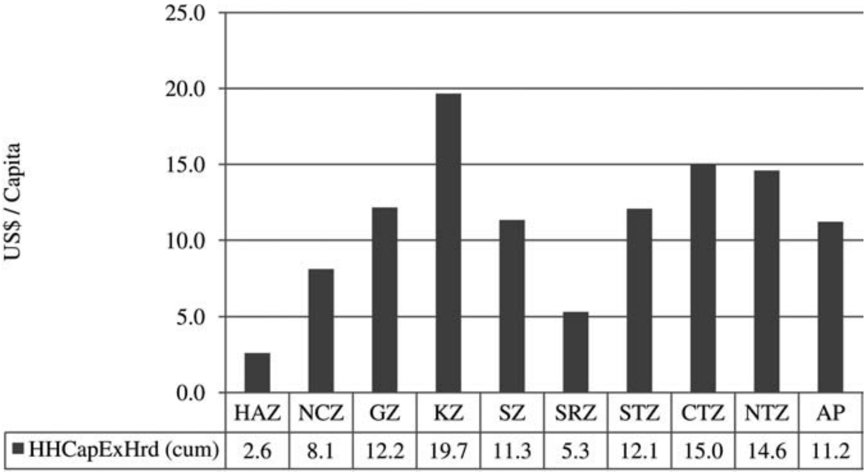
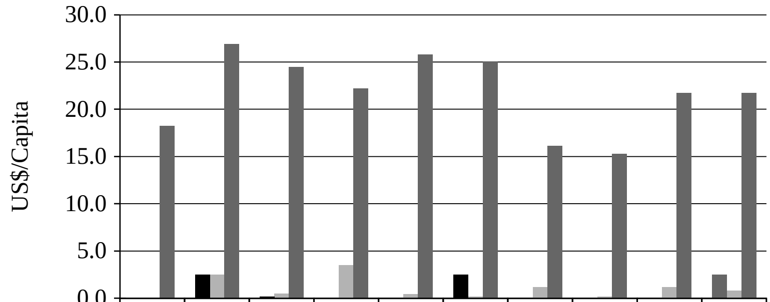


Figure 4.6 Household investment in water infrastructure (CapEx)

i.e., the village wage rate. All these household costs, especially the opportunity costs of time, along with the public expenditure on water are treated as the economic costs of providing water.

The household costs are based on a sample of 5,350 households spread over 107 sample villages. Household expenditure on water infrastructure or capital expenditure is about US$ 11 at the state level (Figure 4.6). That is, households spend an additional 20 percent on top of the public capital expenditure – their investments range between US$ 2.6 in the High Altitude Zone (HAZ) to US$ 19.7 in the Krishna Zone (KZ). The low household expenditure in the HAZ could be due to the poor economic status of the households in this zone; that is, the poor regions tend to get low public as well as private investments in water infrastructure. In terms of recurring costs, households spend very little on OpEx (US$ 0.1 per capita per year) (Figure 4.7), and this is true across the zones. And household expenditure on buying water is also low: US$ 0.9 per capita per year at the state level, although some zones (such as the Krishna Zone) spend as much as US$ 3.6 per capita per year. As expected, the opportunity cost of the time households spend on fetching water is quite substantial. At the state level the costs are as high as US$ 21.8 per capita per year. Across the zones, the costs range between US$ 15.4 in the Central Telangana Zone (CTZ) and US$ 26.9 in the North Coastal Zone (NCZ). These costs are more than the annualised capital costs (see Table 4.3) and ten times that of all the recurring costs. That is to say, the economic costs of water provision are almost double that of the financial costs. From the economic angle, the households' expenditure on water seems to be more than the public expenditure. This is mainly due to poor access to water across the regions.



	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
HHOpEx	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.1
HHExpBuying Water	0.0	0.1	0.6	3.6	0.5	0.3	1.2	0.2	1.3	0.9
HHOportunity cost	18.4	26.9	24.5	22.3	25.9	25.1	16.2	15.4	21.7	21.8

Figure 4.7 Household expenditure on recurring costs

Unit Costs and Service Levels

Providing service is expected to be the main reason behind the spending on water supply systems. While assessing service levels is complex, as it represents multiple indicators, a service ladder approach using four parameters – quantity, quality, accessibility and reliability – is adopted in WASHCost research (for details, see Moriarty *et al.* 2011). Service levels are assessed in terms of the proportion of households receiving basic and above service levels for the four different parameters (for details on service levels, see Chapter 3 above), as the basic and above service levels correspond with the Indian norms of service levels.

At the state level, majority of the households (above 50 percent) get basic and above service levels for three parameters in all the zones (Figure 4.8). Accessibility gets the lowest rating, with only 15 percent of the households reporting above basic service level. Across the zones, the Scarce Rainfall Zone (SRZ) reported the highest proportion (> 50 percent) of the households receiving basic and above service levels in all the four parameters. On the other hand, the High Altitude Zone (HAZ) has the lowest proportion of households receiving basic and above services in all four parameters. Further, while low unit costs (US$ 9.2) in HAZ could be seen as the reason for the poor service level, the relation does not seem so straightforward in the case of the Southern Zone (SZ), Scarce Rainfall Zone (SRZ), and Central Telangana Zone (CTZ), where the service levels don't strictly correspond to unit costs. The Krishna Zone, which has the second-lowest unit cost (US$ 13), has more than 60 percent of the households receiving basic and above service levels in three parameters, due to household investments in individual bore wells, which indicates that unit costs could be considered a pointer to service levels at best.

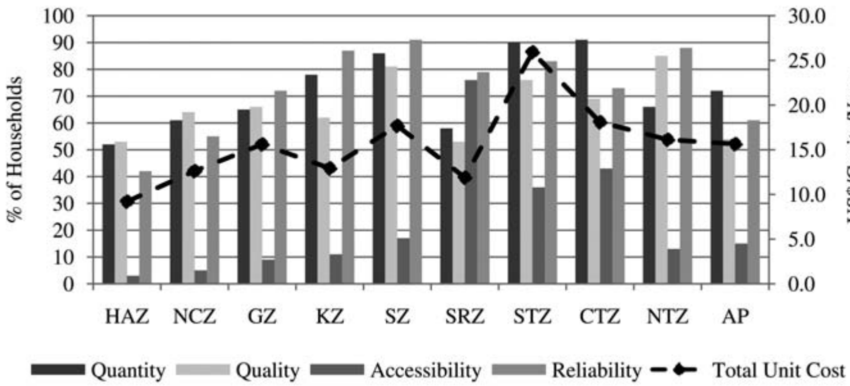


Figure 4.8 Service levels (basic and above) and unit costs across zones

This is because the composition of costs also plays an important role in the provision of sustainable services; and there could be a number of other factors as apart from unit costs that influence service levels. A more nuanced analysis of the relationship between costs and service levels is taken up in the next chapter.

IV Cost of Provision for Different Technologies

The sample villages represent all the existing technologies prevalent in the rural water supply. The 187 sample villages are divided into eight groups based on the type or combination of technologies used: They represent four pure technologies: Hand Pumps (HPs); Direct Pumping (DP) or Mini-Piped Water Supply (MPWS); Single-Village Schemes (SVS); and Multi-Village Schemes (MVS). These are used in 107 of the 187 sample villages, the remainder using different combinations of these four technologies (Table 4.4). Most villages (45) fall under the MPWS and SVS combination. However, the villages with a combination of these technologies, though analysed here, may not be strictly comparable to the pure technologies, as the costs and service levels cannot be attributed to a specific technology. Moreover, these combinations are not part of a planned policy intervention; they are the result of *ad hoc* practice. Thus, comparing the villages served by a single technology would help to identify the least-cost options for policy purposes.

Though all these technologies and combinations coexist, the current policy focus is mainly on the single- or multi-village schemes. Hand pumps are no longer promoted as comprehensive rural drinking water schemes, but are used for emergency relief during droughts and at inaccessible locations, such as the hilly and tribal habitations. Some of the old and functioning hand pumps are connected to electric motors in most villages, i.e., converted as sources for DP or MPWS schemes. In the light of the increasing population size of the villages,

Table 4.4 Distribution of sample villages by the type of technology in rural water supply schemes

Technology	*Description*	*Source*	*Coverage (population)*	*No. of sample villages**
Hand Pump (HP)	Water is available only through hand pumps fitted to shallow aquifer.	Ground-water	Low (250)	22 (11)
Direct Pumping or Mini-Piped Water Supply (DP or MPWS)	An electrical, usually submersible, pump is directly connected to the bore well. Water is available during pumping hours only in the simplest configuration serving a single habitation. Otherwise it is provided with a battery of taps attached to a storage tank, in which case water is available for longer periods.	Ground-water	Medium (500)	34(12)
Single-Village Scheme (SVS)	Piped network supply system with pumping, storage and distribution through public stand posts and provision for house connections as well. Water is filtered using sand filters, in the case of surface water sources; no filtering in the case of groundwater.	Ground-water or surface water	Medium to large (more than 500)	33 (28)
Multi-Village Scheme (MVS)	Centralised supply system with large-scale storage at central location. Water is drawn either from surface reservoirs or groundwater aquifers to a filter (surface water) and then supplied to a number of villages. Each village will have its own storage and distribution network.	Ground-water or surface water	Large to very large (multiple villages)	18 (13)
MPWS + SVS	Villages that had mini-piped water supply and were then upgraded to single-village schemes. Both are functional.	Ground-water or surface water	Large (more than 500)	45 (19)
MPWS + MVS	Villages that had mini-piped water supply and are presently connected to multi-village schemes. Both are functional.	Ground-water or surface water	Large to very large (multiple villages)	11 (6)
SVS + MVS	Initially single-village schemes and presently connected to multi-village schemes. Both are functional.	Ground-water or surface water	Large to very large (multiple villages)	13 (12)
MPWS + SVS + MVS	Villages that had mini-piped water supply, were then upgraded to single-village schemes, and are presently connected to multi-village schemes. All are functional.	Ground-water or surface water	Large to very large (multiple villages)	11 (6)

*Figures in brackets are the number of sample villages for which service-level data are available.

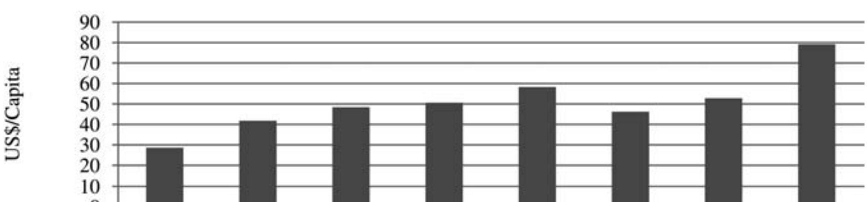
coupled with the increasing opportunity costs of rural labour and shortages of power, DP or MPWS schemes are not being encouraged any more, and future technology policy for rural drinking water will be mainly focused on single- or multi-village schemes – the move is in favour of the latter.

Fixed Costs (CapEx)

Fixed costs include the capital expenditure on hardware (infrastructure) and software (planning and design). When the per capita sum of (cumulative) capital costs is taken into account, multi-village schemes are, relatively speaking, the most expensive of the pure technologies (Figure 4.9). Hand pumps are the cheapest, followed by DP/MPWS, and SVS. Per capita costs are more in the case of villages that are served by multiple schemes. However, cost differences are statistically significant only in the case of hand pumps and the combination of (MPWS + SVS + MVS). That is, the per capita costs of hand pumps are significantly cheaper, while those for MPWS + SVS + MVS are significantly higher when compared to the other technologies. The per capita costs of the pure technologies (MPWS, SVS and MVS) are not significantly different. This is mainly due to the high variations in costs within the technologies (see Appendix Table A4.6).

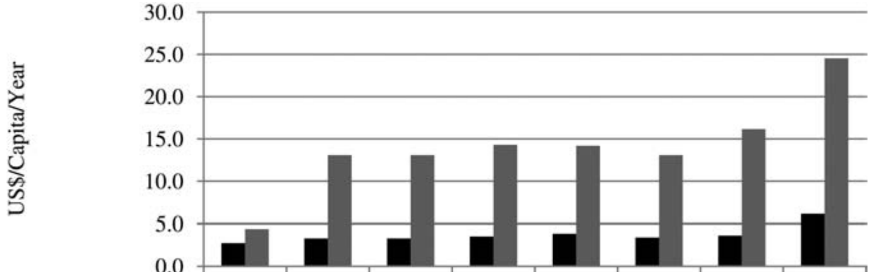
Annualised unit costs were calculated for normative as well as observed life of the schemes. While the normative unit costs reflect the ideal conditions of good asset management, observed unit costs represent the actual picture under the present management system. The normative life span is worked out on the basis of the economic and useful life of the systems, while the observed life span is the life of the systems in reality. The normative life span data are provided by the department (RWSS). Future service delivery requirements and their cost norms are arrived at by the department on the basis of the normative life span of the systems.

The observed life span is often found to be lower because the systems break down frequently, due to lack of maintenance or to the hydro-geology of the region (bore well failure). Moreover, poor design and implementation also



	HP	MPWS	SVS	MVS	MPWS+ SVS	MPWS+ MVS	SVS+MV S	MPWS+ SVS+MV S
■ CapExHrd	29	42	48	51	58	46	53	79

Figure 4.9 Capital (cumulative) expenditure per capita across technologies



	HP	MPWS	SVS	MVS	MPWS +SVS	MPWS +MVS	SVS+ MVS	MPWS +SVS+ MVS
■ CapEx-Normative	2.8	3.3	3.3	3.5	3.9	3.4	3.6	6.2
■ CapEx-Observed	4.4	13.1	13.1	14.3	14.2	13.1	16.2	24.5

Figure 4.10 Technologies: Fixed costs per capita per year with normative and observed life spans

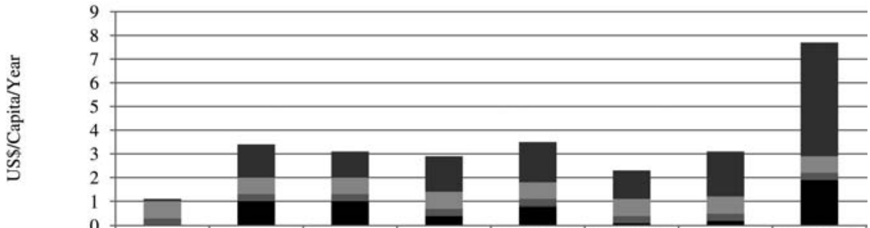
speed up the decay of the systems. Similarly, in the case of new systems where breakdowns are few, the observed life span could be lower than the norm, pushing the costs up.

When capital costs are annualised, the unit costs range between US$ 2.8 and US$ 6.2 per capita per year when normative life span is assumed (Figure 4.10). However, this is different from reality, as the unit costs are higher when the observed life span is taken into account. In the case of hand pumps, the unit cost of provision has gone up from US$ 2.8 (normative) to US$ 4.4 (observed) per capita per year: 57 percent higher (Figure 4.10). The difference between normative and observed unit costs is four times in the case of the other technologies. The life span could be improved with investments or allocations towards capital maintenance, which are currently absent.

Recurrent Costs (CapManEx, OpEx, ExIDS, ExDS)

Recurrent costs are also annualised on per capita basis. As far as pure technologies are concerned, the recurring costs range between US$ 0.9 per capita per year in the case of HPs and US$ 2.8 in the case of MPWS (Figure 4.11). Recurring costs of single- and multi-village schemes are the same: US$ 2.5 per capita per year. The unit costs are as high as US$ 6.3 per capita per year in the case of a combination of three technologies. These cost differences are marginal and significant statistically only in the case of HPs and the combination of three technologies (MPWS + SVS + MVS) (Appendix Table A4.8).

Hand pumps are the cheapest, even in terms of recurring costs. The high unit costs in villages served with a combination of technologies could be due to maintenance; because all the technologies are functional, they all



	HP	MPWS	SVS	MVS	MPWS+SVS	MPWS+MVS	SVS+MVS	MPWS+SVS+MVS
■ OpEx	0.1	1.4	1.1	1.5	1.7	1.2	1.9	4.8
■ ExIDS	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
■ ExDS	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
■ CapManEx	0	1	1	0.4	0.8	0.1	0.2	1.9

Figure 4.11 Average cost of provision

incur operation and maintenance costs along with other recurring costs (Figure 4.11). In some cases, the villages are upgraded to multi-village schemes for political reasons, although they may not be in need of improved service levels, and the unit costs of the combination of three technologies (MPWS + SVS + MVS) are significantly higher than those of the other technologies (Appendix A4). The observed differences in unit costs are not, however, significantly different between any of the pure technologies. Multi-village schemes have not only high cumulative costs but also a wide range and variations. As a result, the median value of the cumulative cost of MVS is lower when compared with SVS (Appendix Table A4.7). This is mainly because variations between villages with the same technologies are much higher than between the technologies when all the villages are aggregated by technology (Appendix Table A4.7).

Relative Costs

Relative costs are calculated using fixed as well as recurring costs (unit cost). The annualised relative costs by life-cycle cost components show that the relative costs vary between normative and observed life spans. Though the infrastructure costs (CapExHrd) account for a major share, they range between 73 percent (HPs) and 51 percent (MPWS) between the technologies (Figure 4.12). However, these variations are marginal when observed life span is used – the values range between 82 percent (HPs) and 84 percent (MVS and SVS) (Figure 4.13).

In the case of normative life span, the share of operation and maintenance (OpEx) goes up as one moves from HPs to MVS, while the share of capital maintenance (CapManEx) is the highest (14 percent) in the case of SVS and DP/MPWS schemes. There is no capital maintenance in the case of hand pumps, i.e., there is no case of hand pump replacement in the sample villages.[4]

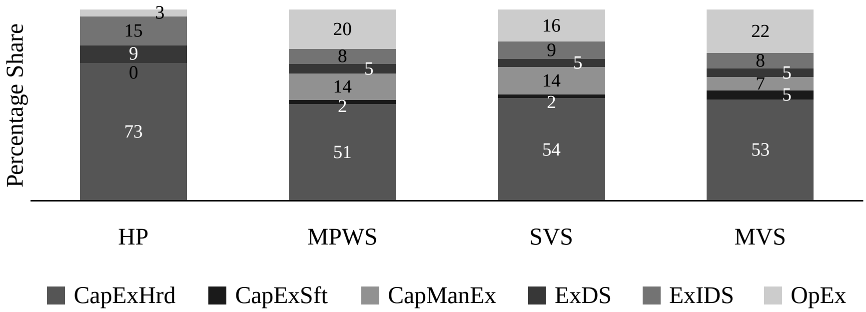


Figure 4.12 Technologies: Share (percent) of unit costs (fixed + recurring) for normative life span

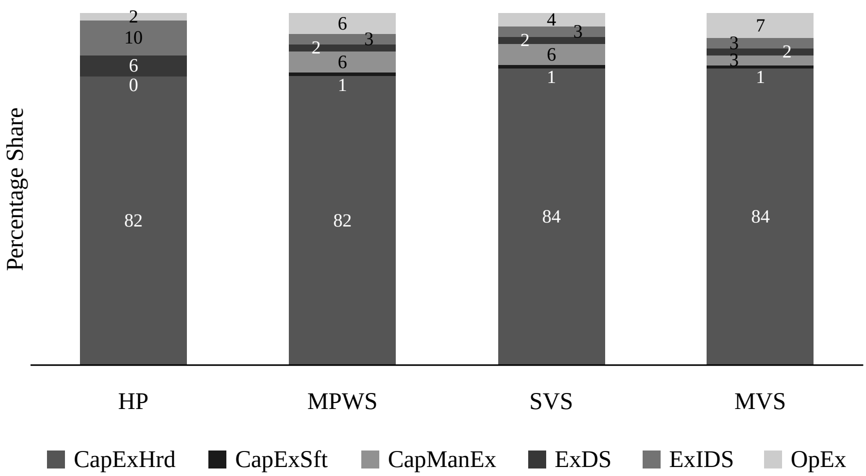


Figure 4.13 Technologies: Share of unit costs (fixed + recurring) for observed life span

Capital maintenance costs are on the low side in the case of MVS because these schemes are relatively new.

In the case of observed life span, also, the relative shares are in the same order, though the magnitudes differ. Even when the observed life span of the systems is taken into account, operation and maintenance costs are high in the case of MVS, at 7 percent.[5] While these costs are 2 percent for hand pumps, they account for 4 percent for SVS and 6 percent for DP/MPWS and MVS. Capital maintenance is as high as 6 percent in the case of SVS and DP/MPWS, but 3 percent in the case of MVS.

Furthermore, while the difference between the share of fixed and recurring costs is not much in the case of observed life span, the share of recurring costs is substantially lower for hand pumps in the case of observed life span. This is mainly due to the high operational (OpEx) costs of the MVS, MPWS and SVS systems; the SVS and MPWS schemes also have high CapManEx. This indicates that each technology has its cost advantages as well as disadvantages.

Among the recurring costs, operation and maintenance expenditure takes a major share, followed by capital maintenance (Appendix Figures A4.1 and A4.2). The share of operation and maintenance costs goes down as we move from MVS to hand pumps. Hand pumps do not have any capital maintenance expenditure, and capital maintenance is the highest for MPWS schemes, which involve older technology than single- and multi-village schemes. Further, direct and indirect support costs also account for a substantial share. However, in order to assess cost efficiency, these costs need to be linked with service delivery, which we shall look at next.

Unit Cost versus Service Provided per Technology

More than 50 percent of the households receive basic and above service in terms of quantity, quality and reliability (Figure 4.14). Accessibility, measured in terms of the time spent on fetching water, appears to be a major concern irrespective of the technology used. At the highest level, only 36 percent of the households spend less than 30 minutes a day for fetching water (receiving above basic service) in the case of villages that have three technologies functioning simultaneously (MPWS + SVS + MVS). Accessibility is the lowest among MVS and HP villages. Unit costs would go up in the case of low accessibility when opportunity costs of time are taken into account. Service levels are poor for all indicators in the case of HP villages. Among the pure technologies, SVS is providing better service in terms of all the indicators

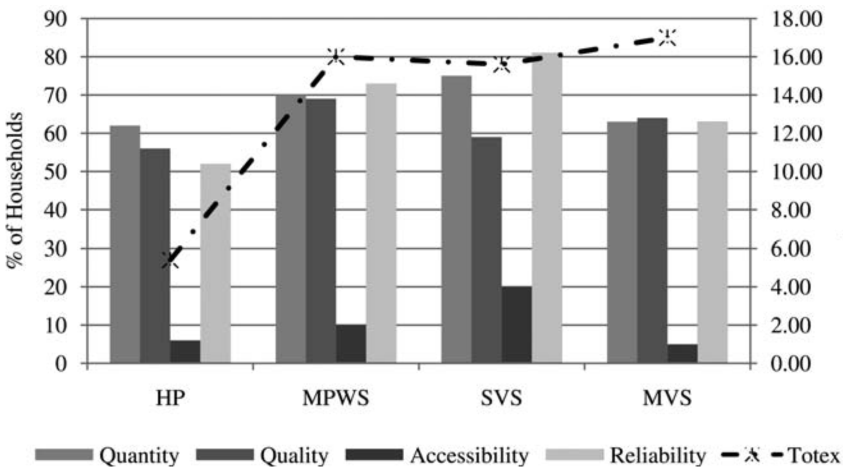


Figure 4.14 Service levels (basic and above) and unit cost across technologies

except quality followed by MPWS, while MVS villages compare poorly with both these technologies in all the indicators except quality, which is slightly better than that of SVS. The centralised distribution systems of MVS do not seem to be efficient in service delivery, and the differences in service levels are not statistically significant in most cases, especially among the pure technologies (Appendix Table A4.8).

However, as mentioned earlier, the differences in unit costs are not very different among these technologies, except that HP is the cheapest and the combination of three technologies (MPWS + SVS + MVS) is the most expensive. When unit costs are plotted against the service levels, it is clear that while HP is associated with poor service levels, the most expensive technology provides only marginally better service, that too in the case of quantity, quality and accessibility. On the other hand, SVS and MPWS provide relatively better services when compared to MVS. It may be noted that better quality and accessibility is also associated with buying water (Appendix Figures A4.4 and A4.6). In the absence of buying water, MVS would do well in terms of quality, due to its dependence on surface water sources. While these service levels are based on the proportion of households receiving a specific level of service, the actual cost of provision in terms of cost per unit of water is not captured here. Since the cost per unit of water is an important indicator while comparing the technologies, this aspect is covered in the following section.

Cost per Unit of Water

Here we assess the cost per unit of water across technologies. For this we estimated the actual use of water at the household level using the sample household data. The actual service received is the net wastage from the water pumped. In general, wastage is estimated to be about 50 percent of the pumped water (WASHCost India 2010).

The total water consumption for the year under each technology (sample villages) is compared with the annualised cost per capita for the specific technology (sample villages). The ratio between the annualised cost and the annual water use of the habitation gives the cost per unit of water. While the per capita service level is not very different across the technologies, especially the pure technologies, the cost per unit of water, at the aggregate level, varies (Table 4.5).

As far as pure technologies are concerned, in terms of both normative and observed life spans of the systems, the cost per unit of water is the lowest in the case of hand pumps and highest in the case of MVS. Among the combination of technologies, MPWS + SVS + MVS schemes have the highest cost per unit of water, followed by MPWS + SVS, SVS + MVS, and MPWS + MVS. While costs in HP-dependent villages are low, their service levels are also low, especially in terms of reliability and accessibility. Single-village schemes appear to be the best of the lot, with better service indicators and relatively low costs, in terms of both cost per capita per year and cost per unit of water. On

Table 4.5 Cost per unit of water

Technology	*Annualised cost/cap (US$)*		*Annualised cost (US$)*⋆		*Service in quantity (lpcd)*†	*Population covered*	*Total amount of water used (m^3/year)*	*Cost per unit of water (US$/$m^3$)*	
	Normative	*Observed*	*Normative*	*Observed*				*Normative*	*Observed*
HP	4.2	5.4	2,9518	37,951	40	7,028	102,609	0.29	0.37
MPWS	6.9	16	5,9575	138,144	42	8,634	132,359	0.45	1.04
SVS	6.6	15.6	229,178	541,694	41	34,724	519,645	0.44	1.04
MVS	7.0	17	140,966	342,346	41	20,138	301,365	0.47	1.14
MPWS + SVS	7.6	16.7	263,264	578,488	40	34,640	505,744	0.52	1.14
MPWS + MVS	6.1	14.7	28,463	68,590	45	4,666	76,639	0.37	0.89
SVS + MVS	7.2	18.6	149,033	385,001	46	20,699	347,536	0.43	1.11
MPWS + SVS + MVS	13.9	29.6	116,079	247,190	38	8,351	115,828	1.00	2.13

⋆ Costs are unit costs (fixed + recurring), as calculated earlier, multiplied by the population covered under the technology.
† These quantities are weighted averages of summer and non-summer water use.

the other hand, MVS has higher unit costs with low service levels when compared to MPWS. These unit costs provide the aggregate picture. A more detailed analysis of the factors responsible for these variations will be taken up in the next chapter.

V Conclusions

The cost estimates using the Life-Cycle Costs Approach (LCCA) bring out the following important issues:

1. Unit costs revealed by the LCCA are substantially higher than the prescribed norms, and they vary substantially across the agro-climatic zones.
2. Intra-zonal (inter-village) variations are much higher than the inter-zonal variations.
3. Unit costs vary between US$ 9.2 and US$ 26 (fixed and recurrent) between the zones, while they range between US$ 1.1 and US$ 81.4 between villages. These variations are quite substantial and go against unconditional allocations.
4. Lower observed life span of the systems is one of the main reasons for these variations, apart from the agro-climatic conditions.
5. Across the technologies, the average unit costs are about 3 times lower for hand pumps.
6. Multi-village schemes are relatively more expensive, though the cost differences are not statistically significant.
7. Multi-village schemes are associated with high (cumulative) capital costs with wide variations.
8. Cost composition as well as cost shares vary across locations. Cost composition is presently focused on infrastructure to the neglect of other important components such as source protection, capital maintenance, quality, etc.
9. All the technologies are associated with high recurring costs when compared to hand pumps, especially the operation and maintenance costs. On the other hand, capital maintenance costs are more in the case of SVS and MPWS schemes.
10. As far as service levels are concerned, hand pumps provide poor services in terms of reliability, accessibility and quality. Moreover, hand pumps are not the commonly used technology; they are used mostly to cope with scarcity conditions. At the policy level also, this is not a policy option due to the low preference at the community level.
11. Single-village schemes perform better in the case of services levels in terms of all the four indicators. However, the differences are not statistically significant.
12. Irrespective of the technology, accessibility is the main concern, as a majority of the sample households spend more than 30 minutes a day

fetching water. In the light of the increasing opportunity cost of labour, this could result in substantial economic losses in general, and welfare losses in cases where children are involved, in fetching water.

13 Multi-village schemes are expensive even in terms of cost per unit of water, despite their larger coverage of population.

14 There is no clear relation between unit costs and service levels (quantity, quality, accessibility and reliability) between zones and technologies.

15 The analysis suggests that allocations towards capital maintenance could help in reducing the gap between normative and observed life spans.

While the approach of unconditional allocations towards provision of water in rural areas may be easier administratively and might benefit the low-cost regions, it would result in a less than desirable level outcome in the high-cost regions. There is need for rethinking on the policy of blanket or uniform allocations across the zones on the basis of the norms fixed at the state level; Added to this are the intra-village variations across socio-economic groups and geographical locations.

Multi-village schemes are not necessarily the best available option. In fact, single-village schemes appear to be more efficient, despite all their drawbacks. One reason for this could be that the operation and management of multi-village schemes is split between contractors and the village panchayat. The village panchayat does not have the control over the quantum of water released and the time of release. On the other hand, in the case of single-village schemes the village panchayat is in full control of the system. The management problems at the village level are the same for both the schemes, but SVS are plagued with the additional problems associated with source sustainability, water quality, etc.

It would be better to address these issues and strengthen the SVS, rather than moving towards multi-village schemes, which are not efficient. What is more, MVS also will have source sustainability problems associated with climate change (IPCC 2008). In either case, source sustainability needs to be addressed effectively, and the management becomes easier in the context of single-village schemes with better planning. Further, there is a need to revise the allocations to the sector in terms of magnitude and composition, along the lines suggested here. LCCA is one tool that can help in achieving water security at the household level, through judicious allocations towards source sustainability or source protection, water quality, capital maintenance, etc. It facilitates fairly comprehensive planning with a pragmatic and integrated water resource management approach to rural water service delivery.

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Appendix

Table A4.1 Life span of water and sanitation system components

Component	*Technical lifetime (yrs)*	*Economic lifetime (designed period) (yrs)*		*Suggested useful life (yrs)*
	RWS	*CPHEEO*	*RWS*	*RWS*
Transmission Mains (raw & clear water)	20–50	30	20–30	20
Distribution Mains	20–50	30	20–30	20
Bore Wells	20–40	–	10–15	10
Buildings (civil works)	30–50	30	30–50	30
Pumps & Transformers	10–20	15	10–15	10
Storage Dams/Reservoirs	50–75	50	30–50	50
Infiltration Works	30–50	30	10–15	10
Water Treatment Units	20–40	15	10–15	10
Pipe Connections to Treatment Units & Other Small Appurtenances	–	30	10–30	10
Clear Water Reservoirs at the Head Works, Balancing Tanks & Service Reservoirs	15–50	15	15–30	15
Distribution System	10–30	30	5–15	10
Public Stand Post	10–20	–	10–20	10
Hand Pumps	10–15	–	10–15	10
Ceramic Pan	20–50	–	20–30	20
ISL	20–40	–	20–30	20

Source: Department of RWSS, Government of Andhra Pradesh.

Note: RWS = Rural Water Supply Department, GoAP, Hyderabad; CPHEEO = Central Public Health and Environmental Engineering Organisation, GoI, New Delhi.

Appendix 4.1 Note on Indirect Support Costs

Since IDS is not considered under a separate head, we made some assumptions to capture these costs. For instance in Andhra Pradesh, for ExIDS, we included the allocations made towards ten institutions, such as the planning department, the assistance provided to various research organisations and universities, and the allocations made for planning and research under the state schemes as well as by the planning department (Table A4.2). At the national level, we considered the allocations that went to 17 departments including the Ministry of Planning, various institutes of technology and management, the Indian Council of Social Science Research, and other research organisations and open universities (Table A4.3).

The information was gathered for two years 2008–09 and 2009–10. The average of these two years was calculated to iron out the differences. These allocations were converted into per capita terms using the 2009–10 population (Tables A4.2 and A4.3).

On per capita basis, the total expenditure on research and development amounts to Rs. 48 at Andhra Pradesh level, and Rs. 72 at the all-India level. Together the expenditure is Rs. 120. After discussion with public finance experts, it is assumed that 20 percent of this could be assumed as ExIDS on WASH sector, i.e., Rs. 24. This roughly comes to US$ 0.50. That is, ExIDS WASH sector in India is about US$ 0.50.

Table A4.2 Budget allocations towards indirect support costs in Andhra Pradesh (2008–2010) (Rs. million)

S. No.	*Major Head*	*2008–09*	*2009–10*
1	Planning Department	54.7	603
2	Centre for Economic and Social Studies	15.0	17.5
3	Planning and Research (state scheme)	0	69.3
4	Research Scheme (planning department)	0	1.0
5	Assistance to Jawaharlal Institute of Advanced Studies	0	15.0
6	Assistance to C.R. Rao Advanced Institute of Mathematics	0	15.0
7	Assistance to Council for Social Development	0	05.0
8	Assistance to universities	4,121.3	3,163.7
9	Dr MCR Institute of HRD	13	68.2
10	Society for Elimination of Rural Poverty	0	30.0
11	Total (1–10)	4322.0	3415.0
12	Average of 2008–09 and 2009–10 Budget Allocation	3,868.5	
13	Population (2009–10) approximates (millions)	80	
14	Per Capita Expenditure	48	

Source: Various Budget Documents, Annual Plans (2008–09, 2009–10), Government of Andhra Pradesh.

Note: Population is taken from the 2001 Census. Per capita household expenditure is expressed in terms of rupees.

Table A4.3 Budget allocations towards indirect support costs in India (2008–2010) (Rs. million)

S. No.	*Major Head*	*2008–09*	*2009–10*
1	Planning Commission	1,041.3	1,748.2
2	Indian Council of Social Science Research	505.2	515.5
3	Grants-in-aid to Research	30	50
4	University Grants Commission (Gender Budget)	17,983.6	2,2702.8
5	University Grants Commission	14,100.9	18,313.6
6	Indian Institutes of Technology	18,486.1	19,950.6
7	Indian Institutes of Management	1,111.5	1,882.1
8	Indian Institute of Science, Bangalore	2,090	2,452.8
9	Indian Council of Historical Research	119.7	135.1
10	Indian Institute of Advanced Studies, Shimla	849.0	927.0
11	Indian Council of Philosophical Research	58.0	66.0
12	Shastri Indo-Canadian Institute	27.7	27.7
13	Indian Institute of Science for Education and Research	1,750	2,150
14	Rural Universities	31.1	37.0
15	Indian Institutes of Information and Technology	1,052.3	1,270.4
16	National Institutes of Technology	11595.4	16160.0
17	Indira Gandhi National Open University	824.0	820.0
18	Total (1–17)	70891.7	88374.5
19	Average of 2008–09 and 2009–10	79633.1	
20	Population (2009–10) Approximates	1100	
21	Per Capita Expenditure	72	

Source: Various Budget Documents, Expenditure Budget (vols 1 & 2) 2008–10, Government of India.

Note: Population is taken as per the 2001 Census. Per capita household expenditure is expressed in terms of rupees.

Table A4.4 Cost norms of Rural Water Supply and Sanitation Department of Andhra Pradesh

	MVS (percent)	*SVS (percent)*	*Weighted Average*
Per capita cost	Rs. 2000–2800 (US$ 41–58)	Rs. 900–1200 (US$ 18.6–24.8)	1455 (US$ 30)
Per capita maintenance cost	Rs. 60.00– 65.00 (US$ 1.2–1.3)	Rs. 30.00–35.00 (US$ 0.6–0.7)	41.5 (US$ 0.86)

Table A4.5 Difference in unit costs (observed/normative) between technologies (paired 'T' test)

Zone	*HAZ*	*NCZ*	*GZ*	*KZ*	*SZ*	*SRZ*	*STZ*	*CTZ*	*NTZ*	*AP*
HAZ	***8.4/4.7***									
NCZ	NS/NS	***11.5/4.2***								
GZ	★★/NS	NS/NS	***14.2/4.9***							
KZ	NS/NS	NS/★★	NS/NS	***11.8/5.6***						
SZ	★★/NS	NS/★★	NS/NS	NS/NS	***16.1/6.4***					
SRZ	NS/NS	NS/NS	NS/NS	NS/NS	NS/NS	***10.8/5.2***				
STZ	★★/★★	★★/★★	★★★/★★	★★/★★	NS/★★	★★/★★	***23.6/9.9***			
CTZ	★★/★★	NS/★★	NS/NS	NS/NS	NS/NS	NS/NS	NS/★★	***16.5/6.5***		
NTZ	★★/★★	NS/★★	NS/NS	NS/NS	NS/NS	NS/NS	NS/★★	NS/NS	***14.7/6***	
AP	★★/★★	NS/★★	NS/★★★	NS/NS	NS/NS	NS/NS	★★★/★★	NS/NS	NS/NS	***14.2/6.0***

NS = Not Significant
★★ and ★★★ indicate significance at 5 and 10 percent confidence levels respectively.

Table A4.6 Statistical significance of difference between unit costs (observed/normative) across technologies (paired 'T' test)

Technology	*HP*	*MPWS*	*SVS*	*MVS*	*MPWS + SVS*	*MPWS + MVS*	*SVS + MVS*	*MPWS + SVS + MVS*
HP	4.9/3.4							
MPWS	★/★	14.5/5.9						
SVS	★/★	NS/NS	14.2/5.6					
MVS	★★★/★★	NS/NS	NS/NS	15.4/6				
MPWS + SVS	★/★	NS/NS	NS/NS	NS/NS	15.2/6.5			
MPWS + MVS	★★/★★	NS/NS	NS/NS	NS/NS	NS/NS	13.4/5.1		
SVS + MVS	★/★	NS/NS	NS/NS	NS/NS	NS/NS	NS/NS	16.9/6.2	
MPWS + SVS + MVS	★★/★	NS/★★	NS/★★	NS/★★★	NS/★★★	NS/★★	NS/★★	26.9/12.1

Note: The mean values of each technology are compared with every other technology, and the differences are tested for significance. In this table, while the top diagonal line gives the unit costs in terms of observed and normative life span of the systems, the cells below the diagonal indicate whether the difference between these technologies are statistically significant or not:

NS = Not Significant
★, ★★ and ★★★ indicate significance at 1, 5 and 10 percent confidence levels respectively.

Table A4.7 Cost of provision by technology: Variations across the sample villages (in US$ per capita/year)

	HP	*MPWS*	*SVS*	*MVS*
CapExHrd (cumulative)				
Average	29	42	48	51
Median	24	37	47	42
Range (min–max)	2.2–88	0.3–102	2.2–100	2.2–120
CV	65	63	42	70
CapExHrd (normative)				
Average	2.8	3.3	3.3	3.5
Median	2.6	3.0	3.5	3.0
Range (min–max)	0.2–8.8	0.03–9.9	0.2–6.6	0.2–9.9
CV	66	68	40	66
CapExHrd (observed)				
Average	4.4	13.1	13.1	14.3
Median	2.5	11.8	9.5	8.6
Range (min–max)	0.2–17.7	0.3–41.8	0.3–60.5	2.2–46.2
CV	99	83	90	93
CapExSft				
Average	0	0.08	0.05	0.3
Median	0	0	0.02	0.1
Range (min–max)	0	0–1.3	0–0.3	0–3.3
CV	0	261	149	236
CapManEx				
Average	0	1.0	0.9	0.4
Median	0	0	0.2	0
Range (min–max)	0	0–7.7	0–7.7	0–2.2
CV	0	218	177	199
OpEx				
Average	0.07	1.3	1.0	1.4
Median	0	0.3	0.8	0.8
Range (min–max)	0–1.3	0–7.7	0.2–4.4	0–9.9
CV	354	143	82	160
CapExDS	0.3	0.3	0.3	0.3
CapExIDS	0.6	0.6	0.6	0.6

Note: CV = Coefficient of Variation.

The low per capita CapEx cost in the case of MVS is due to the villages located at the head reach of the system, where little or no investments (like overhead tank, etc.) was made within the village.

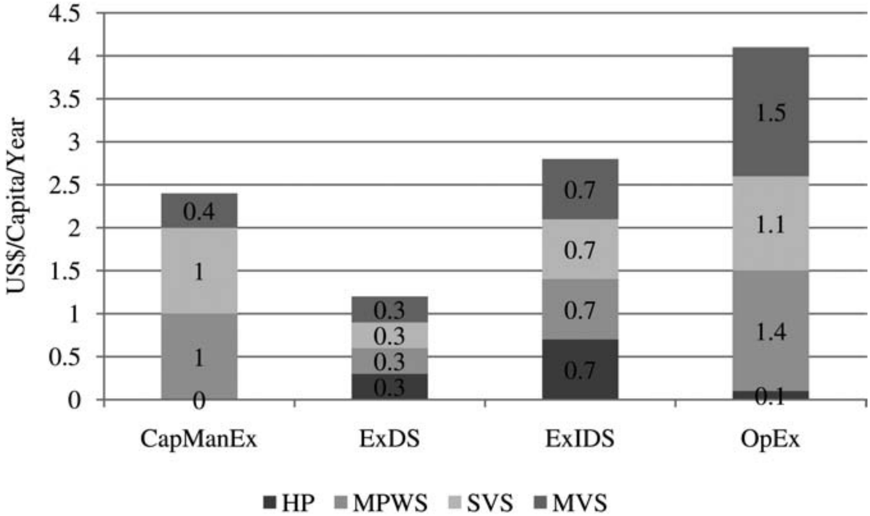

Figure A4.1 Relative share of recurring costs: Normative

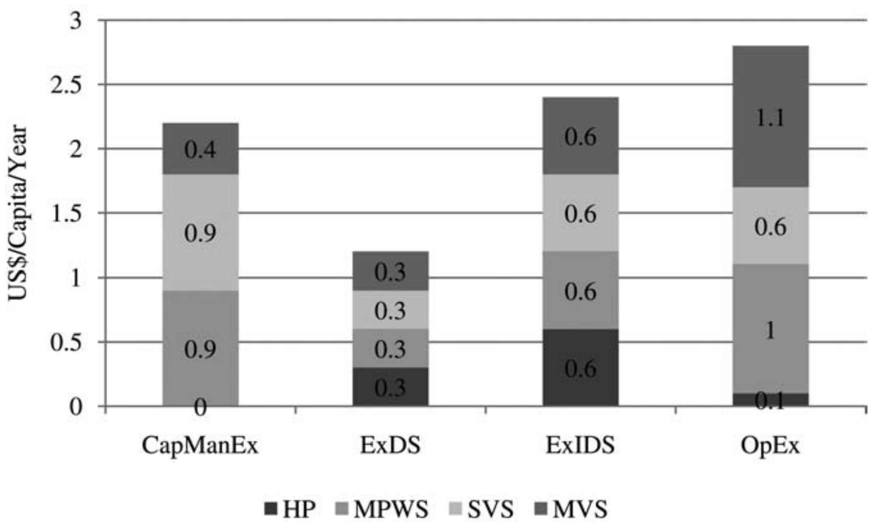

Figure A4.2 Relative share of recurring costs: Observed

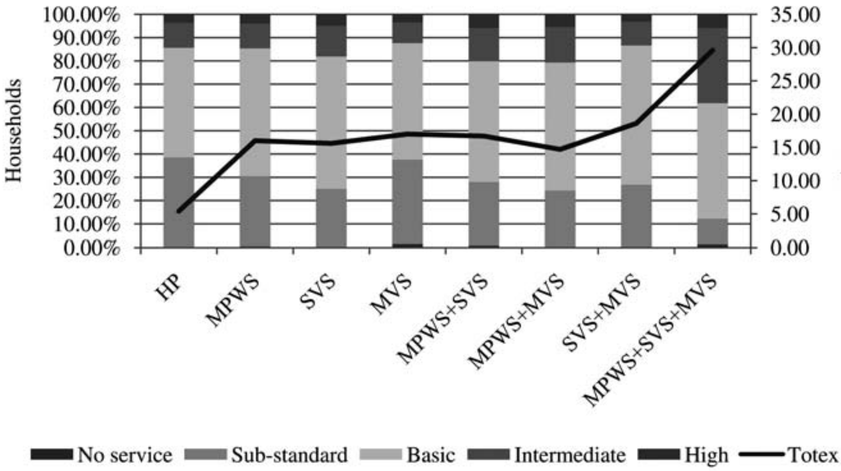

Figure A4.3 Service levels in terms of quantity and unit cost (fixed + recurring) across technologies

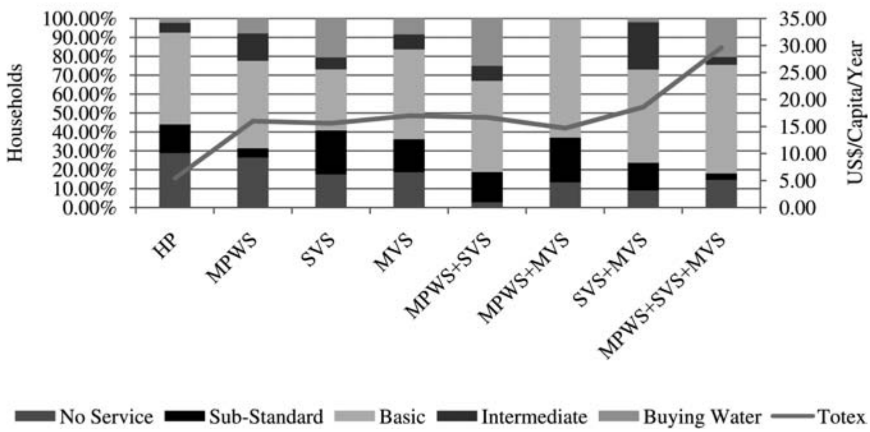

Figure A4.4 Service levels in terms of quality and unit cost (fixed + recurring) across technologies

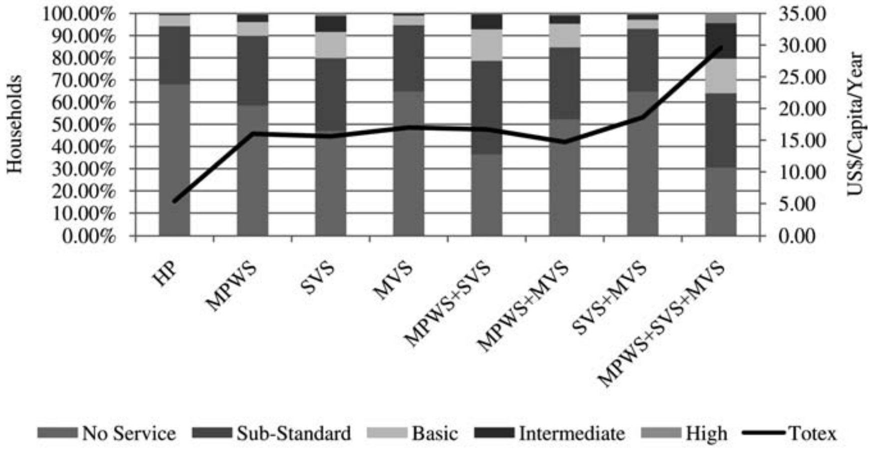

Figure A4.5 Service levels in terms of accessibility and unit costs (fixed + recurring) across technologies

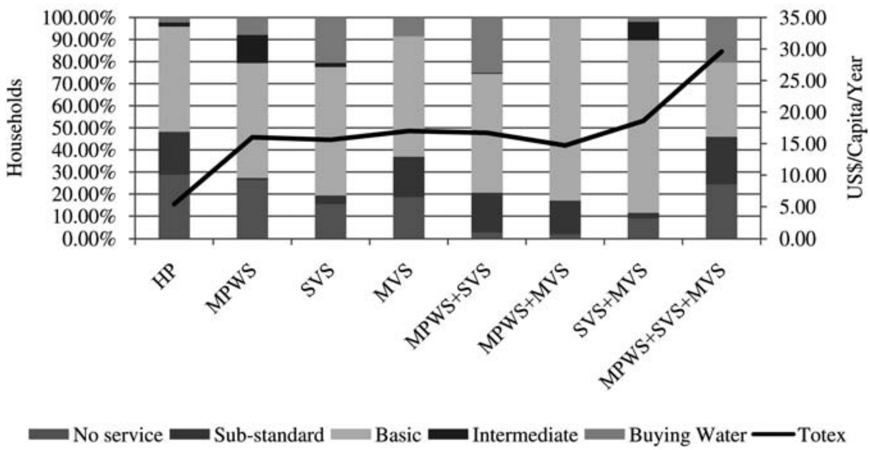

Figure A4.6 Service levels in terms of reliability and unit cost (fixed + recurring) across technologies

Table A4.8 Statistical significance of differences between service levels across technologies (paired 't' test)

Technologies	*Quantity*	*Quality*	*Accessibility*	*Reliability*
HP/MPWS	NS	NS	NS	NS
HP/SVS	NS	NS	**	NS
HP/MVS	NS	NS	***	NS
HP/MPWS + SVS	***	NS	NS	NS
HP/SVS + MVS	NS	NS	NS	NS
HP/MPWS + SVS + MVS	NS	NS	NS	NS
MPWS/SVS	NS	NS	NS	NS
MPWS/MVS	NS	NS	NS	NS
MPWS/MPWS + SVS	NS	NS	**	NS
MPWS/MPWS + MVS	NS	NS	***	NS
MPWS/MPWS + SVS + MVS	NS	NS	***	NS
SVS/MVS	NS	NS	NS	NS
SVS/MPWS + SVS	NS	NS	*	NS
SVS/SVS + MVS	NS	**	NS	NS
SVS/MPWS + MVS	NS	NS	*	***
SVS/MPWS + SVS + MVS	NS	NS	*	NS
MVS/MPWS + SVS	NS	NS	NS	NS
MVS/MPWS + MVS	NS	NS	**	***
MVS/SVS + MVS	NS	NS	NS	NS
MVS/MPWS + SVS + MVS	NS	NS	***	**
MPWS + SVS/MPWS + MVS	NS	NS	**	NS
MPWS + SVS/SVS + MVS	***	NS	*	NS
MPWS + SVS/MPWS + SVS + MVS	***	NS	NS	NS
MPWS + MVS/SVS + MVS	***	NS	*	***
SVS + MVS/MPWS + SVS + MVS	NS	NS	**	**

NS = Not Significant
** and *** indicate significance at 5 and 10 percent confidence levels respectively.

5 Explaining Inter-Village Variations in Drinking Water Provision: Factors Influencing Costs and Service Levels in Rural Andhra Pradesh

V. Ratna Reddy

I Introduction

The costs and service levels in the provision of drinking water vary across the regions as well as within them (across villages), and understanding these variations is critical for policy planning. Identifying various factors and determinants of costs and service levels would help identify the policy initiatives that could enhance service levels and reduce unit costs. Besides, the analysis of the factors influencing the costs and service levels could also provide insights for future policies which need to be designed with reference to expected socio-economic changes. However, the aggregate-level analysis at the agro-climatic zone level and in terms of technology has not been much help in identifying the factors influencing costs and service levels (Chapter 4 above). The variations mentioned could be across socio-economic groups, demographic situations, geographical locations, technologies, the source of water, etc. This chapter attempts to understand the reasons or factors influencing the variations across the villages in order to facilitate judicious allocation of resources and improved service delivery.

The important aspects that we have tried to address here include:

- the factors influencing unit costs;
- the extent to which service levels are influenced by unit costs;
- the cost components that influence service levels; and
- the non-cost factors that influence service levels.

Since the possible reasons or factors that explain the variations in unit costs and service levels could not be identified at the aggregate (state) level, a disaggregated analysis at the village level forms the basis for identifying the factors.

Costs and Service Level Variations

Within the cost components, variations are higher in the case of capital expenditure on hardware (CapExHrd), especially when measured in terms of

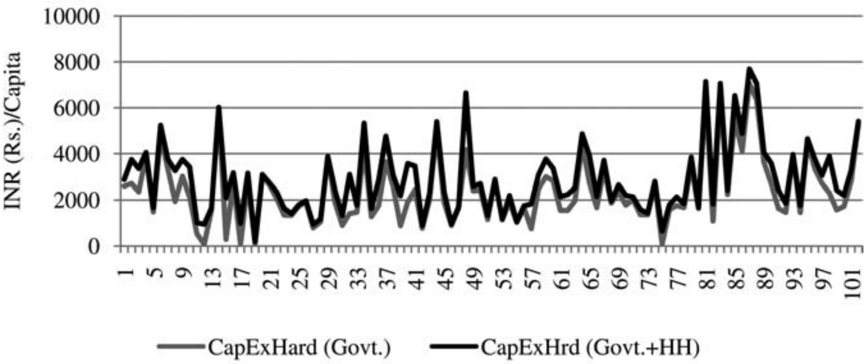

Figure 5.1 Variations in cumulative costs across sample villages

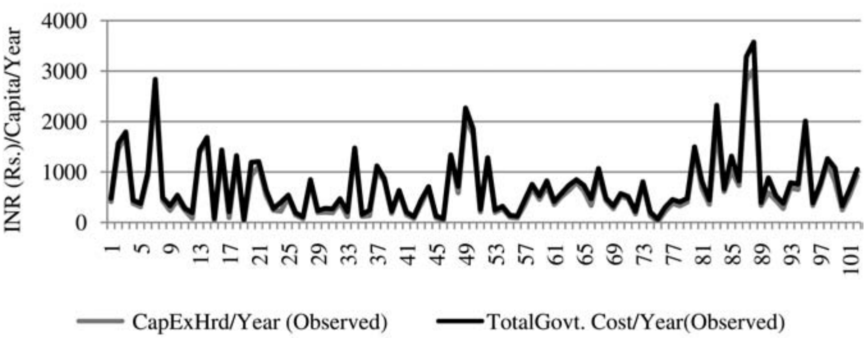

Figure 5.2 Variations in annualised costs across sample villages

the cost per capita and cost per capita per observed year (Figures 5.1 and 5.2). Cumulative unit costs of hardware (Govt. and Govt. + Households) show similar variation patterns in both cases. It was observed that variations are higher in the case of annualised costs (Fig. 2).[1] While the variation in the life span of the systems is an important factor influencing unit costs, what explains these variations in life spans needs better understanding.

Similarly, what factors other than life span determine unit costs? Wide variations are also observed in the service levels provided (Figure 5.3). Household perceptions (ordinal measure) rather than actual service received (cardinal measure) seem to vary more across sample villages. In order to address and explain the variations between the sample villages as well as between indicators, this paper takes up the disaggregated analysis of the costs and service levels at the village level.

II Approach

The different indicators of the costs and service levels are used as dependent variables, and a set of independent variables is identified from the village and

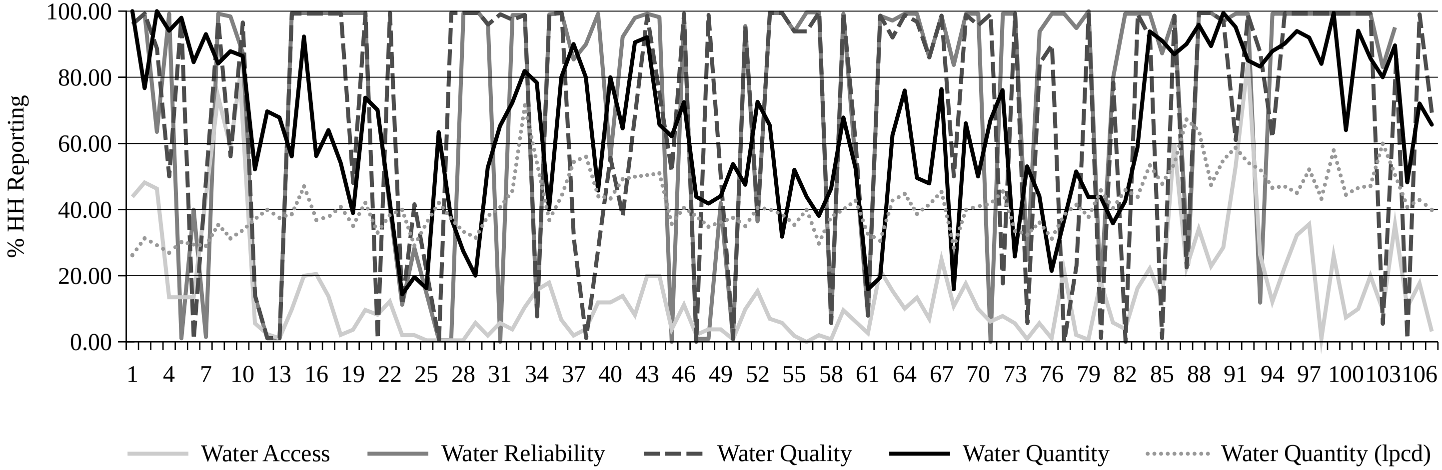

Figure 5.3 Variations in service levels across sample villages (percentage of households that reported receiving above basic service level)

household data using the correlation matrix. All the variables are standardised in per capita terms. The data set is based on 107 villages spread over nine agro-climatic zones, which have cost as well as service level data. For the purpose of identifying the factors influencing the unit costs and service levels, multiple regression analysis has been adopted.

Variations in Costs

The basic specification for cost variations is as follows:
where:

$DWCOST_{vt}$ = Drinking water cost in village 'v' and time 't'

and

U_{vt} = Error term

The independent variables are selected based on the theoretical considerations. These were selected from an exhaustive list of indicators generated from the village and household surveys, which are primarily used to identify the important variables with the help of a simple correlation matrix. These indicators are broadly classified in six groups: social, economic, demographic, source-related, technical, and institutional factors. The details of variable measurement and their theoretical/expected impact on unit costs are presented in Table 5.1. Based on the extent of variations across villages, we have included

Table 5.1 Measurement and expected signs of the selected variables pertaining to unit costs

Variable	*Measurement*	*Theoretical/ expected impacts*
$DWCOST_{1–4}$	CapExHrd-Govt. = per capita government expenditure on capital expenditure – hardware in Rs. CapExHrd-Govt. + HH = per capita total (govt. and household) capital expenditure on hardware in Rs. CapExHrd-Govt. Observed = per capita government expenditure on capital expenditure – hardware per year (observed) in Rs. (fixed costs). TExp-Govt. Observed = per capita total Govt. expenditure (fixed + recurring) per year (observed) in Rs.	Dependent variables
VS	Village size (number of households in the village)	Negative
AFS	Average family size	Negative/ positive
percent SC/ST	Proportion of Scheduled Castes/Scheduled Tribes (lowest social category) households	Positive?

(Continued)

Table 5.1 (Continued)

Variable	*Measurement*	*Theoretical/ expected impacts*
SDI	Social diversity index ranging from '0 to 1', where '0' is no diversity and '1' is high diversity. Index of social heterogeneity = $1-\sum_{i}^{n} P^2$ [no pi character visible in the preceding expression] where Pi is the proportion of total population in the ith [??] caste group	Positive/ negative?
LEdu	Level of education (average number of years of schooling)	Positive/ negative
HHINC	Household income (Rs. per year)	Positive
FARMSIZE	Farm size (net sown area per household)	Positive
percent HHBUY	Percentage of households buying water	Positive
HHExp-T	Household expenditure on water (tariff)	Positive
HHExp-B	Household expenditure on bottled water	Positive/ negative
DISTMRKT	Distance from the market place (km)	Negative
SOURCE	Source of water measured as a dummy variable (groundwater = 0; surface water = 1)	Positive/ negative?
percent HC	Proportion of house connections	Positive
ZONE	Agro-climatic zones measured as dummy variable [1 = High Altitude Zone (HAZ); 2 = North Coastal Zone (NCZ); 3 = Godavari Zone (GZ); 4 = Krishna Zone (KZ); 5 = Southern Zone (SZ); 6 = Scarce Rainfall Zone (SRZ); 7 = Southern Telangana Zone (STZ); 8 = Central Telangana Zone (CTZ); and 9 = North Telangana Zone (NTZ)]	Positive/ negative?
TECH	Type of technology measured as dummy [1 = Hand Pump (HP); 2 = Direct Pumping (DP); 3 = Single-Village Scheme (SVS); 4 = Multi-Village Scheme (MVS); 5 = (HP + DP); 6 = (DP + SVS); 7 = (SVS + MVS); and 8 = (DP + SVS + MVS)	Positive
AGESyt	Age of the system (number years since established)	Positive/ negative
GI	Governance indicator (average score) Institutional Space (IS), i.e., functioning of village water and sanitation committee; women/SC/ST participation in decision-making and meeting of grama sabha (village gathering) on WASH issues Involvement in Planning (IP) Involvement in Financial Management (IFM) Involvement in Operation and Management of Systems (IO&M) Capacity Building Inputs (CBI)	Negative
U_t	Error term	

Note: '?' is used when we are not certain of the impact.

four dependent variables pertaining to unit costs. These include fixed costs per capita as well as per capita per observed year, viz. fixed capital expenditure on hardware by the government per capita (CapExHrd-Govt.) and the fixed capital expenditure on hardware by the government per observed year (CapExHrd-Govt. Observed). The total cost, including fixed and recurring costs, per observed year is another dependent variable (TExp-Govt.). The total fixed capital expenditure by the government and households (TCapExHrd) is also used as a dependent variable.

Independent variables under demographic factors include the size of the village in terms of the number of households and household size. The size of the village is expected to have a negative impact on unit cost, due to scale economies. Household size also may have a negative impact, though it is not clear how effective the scale economies would be at this level. On the contrary, larger households may have higher household investments, due to higher water requirement. Social indicators include the proportion of SC/ST households (percent SC/ST), Social Diversity Index(SDI),[2] and Level of Education (LEdu). In the absence of *a priori* evidence on the impact of percent SC/ST and SDI indicators on unit costs, we hypothesise a positive or a negative impact, which will be tested in this paper. On the other hand, the level of education measured in terms of average years of schooling per household is expected to have a negative impact on unit costs, because educated communities are expected to demand transparent management.

Economic indicators include household income (HHINC), farm size (FARMSIZE), household expenditure on water tariff (HHExp-T), household expenditure on buying water (HHExp-B), and distance from the market place (DISTMRKT). Of these, household income and farm size reflect the economic status of the households at the village level – villages with high average household income and farm size are expected to influence costs positively, because economically well-off villages are expected to mobilise better funding for the water projects when compared to low-income villages. In the case of farm size, larger farm size is often associated with rainfed or poor regions. In this case, the impact of farm size need not be positive. Similarly, average payment (tariff) for water is likely to be higher for two reasons:

- a larger proportion of house connections indicates a better economic situation; and
- better compliance of tariff payments.

While the former might have positive impact, the latter may have a negative impact. Further, household expenditure on water could also be due to two reasons:

- a better economic situation; and
- poor quality of water.

These factors, too, may have opposite impacts on unit costs. Therefore, these indicators could have either positive or negative influence on unit costs depending on their relative importance. On the other hand, better access to market may have negative influence on unit costs, due to availability of material and low transport costs.

The source-related variables include source of water (SOURCE) measured as a dummy (groundwater = 0 and surface water = 1), water quality (WQ) measured as the perception of the people (percent households reporting sweet/good water), and house connections (percent HC), which indicates the dependence on public source. In the case of source, groundwater is expected to be more expensive, due to extraction costs when compared to surface water. However, in the case of MVS, where surface water is brought in from far-off places, the unit costs could be higher. We anticipate either a negative or a positive influence or this variable that needs to be tested. Better water quality is expected to reduce costs in terms of treatment and better functioning of the systems. Here we have also incorporated a dummy variable for the nine agro-climatic zones. In the absence of data on hydro-geology, agro-climatic zones represent the natural conditions that determine the source potential and fragility of each zone. Using this variable, we test whether natural factors influence unit costs or not, and we do not have any *a priori* expectation on the sign of this variable.

As discussed earlier, we have identified eight technologies in the sample villages. These include four 'pure' technologies – Hand Pumps (HPs); Direct Pumping or Mini-Piped Water Supply schemes (DP/MPWS), Single Village Schemes (SVS), and Multi-Village Schemes (MVS). The remaining four technologies are combinations of these four technologies, such as HP + MPWS, MPWS + SVS, SVS + MVS, and MPWS + SVS + MVS. These technologies are numbered 1 to 8 in the same order, and the unit costs are expected to go up as the technology moves from 1 to 8, because multiple technologies are add-on investments over the existing systems. The age of the system (AGESyt) is measured in terms of the number of years the system(s) are functioning or providing the service. The longer the system is functioning, the higher would be the cumulative costs due to capital maintenance. On the other hand, annualised costs are expected to be lower in the case of older systems. Therefore, age of the system is expected to have a positive impact on the cost per capita and a negative impact on the cost per capita per year.

Governance is measured using 19 indicators; for the present analysis, these are categorised in five groups (Table 5.1) as well as an aggregate Indicator of Governance (GI). These include:

- Institutional Space (IS), including (i) functioning of village water and sanitation committees, (ii) women/SC/ST participation in decision-making, and (iii) meeting of *grama sabha* (village meeting) on WASH issues;
- community Involvement in Planning (IP), which includes: feasibility study, technical survey, system integration, and extension;

- Capacity Building Inputs (CBI), which includes effectiveness of training and IEC activities;
- Involvement in the O&M Systems (IO&MS), which includes O&M of PSPs and HPs, water quality testing, solid waste management, waste water management, and hygiene and sanitation; and
- involvement in Financial Management (FM), which includes maintaining water and sanitation records, tariff collection, and proactive disclosure.

All the six indicators (including overall governance – GI) are used in the analysis in order to assess their relative importance in influencing the unit costs, and all the governance indicators are expected to have a negative influence on unit costs, because governance is expected to increase cost efficiency due to transparency and better management practices (Reddy *et al.*, 2009).

Variations in Service Levels

The basic specification for the analysis of service levels is as follows:
where:

$DWSL_{vt}$ = Drinking water service level in village '*v*' and time '*t*';

and

U_{vt} = Error term

Here, too, the independent variables are selected based on theoretical considerations. The variables are also identified with the help of a simple correlation matrix. In the case of service levels, some more economic (cost) variables are added to the list of independent variables listed above (Table 5.2). The service levels are available in quantitative terms as well as through the qualitative perceptions of the households. Using the service ladder approach, the four service indicators – quantity, quality, accessibility and reliability – are measured. The households assign scores to each of these indicators using five levels: no service, sub-standard, basic, intermediate, and high. In order to avoid complications in measuring the variables and interpreting them, we have considered the proportion of households scoring above basic service level, which is close to the service norms in India pertaining to the four indicators. Both quantitative and qualitative indicators are generated for summer and non-summer months. In the case of quantitative measures, summer, non-summer, and overall (year) quantities are taken into account. Altogether, we have included six dependent variables. These are:

- DWSLq-t = drinking water service level in quantity total (lpcd);
- DWSLq-s = drinking water service level in quantity during summer (lpcd);

Table 5.2 Measurement and expected signs of the selected variables

Variable	*Measurement*	*Theoretical/ expected impacts*
$DWSL_{1-6}$	DWSLqt = drinking water service level in quantity (lpcd) – (summer + non-summer/ summer/non-summer) DWSLqn = drinking water service level in quantity (percent households receiving basic and above) DWSLAc = drinking water service level in accessibility (percentage of households receiving above basic accessibility) DWSLr = drinking water service level in reliability (percentage of households receiving above basic service level)	Dependent variables
AFS	Average family size	Negative
VS	Village size (number of households in the village)	Positive
percent SC/ST	Proportion of SC/ST households	Positive/ negative?
SDI	Social diversity index (see Table 5.1)	Positive/ negative?
LEdu	Level of education (average number of years of schooling)	Positive
percent HC	Proportion of house connections	Positive
HHINC	Household income (Rs. per year)	Positive
FARMSIZE	Farm size (net sown area per household)	Positive
OpEx	Operation and maintenance cost per capita per year (Rs./capita)	Positive
CapExHrd	Capital expenditure per capita/per observed year (Rs./capita)	Positive
HHCapExHrd	Household capital expenditure per capita (Rs./capita)	Positive
HHExp	Household expenditure on water (tariff) (Rs./capita)	Positive
HHExp-B	Household expenditure on bottled water (Rs./capita)	Positive/ negative
percent HHBUY	Percentage of households buying water	Positive/ negative
DISTMRKT	Distance from the market place (km)	Positive
TIME	Time spent in fetching water (minutes/capita/ day)	Positive/ negative
OCT	Opportunity cost of time (Rs./capita/day)	Positive/ negative
SOURCE	Source of water (dummy) (groundwater = 0; surface water = 1)	Positive

Variable	*Measurement*	*Theoretical/ expected impacts*
WQ	Water quality (percentage of HHs reporting sweet/good quality)	Positive
ZONE	Agro-climatic zones (dummy variables: 1, 2, 3, 4, 5, 6, 7, 8, and 9) (see Table 5.1)	Positive/ negative?
TECH	Type of technology (dummy variables: 1, 2, 3, 4, 5, 6, 7, and 8) (see Table 5.1)	Positive
AGESyt	Age of the system (number of years since established)	Negative
NNGP/NGP	Dummy variable representing NGP/non-NGP status of the village (NGP = 1 and NNGP = 0)	Positive
GI	Governance indicators (average score)	Positive
	Institutional space (IS)	
	Involvement in Planning (IP)	
	Involvement in Financial Management (IFM)	
	Involvement in Operation and Management of Systems (IO&MS)	
	Capacity Building Inputs (CBI)	
U_t	Error term	

Note: '?' is used when we are not certain about the impact.

- DWSLq-ns = drinking water service level in quantity during non-summer (lpcd);
- DWSLqn = drinking water service level in quantity (percentage of households receiving basic and above);
- DWSLAc = drinking water service level in accessibility (percentage of households receiving above basic accessibility); and
- DWSLr = drinking water service level in reliability (percentage of households receiving above basic service level).

Most of the independent variables used in the cost analysis are retained in the service level analysis as well, with a few additional cost variables added. However, the expected signs are different in the case of service level analysis. Most of the selected variables are expected to have a positive impact on the service levels (Table 5.2). Under demographic factors, the size of village is expected to have a positive impact on the service level, especially quantity, as the demand for water is expected to increase with population. Household/Average Family Size (AFS) is expected to have either positive or negative impact – while larger households may use more water (litres per day), they tend to use less in per capita terms (Reddy 1999). On the other hand, larger households would have more people involved in fetching water, and hence may increase water demand, though this may not apply in the case of house connections. Social indicators, such as SC/ST households (percent SC/ST) and Social Diversity

Index (SDI), may influence service levels either positively or negatively. On the other hand, the level of education (LEdu.) is expected to increase the demand for water, as educated people tend to use more water for hygiene purposes.

Economic indicators include household income (HHINC), farm size (FARMSIZE), capital expenditure of government (CapExHrd), household capital expenditure (HHCapExHrd), operation and maintenance expenditure (OpEx), households buying water (percentHHBUY), household expenditure on water tariff (HHExp-T), household expenditure on buying water (HHExp-B), and distance from the market place (DISTMRKT). All these variables are expected to have a positive influence on service levels, though some of them (percentHHBUY and HHExp-B) could have a negative impact, as buying water may be a consequence of poor water service, while higher expenditure on fixed as well as recurring costs is expected to improve the service levels. Another important indicator that is part of economic costs of water provision is the time spent by the households on fetching water. This variable is measured both in physical terms (TIME) and monitoring terms using the Opportunity Cost of Time (OCT). These two variables may have a positive or negative impact, since we cannot be sure of the causality between service level and the time variable. This is because households may have to spend more time in fetching water due to poor service levels. On the other hand, a household's service level may be higher due to more time being spent for fetching water. Similarly, higher-income households and villages close to markets (DISTMRKT) are expected to have greater demand for water. The average payment (tariff) for water is likely to have a positive impact on service levels, as more house connections implies better access to water, and better compliance with tariff payments demands better services. Household expenditure on buying water could have a positive or negative influence on service levels as well, as in the case of unit costs.

In the case of source, surface water is expected to be more reliable compared to groundwater. We anticipate a positive impact of this variable on service levels. The dummy variable for the nine agro-climatic zones is used to test whether natural factors influence service levels or not, and we do not have any *a priori* expectation on the sign of this variable. The technology variables are expected to influence the service levels positively, as multiple systems are more reliable than a single system. The age of the system (AGESyt) is expected to influence service levels negatively, because functional efficiency goes down with age, and all the governance variables are expected to have a positive impact on service levels, due to better management practices. Another institutional variable pertaining to the Nirmal Gram Puraskar (NGP) status of the village is also included. Though this status is related to sanitation, it is expected that the general institutional effectiveness is not necessarily confined to sanitation. The NGP status of the village, therefore, is expected to have a positive impact on service levels.

Ordinary Least Squares (OLS) estimates were used to regress the different dependent variables ($DWSL_{1-6}$) against the selected independent variables. Descriptive statistics of the selected variables are presented in Appendix Table A5.1. Regressions were run on cross-sectional data at the village level using the data from 107 villages (n = 107). Various permutations and combinations of independent variables were used to arrive at the best fit. Multi-colinearity between the independent variables was checked using the Variance Inflation Factor (VIF) statistic. Multi-colinearity is not a serious problem as long as the value of the VIF is below 2. The best-fit specifications were selected for the purpose of the final analysis. Though we have also tried log-linear estimates, only linear specifications were retained for the purpose of analysis, as the log-linear specification has poor explanatory power.

III Cost Drivers: Factors Influencing Unit Costs

The estimates indicate that the specifications using four dependent (exogenous) variables explain about 50 to 60 percent of the variations in the existing unit costs across the sample villages (Tables 5.3 and 5.4). Two of the dependent variables pertain to unit costs per capita and the other two are annualised unit costs using the observed life span of the systems, i.e., per capita per year. It may be noted that the specifications of the annualised unit costs have relatively less explanatory power, with fewer variables turning significant (Table 5.4). All the selected variables are found to have the theoretically expected signs, which are consistent across specifications (see Table 5.1). These specifications are also selected purposively, as they do not have the multi-colinearity problem (correlation between independent variables). A number of variables turned out to be significant in the selected specifications.

The size of the village (number of households) has a significant negative impact on the unit costs – total and annualised per capita costs. Due to economies of scale, the unit costs tend to be lower as the population of the village increases. The magnitude of the estimates indicates that the scale of economies in unit costs could be substantial as we move from small to big villages (see Appendix Table A5.1) – every 1 percent increase in the average size of the village (327 households at present) would reduce the costs by 1.5 percent. Similarly, per capita cost norms need to take the size of the village into account while estimating the costs. Our estimates indicate that the unit costs would come down by 15 percent for an increase in size of the village by 33 households. Further, the age of the system (AGESyt) has turned out to be significant in all the specifications. As expected, AGESyt has a positive impact on the total unit costs and a negative impact on the per year costs per capita. While the cumulative costs are expected to be more as the system becomes older, because of replacement and rehabilitation costs, even the operational expenditure costs are found to be higher in the older systems. However, the per year costs tend to be lower as the age of the system increases. This indicates that maintaining the systems for longer periods with appropriate allocations for capital

Table 5.3 Regression estimates of selected specifications: Unit costs per capita

Variables	*Dependent variables*			
Independent variables	*CapExHrd (Govt.)*		*CapExHrd (Govt. + HH)*	
	Coefficient	*VIF*	*Coefficient*	*VIF*
(Constant)	850.43 (0.72)	—	1,283.13 (1.17)	—
VS	–1.447* (-3.09)	1.57	–1.488* (–3.24)	1.55
AFS	513.324*** (1.72)	1.99	396.875 (1.44)	1.74
FARMSIZE	–207.405** (–2.57)	1.33	–187.885** (–2.44)	1.22
LEdu	–75.440** (–2.27)	1.81	–67.668** (–2.06)	1.78
SOURCE	244.83 (0.81)	1.52	—	
percent HC	10.916** (2.34)	1.97	9.536 **(2.12)	1.86
TECH (HP)	–640.58 (–1.60)	1.45	–729.11 *** (–1.87)	1.40
TECH (SVS + MVS)	1,494.04 (3.98)*	1.28	1,642.872* (4.50)	1.22
TECH (MPWS + SVS + MVS)	1,683.12* (2.81)	1.73	1,903.69* (3.55)	1.40
HHExp-B	7.27*** (1.78)	1.57	6.899*** (1.70)	1.57
HHExp-T	0.651** (2.08)	1.85	1.61* (5.26)	1.78
AGESyt	68.80* (2.66)	1.26	68.27* (2.66)	1.26
Zone (STZ)	1,604.59* (3.44)	1.68	1,624.61* (3.50)	1.68
Zone (SZ)	476.96 (1.33)	1.33	431.94 (1.22)	1.32
IS	9.25 (1.03)	1.61	8.20 (0.92)	1.60
R^2	0.57		0.62	
Adjusted R^2	0.50		0.56	
N	107		107	

Figures in brackets are 't' values
*, ** and *** indicate significance at 1, 5 and 10 percent level respectively

maintenance (CapManEx) and operation and maintenance (OpEx) would help in reducing the overall unit costs. That is, increasing the life of the system is critical for reducing the unit costs.

On the other hand, adding new systems or technologies to the existing ones could prove expensive, as revealed in the cases of combinations of technologies. Combination of technologies, especially SVS + MVS and MPWS + SVS + MVS, are more expensive in terms of cumulative as well as unit costs. This calls for proper planning in designing and implementing appropriate technology options. The *ad hoc* approach of upgrading the systems is proving to be expensive: i.e., service levels are not growing proportionately to costs. On the contrary, Hand Pumps (HPs) proved to be negatively influencing the cumulative costs for the obvious reason that HP is a low-cost technology.

The average family or household size in the village has a positive impact on the total unit costs and a negative impact on the annualised costs. Given the

Table 5.4 Regression estimates of selected specifications: Unit costs per capita per year

Variables	*Dependent variables (annualised)*			
Independent variables	*CapExHrd (Govt.) Observed*		*TExp (Fixed + Recurring) Observed*	
	Coefficient	*VIF*	*Coefficient*	*VIF*
(Constant)	907.23* (8.66)	—	2,063.25* (4.08)	—
VS	–0.57* (–3.47)	1.09	–0.55* (–3.04)	1.20
AFS	—	—	–203.14*** (–1.94)	1.23
percent HHBUY	—	—	–3.26 (–1.42)	1.60
TECH (HP)	—	—	–270.20 (–1.60)	1.29
TECH (SVS + MVS)	457.82* (3.15)	1.08	489.27* (3.12)	1.11
TECH (MPWS + SVS + MVS)	725.92* (3.53)	1.14	938.27* (4.11)	1.25
OCT	—	—	–0.20 (–1.34)	1.19
AGESyt	–56.31* (–5.60)	1.07	–52.76* (–4.62)	1.23
Zone (STZ)	500.75* (2.98)	1.23	619.22* (3.21)	1.43
GI (CBI)	4.66*** (1.68)	1.14	4.71 (1.45)	1.38
R^2	0.47		0.53	
Adjusted R^2	0.44		0.48	
N	107		107	

Figures in brackets are 't' values
*, ** and *** indicate significance at 1, 5 and 10 percent level respectively

increasing trend in nuclear families (GoI 2011), the total costs are likely to decrease, while annualised costs are likely to increase. This goes against the general perception that providing water to a greater number of households of smaller family size would be more expensive than providing to a smaller number of households of bigger family size. Though there is no theoretical basis for this, we presume that cost norms could be adjusted downwards as the size of households declines over the years.

Level of education (LEdu) has turned out to be significant, with a negative sign in the case of cumulative expenditure. Higher education levels in the village could provide the much needed checks and balances in the case of fund allocations and expenditure. Education can also help in enhancing the activities and functioning of the institutions – formal as well as informal. Informed discussions and decisions could lead to efficient allocation of resources. Thus, improving literacy and education levels in the rural areas is critical for cost-effective management of water systems.

Landholding (net sown area) per household (FARMSIZE) has a negative influence on unit costs, both cumulative and annualised. FARMSIZE is often used to represent the economic status of the households in the rural areas. While larger farm size means better economic status within a village, this is not necessarily true across villages, because it is observed that the average farm size is higher in the dry or rainfed regions. That is, villages with larger farm size are likely to represent dry regions. Extending the logic that unit costs are low in the dry regions indicates that the dry regions with larger average farm size have low unit costs. This emphasises the fact that provision costs are low in the less-endowed regions.

As expected, the coefficient of household expenditure on water (HHExp-B) and payment of tariff (HHExp-T) have turned out to be positive and significant in the case of cumulative costs. These two indicators as expected reflect the economic status of the villages, though buying water could be due to the poor quality of water. The positive impact of economic status or economically well-off villages indicates that these villages are likely to push costs up. This could be because economically better-off villages are likely to garner more funds for their schemes. Only one of the governance indicators, Capacity Building Inputs (CBI), turned out to negatively influence costs, again the annualised costs. While better governance is expected to reduce the costs, the level of governance appears too meagre to have any impact on unit costs. That is, in the absence of comprehensive governance interventions, capacity building by communities may only end up increasing costs (by however little) rather than enhancing service delivery.

IV Factors Influencing Service Levels

The regression estimates of factors influencing service levels have been carried out on four different service variables and six specifications (see Table 5.2).[3] The dependent variables include both quantitative and qualitative variables. Quantitative variables are based on the actual quantity used at the household level measured in litres per capita per day (lpcd). This variable is taken for summer, non-summer, and the entire year.[4] Quantity is also measured in terms of quality (household perception), i.e., the percentage of households reporting that the quantity of water they receive is above basic service level. Both summer and non-summer perceptions are used for estimation purposes. Other service level indicators include household perceptions on access and reliability (percentage of households scoring above basic service level: i.e., less than 30 minutes per day and the predictable supplies, except during breakdowns). Summer/non-summer differences are not observed in the case of these two variables, and hence, only the scores for the entire year have been used. The selected specifications explain about 70 percent of the variations in service levels in quantitative as well as qualitative terms. The explanatory power of the non-summer variable is more when compared to summer and the entire year. Most of the selected variables have the expected signs (Tables 5.5, 5. 6 and 5.7).

Table 5.5 Regression estimates of selected specifications of service levels (lpcd)

Variables	*Dependent variables (lpcd)*					
Independent variables	*DWSLqt (lpcd-S + NS)*		*DWSLqt (lpcd – S)*		*DWSLqt (lpcd – NS)*	
	Coefficient	*VIF*	*Coefficient*	*VIF*	*Coefficient*	*VIF*
(Constant)	46.45* (10.18)		52.70* (10.22)	—	43.82* (10.03)	—
AFS	–2.90* (–2.86)	1.11	–2.90** (–2.53)	1.1	–4.17* (-3.66)	1.6
FARMSIZE	0.87* (2.64)	1.07	1.01* (2.70)	1.1	0.99* (3.11)	1.1
LEdu	—	—	—	—	0.18 (1.29)	1.7
DISTMRKT	—	—	—	—	0.14*** (1.96)	1.2
percent HHBUY	–0.03 (-1.15)	1.74	–0.03 (-0.95)	1.8	—	—
TECH (MPWS + SVS)	—	—	–2.77*** (–1.79)	1.2	—	—
TECH (SVS + MVS)	—	—	—	—	3.16** (2.03)	1.2
percent HHPAYTARIFF	—	—	—	—	–0.01 (–1.22)	1.3
ZONE (CTZ)	–7.85* (–4.16)	1.32	–10.63* (-4.94)	1.3	–6.20* (-3.61)	1.3
ZONE (HAZ)	—	—	–3.19*** (–1.68)	1.1	—	—
ZONE (KZ)	11.91* (7.21)	1.27	10.49* (5.40)	1.4	11.22* (7.49)	1.2
ZONE (STZ)	16.63* (8.31)	1.48	16.83* (7.27)	1.6	16.48* (9.51)	1.3
ZONE (SZ)	9.14* (6.08)	1.13	7.21* (4.15)	1.2	9.50* (6.29)	1.3
GI (IO&MS)	0.11** (2.23)	1.51	0.11*** (1.84)	1.5	0.09 *** (1.69)	1.8
R^2	0.70		0.67		0.74	
Adjusted R^2	0.68		0.63		0.71	
N	107		107		107	

Note: Figures in brackets are 't' values
*, ** and *** indicate significance at 1, 5 and 10 percent level respectively

Table 5.6 Regression Estimates of Selected Specifications of Service Levels (percent HHs scoring > basic)

Independent variables	*Specifications*					
	Water quantity S1		*Water quantity S2*		*Water quantity NS*	
	Coefficient	*VIF*	*Coefficient*	*VIF*	*Coefficient*	*VIF*
(Constant)	68.42⋆ (4.91)	—	35.44⋆ (7.11)	—	–6.59 (–0.68)	—
AFS	–3.48 (–1.17)	1.09	—	—	2.83⋆ (3.21)	1.12
SDI	–13.24 (–1.44)	1.94	—	—	—	—
FARMSIZE	1.80⋆⋆⋆ (1.76)	1.17	1.80⋆⋆⋆(1.87)	1.07	—	—
TECH (HP)	—	—	7.28 (1.49)	1.22	—	—
TECH (MPWS)	7.51 (1.56)	1.07	8.40⋆⋆⋆ (1.76)	1.08	—	—
LEdu	—	—	—	—	0.75⋆⋆ (2.27)	1.26
SOURCE	—	—	—	—	–6.54⋆⋆ (–2.10)	1.15
percent HHBUY	—	—	—	—	–0.18⋆ (–2.76)	1.87
TIMESPENT	—	—	—	—	0.001 ⋆⋆ (2.10)	1.47
CapEx (Observed)	–0.001⋆⋆⋆ (–1.64)	1.58	—	—	—	—
Water Reliability	—	—	-0.10 ⋆⋆ (–2.10)	1.67	—	—
Water Quality	—	—	0.07⋆⋆⋆ (1.75)	1.49	—	—
AGESyt	-0.82⋆⋆ (-2.37)	1.26	—	—	–0.78⋆ (–2.72)	1.10
ZONE (CTZ)	37.12⋆ (6.83)	1.26	35.11⋆ (6.70)	1.20	53.53⋆ (10.46)	1.43
ZONE (HAZ)	–19.17 ⋆ (–3.15)	1.72	–15.55⋆ (–3.12)	1.19	–16.32⋆ (–3.70)	1.16
ZONE (KZ)	23.27⋆ (4.98)	1.17	26.52⋆ (5.55)	1.26	30.41⋆ (6.86)	1.36

ZONE (STZ)	41.25★ (7.04)	1.46	33.86★ (6.34)	1.25	50.40★ (9.21)	1.64
ZONE (SZ)	27.70 ★ (6.04)	1.20	34.15★ (7.38)	1.26	30.54★ (7.24)	1.31
GI (IS)	0.32★ (2.94)	1.33	—	—	—	—
NGP/NNGP	—	—	—	—	0.44★ (2.92)	1.94
GI (IO&MS)	—	—	0.61★ (3.84)	1.70	11.19★ (2.90)	1.52
R^2	0.66		0.67		0.81	
Adjusted R^2	0.62		0.63		0.78	
N	107		107		107	

S1 = summer specification 1
S2 = summer specification 2
NS = non-summer specification
Figures in brackets are 't' values
★, ★★ and ★★★ indicate significance at 1, 5 and 10 percent level respectively.

Table 5.7 Regression estimates of selected specifications of service levels (access and reliability)

Variables	*Dependent variables*			
	Access		*Reliability*	
	Coefficient	*VIF*	*Coefficient*	*VIF*
(Constant)	7.89 *** (1.85)	—	–50.48 ** (–2.15)	—
AFS	—	—	22.28* (3.69)	1.57
percent SC/ST	—	—	–0.28* (–2.94)	1.05
SDI	–11.02** (–2.26)	1.75	—	—
FARMSIZE	–1.46 ** (–2.47)	1.26	—	—
LEdu.	—	—	–1.81** (–2.46)	1.69
DISTMRKT	–0.19 (–1.58)	1.10	—	—
GI	–0.18* (–2.94)	1.80	—	—
SOURCE	8.98* (4.23)	1.35	—	—
percent HC	0.24* (7.01)	1.99	—	—
TECH (MPWS)	6.05** (2.03)	1.24	—	—
TECH (SVS)	4.51** (2.10)	1.39	17.52* (2.75)	1.31
TECH (SVS + MVS)	—	—	12.90 (1.56)	1.19
TECH (MPWS + SVS + MVS)	—	—	–38.67* (–3.30)	1.27
HHExp-B	—	—	0.12 ** (1.96)	1.71
OCT	–0.00*** (–1.73)	1.49	—	—
HHCapExHrd	0.01* (4.53)	1.44	—	—
WQ	0.05*** (1.93)	1.53	0.55* (7.87)	1.29
Zone (CTZ)	18.66* (5.78)	1.44	—	—
Zone (KZ)	—	—	23.18 ** (2.28)	1.93
Zone (SRZ)	—	—	32.13* (3.70)	1.21
Zone (STZ)	11.69* (3.46)	1.58	24.68 * (2.51)	1.43
Zone (SZ)	—		27.95 * (3.39)	1.35
NGP/NNGP	13.43 * (5.49)	1.54	—	—
OpEx	—	—	1.13* (3.89)	1.93
R^2	0.80		0.64	
Adjusted R^2	0.77		0.58	
N	107		107	

Figures in brackets are 't' values.
*, ** and *** indicate significance at 1, 5 and 10 percent level respectively

Quantity (litres per capita per day – lpcd)

It may be noted that none of the fixed-cost variables turned out to be significant in explaining the variations in service levels, especially the quantity measured in lpcd (Table 5.5). Though one expects a direct relationship between expenditure on infrastructure and the quantity of water supplied, these costs do not seem to have any bearing on the actual quantity received by the households. On the contrary, one of the governance indicators – GI (IO&MS) – has revealed a positive and significant impact on water quantities received by the households in both the seasons. That is, villages with better institutional arrangements, especially relating to O&M, appear to have better service levels. This indicates that governance factors play a more important role when compared to cost factors – or are a precondition for some of the expenditure to take place and make the expenditure effective. Average family size was found to have a negative impact on household water use, which is due to the scale impacts. That is, larger families tend to consume less water in per capita terms (Reddy 1999). On the other hand, farm size was found to have a positive impact indicating that villages with bigger landholdings tend to get better water supplies. As discussed in the case of unit cost estimates, larger farm size is often associated with rainfed regions. It may be deduced that, despite these regions having lower unit costs when compared with the endowed regions, their service levels appear to be better than that of the endowed regions.

Level of education (LEdu) turned out to be positive and significant, though only in the case of non-summer quantities. That is, higher service levels are associated with higher education levels. Education is emerging as a critical factor in reducing unit costs and improving the per capita service level. Promotion of education and literacy levels is an important policy option for improving service levels, not only for water supply but also for other services such as health and hygiene (Reddy and Kullappa 2008). Similarly, villages close to the market (DISTMRKT) were found to have higher consumption of water. Given the potential growth of urbanisation in the coming years, the demand for water in the rural areas is likely to increase. The combined impact of increasing literacy and urbanisation is likely to increase the pressure on water services substantially. Such enhanced demand for water needs to be taken into account while revising the norms and designing the systems in the rural areas.

Among the technologies, the combination of MPWS + MVS seems to provide poor quantities, while SVS + MVS was found to have a positive impact on the quantity of water. It may be noted that the SVS + MVS combination is also more expensive. On the other hand, none of the pure technologies turned out to be significantly influencing service levels in terms of quantity.

Five of the nine agro-climatic zones turned out to be significant. The Central Telangana (CTZ) and High Altitude (HAZ) zones were found to have a negative impact on the service levels, while the impact was found to be positive in the case of Krishna (KZ), Southern Telangana (STZ), and Southern (SZ) agro-climatic zones. This indicates that the agro-climatic conditions of these zones are favourable for improved service levels.

Quantity (Perceptions)

Here we analyse the factors influencing the quantity of water measured in terms of the perception of the households. Service levels when measured in terms of household perceptions about water quantity (lpcd) not only emphasise the earlier findings but also provide new insights. Here, too, none of the cost variables turned out to be positive and significant. On the contrary, the annualised cost variable (CapEx-Observed) turned out to be negatively influencing household perceptions about quantity (Table 5.6). This indicates that cost or expenditure in its present form may not ensure services – not even in terms of quantity.

On the other hand, two of the governance indicators – GI (IO&MS) and GI-IS – and one institutional indicator – Non-Nirmal Gram Puraskar/Nirmal Gram Puraskar (NNGP/NGP) – turned out to be positively significant. This re-emphasises the importance of governance and institutional factors along with unit costs. Unlike in the case of lpcd, family size turned out to be positive in the non-summer period. This could be due to the differences in perceptions of the households and the actual quantities they use. Similarly, households residing in the villages with Hand Pumps (HPs) and Mini-Piped Water Supply (MPWS) schemes perceived that they got better quantity (perceived).

The level of education (LEdu) turned out to be significant with a positive sign. Again, this underlines the importance of education and literacy in influencing service levels. On the other hand, the age of the system (AGESyt) revealed a negative impact on the quantity perception of the households: the older the water supply systems, the poorer the service levels. This is because functional efficiency is likely to go down as the system becomes older, though this variable was not found to be significant in terms of physical quantity (lpcd). The SOURCE variable revealed a significantly negative impact on the service levels. Villages having groundwater as a source of water are likely to get better service in terms of quantity – which goes against the belief that surface water sources are assured and reliable sources of water. This could be due to the fact that most of the surface water schemes, especially SVS, are connected to tanks that are dependent on canal water (system tanks). These tanks, especially those located in the tail ends and the uplands, sometimes get scanty supplies, mainly during low-rainfall years.

As in the case of physical quantities (lpcd) variable, five of the nine zones proved to be significant in influencing the quantity perceptions of the households. While the High Altitude Zone (HAZ) revealed a negative impact, all the others showed a positive impact. The implication that service levels in quantity are low in HAZ, both in physical terms (lpcd) and in the perceptions of the households, calls for policy attention to the provision of basic services in high-altitude or interior regions. There are a number of such inaccessible locations in India, which need to be targeted for priority in the provision of water.

Interestingly, perceptions of quantity are inversely related to reliability and positively related to water quality. Households perceive that reliability of water does not assure quantities because reliable supplies can be maintained even with poor water supplies – reliability may depend on maintenance and management of the system. On the other hand, quantities depend on other factors as well: source, technology, etc. This could be because the water systems are maintained well in scarce (low water availability) conditions, which is noticed in irrigation systems – it is observed that irrigation distribution systems are maintained well in the tail end locations where water is scarce when compared to head reaches (Reddy 1998). On the other hand, households tend to use more water when water quality is good, and *vice versa*. Therefore, poor quality of water also results in low usage of water.

The proportion of households buying water (percent HHBUY) is inversely related to quantity perception. This indicates that households are forced to buy water in order to overcome water shortage or to supplement the poor service levels – buying is more common due to the poor service levels in terms of quantity, rather than affordability. On the other hand, households perceive that the more time they spend in fetching water, the higher their service levels. The logic is that bigger households with higher proportion of active members can fetch, and hence use, more water. This means that good service levels in terms of quantity might result in poor service levels in terms of accessibility: i.e., there is a trade-off between quantity and accessibility. This, in fact, reflects poor service even in terms of quantity.

Accessibility

Of all the service level indicators, access received the lowest scores from the households (Reddy *et al.* 2011). Access is defined as the time spent for fetching water. If a household spends less than 30 minutes per day (either distance or crowding-waiting time), then the household is categorised as having above basic service level. At the aggregate level (AP) more than 80 percent of the households receive less than basic (no or substandard services). Given the poor service levels for accessibility, it would be pertinent to examine the factors influencing accessibility across the sample villages. The specification turned out to be the best of all the specifications in terms of explanatory power, i.e., 80 percent (Table 5.7) – a majority of the explanatory variables turned out to be positively significant. From the policy point of view, SVS and MPWS technologies proved to provide better accessibility. In this regard, replacing SVS with MVS does not seem to be ideal. In fact, MVS has not proved to be better than SVS with regard to accessibility (Reddy *et al.* 2012). This analysis re-emphasises our argument that further research, especially in other states, is necessary before going ahead with the promotion of MVS.

While surface water sources have been found to have a negative impact on quantity, they have a positive impact on accessibility. This could be because waiting time may be less in the case of tank water when compared to well water. Moving towards surface sources or source protection investment that enhances the recharging and availability of groundwater would help improve accessibility. Given the positive relationship between water quality (WQ) and accessibility, improving source sustainability (source protection investments) could achieve the twin objectives of better accessibility and quality service. Accessibility can be improved through wider coverage of house connections (percent HC). This has already found a place in the new guidelines, which aim at 100 percent coverage in terms of house connections by 2017 (GoI 2010a). Accessibility is observed to be better in the case of NGP villages, though NGP is not directly related to water supply (see Table 5.2). However, the NGP status of a village reflects the active institutional presence and their effectiveness within the village. Therefore, strengthening and promotion of village institutions to manage water supply would be necessary to improve accessibility as well as other service indicators. However, the negative and significant relation between overall governance (GI) and accessibility does not support the argument that institutional strengthening could improve accessibility. This may be due to the specific efforts under NGP to improve access to water.

Household expenditure on infrastructure is positively associated with accessibility. Generally, households invest in water infrastructure in order to overcome poor accessibility. Among the agro-climatic zones, only the Southern Telangana and Central Telangana zones showed a positive impact on accessibility. The variables that revealed a negative impact on accessibility are farm size (FARMSIZE), Opportunity Costs of Time (OCT), and Social Diversity Index (SDI). In the case of farm size, accessibility is expected to be lower in rainfed regions, as these regions are characterised by larger farm size. As in the case of quantity, more time is spent in fetching water (OCT) due to poor access, i.e., walking long distances to get water. Similarly, SDI has a negative impact on accessibility, indicating that homogenous communities (caste groups) are likely to have better access. This could be linked to the literature on collective strategies, where homogenous groups (socially or economically) are more likely to cooperate better in managing the common good when compared to heterogeneous groups (Reddy 1997).

Reliability

Basic and above service levels in terms of reliability are defined as predictable supplies except during breakdowns. Reliability (measured as predictable supplies) is observed to be high in the majority of the sample villages. At the aggregate level, about 80 percent of the households reported above basic service levels. The explanatory power of the specification is reasonably good at 64 percent. With regard to factors influencing reliability, operation and maintenance expenditure (OpEx) and SVS technology (TECH (SVS)) were found to have a positive impact on reliability. Allocations towards OpEx were found to be more effective in enhancing the reliability, as OpEx helps in keeping the systems running. On the other hand, the combination of MPWS + SVS + MVS, which is more expensive and provides better service in terms of quantity, is not as reliable as SVS. This again suggests that SVS could be a cost-effective option.

Water quality is positively associated with reliability. System breakdowns may be fewer in the case of good-quality water when compared to low-quality water (saline, high TDS, etc.), though lack of reliability could also influence water quality. The positive association between household expenditure on buying water (HHExp-B) and reliability is due to the fact that households are forced to buy water when supplies are not reliable. Among the agro-climatic zones, Krishna (KZ), Scarce Rainfall (SRZ), Southern Telangana (STZ), Central Telangana (CTZ), and Southern (SZ) zones have higher levels of reliability. The positive and significant association between farm size and reliability is in line with the positive relation between SRZ and reliability. This is because larger farm size is associated with scarce rainfall regions. However, the level of education (LEdu) turned out to be negatively influencing reliability, which is difficult to explain.

V Conclusions

The analysis of cost drivers indicates that economies of scale revealed substantial impact on unit costs. That is, unit costs are less in larger villages and more in the case of villages with larger family size. Over time, it is expected that family size will decline. Hence, costing should take these changes into account while fixing the norms. Unit costs tend to increase with the age of the systems. Though older systems tend to have lower annualised costs due to larger denominator, the costs can be reduced by maintaining the systems properly. That is, increasing the life of the system is critical for reducing the unit costs. For this, allocations towards capital maintenance and operation and maintenance are critical. Only regular upkeep of the systems can ensure sustainable service delivery.

Further, unplanned and *ad hoc* upgrading of the systems in terms of technologies increases unit costs. Proper design and planning with provision for extension and upgrading of service levels could help reduce the costs. The present approach of planning and allocating funds to rural drinking water is not systematic, while the new guidelines (GoI 2010b) seem to have corrected the course in terms of identifying the right issues and recommending appropriate allocations. Adopting the life-cycle cost approach for designing the systems facilitates cost-effective planning.

Economic factors coupled with policy support, like achieving full coverage of house connections, is likely to increase the unit costs. Cost norms need to be adjusted upwards while designing the schemes for full coverage of house connections. On the other hand, policy focus on improved literacy and education levels would help reduce the unit costs.

As far as service levels are concerned, the analysis brings out clearly that the influence of present low levels of expenditure on service is limited. However, this is not to argue that costs do not matter in service provision – it just reflects how inadequate some of the allocations are at the moment. Allocations with heavy bias towards infrastructure (above 80 percent) do not really help in achieving the objective of sustainable service delivery. The analysis clearly shows that investments in infrastructure do not have any significant impact on access to water. In fact, household investments rather than public investments improve access to water. Non-cost factors, such as literacy, house connections, distance to market, governance, and institutional factors, significantly improve service levels. The only cost factor that has significant impact on service levels is OpEx, which has a positive impact on reliability.

It was observed that older systems are less efficient in service provision as well; maintaining such systems could improve efficiencies substantially. Groundwater sources are found to be more reliable in providing services. The analysis clearly indicates that MVS are not necessarily the best option for the provision of sustainable services. Governance and institutional factors are critical for improving the service levels. While surface water sources are found to have a negative impact on quantity, they have a positive impact on accessibility. Social Diversity Index (SDI) was found to have a negative impact on accessibility, indicating that homogenous communities (caste groups) are likely to have better access.

The following policy options could help achieve sustainable service delivery:

1 Maintaining the systems through allocations towards capital maintenance and ensuring minimum allocations towards operation and maintenance, so that systems function efficiently despite their age. Maintaining the systems in good condition would not only reduce costs but also improve service levels.
2 Avoiding *ad hoc* investments or allocations towards extension and upgrading. Adaptation of the Life-Cycle Cost Approach (LCCA) could help in minimising *ad hoc* and wasteful expenditure on infrastructure. The LCCA would also facilitate judicious allocation of resources to different components as mentioned in 1 above.
3 Improving literacy and education levels would not only help to reduce the unit costs in drinking water, but also enhance efficiency in other related sectors: hygiene, health, etc.
4 The existing governance structures appear to be too meagre to have any influence on unit costs. However, they seem to have a positive impact on service levels. Improving the functioning and effectiveness of the governance indicators, such as village water and sanitation committees, could be a viable policy option in this regard.
5 Promotion of MVS with surface water sources does not appear to be a rational option from the cost or the service point of view.
6 Agro-climatic conditions influence costs and service levels, though we do not have enough information on the hydro-geology. Similarly, economies of scale have significant impacts on unit costs and service levels. When adopting cost norms these factors should be taken into account, rather than adopting blanket policies.

The next level of analysis should focus on making these conclusions generic for regions comparable across the country. Besides, identifying threshold levels of critical policy indicators would help informed targeting. These include the age of the systems, the size of village, the size of the household, OpEx, etc.

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Appendix

Table A5.1 Descriptive statistics of selected variables

Variable	*Mean*	*Minimum*	*Maximum*	*Stdv.*
VS	327	17	1,718	284
AFS	4	3	6	0.50
percent SC/ST	31	0	100	26
SDI	0.5	0	0.7	0.21
FARMSIZE	2	0	8	2
LEdu	22	11	32	4
DISTMRKT	10	1	41	7
GI (score)	15	0	79	17
percent HC	30	0	88	32
percent HHBUY	14	0	100	26
ExpDW-T	3	0	360	32
ExpDW-B-Summer	17	0	198	50
ExpDW-B-Non- Summer	23	0	251	456
Time Spent/Capita (min)	5,244	2,122	19,386	2,219
OCT	991	486	3029	345
DWSL q (lpcd) (S + NS)	42	26	72	9
DWSL q (lpcd) (S)	47	28	80	9
DWSL q (lpcd) (NS)	39	25	68	8.5
CapExHrdDW (Govt.)	2,301	0	7,060	1,539
CapExHrdDW (Govt.) per year (Observed)	622	0	3,028	609
TCapExHrdDW (Govt.) per year (Observed)	716	0	3,572	670
CapExHrdW(G + HH)	2,811	139	7,695	1,618
DWSL-Access	15	0	83	17
DWSL-Reliability (S)	74	0	100	38
DWSL-Reliability (NS)	79	0	100	35
DWSL-Quality (S)	68	0	100	39
DWSL-Quality (NS)	67	0	100	40
DWSL-Quantity (S)	64	14	100	24
DWSL-Quantity (NS)	42	0	96	28

Variable	*Mean*	*Minimum*	*Maximum*	*Stdv.*
AGESyt	6	1	22	5
GI –IS	25	0	76	15
GI-CBI	17	0	75	17
GI-O&MS	22	1.25	57	11
GI-FM	17	0	79	17

6 Rural Sanitation and Hygiene: Economic and Institutional Aspects of Sustainable Services

V. Ratna Reddy

I Introduction

This chapter attempts to assess and explain the existing expenditure and service levels achieved for sanitation and hygiene at the village level across 107 sample villages in Andhra Pradesh (AP). The status of AP in terms of access is slightly above the all-India level, with 32 percent of the rural households having Individual Sanitary Latrines (ISLs), while 65 percent of the rural households practice open defecation. The specific objectives include:

- To estimate the actual expenditure per person and its composition in providing sanitation and hygiene at the village level.
- To assess at the village level the service levels resulting from the expenditure.
- To explain the variations in costs and service levels across the sample villages.

II Approach

In the case of sanitation, it is difficult to differentiate financial and economic costs, as provision of sanitation is not purely a public service. In fact, the public and private responsibilities could be demarcated, but for promotional activities as part of public policy. While sanitation in terms of constructing a toilet and management of solid and liquid waste at the household level is purely a private affair, in developing countries like India subsidies are provided to the households to construct toilets. On the other hand, sanitation management and maintaining environmental hygiene, such as provision for solid and liquid waste disposal and management, is beyond household level and is a public affair. In the case of rural areas, the pure public investment in the latter is on a limited scale. As a result, the contribution of households to the overall sanitation expenditure is substantial in most cases, especially in villages where sewer facilities are not provided. Therefore the cost analysis includes both public and household expenditure.

The cost analysis is based on the data collected from 187 habitations spread over nine agro-climatic zones of Andhra Pradesh. The sample villages were selected on the basis of a stratified sampling design in each of the agro-climatic zone. The data on operation and maintenance were obtained from the village panchayat records. The household costs and service levels data was gathered from 107 sample villages spread across the nine agro-climatic zones. A sample of 50 households from each sample village was selected, and a structured questionnaire was canvassed to elicit information on the costs and service levels along with the demographic and socio-economic attributes of the households. On the whole, household costs and service level data are based on a sample of 5,350 households. The quantitative information is complemented with qualitative information collected using the Qualitative Information System (QIS) approach involving focus group discussions, etc. Cost components and calculations are the same as for water (see Chapter 5 above).

The service levels are assessed using the four indicators of access, use, reliability and environmental protection, following the service ladder approach (for details, see Chapter 4). The levels of service for each indicator are categorised under four levels: no service, sub-standard, basic, and improved. Each parameter is defined in terms of the service received. These parameters are assessed using the household-level data. Households are then grouped under different service levels based on the service they received. For the ease of analysis and clarity, we have presented the proportion of households receiving basic and above service level, since less than basic service level could be seen as poor service in the Indian context. The basic and above service levels are defined as follows:

- access: households having one or more ISL;
- use: all family members using and disposing infant faeces in the toilet;
- reliability: households spending Rs.500 or more per year on maintenance of the toilet; and
- environmental protection: drains are well maintained; dumps are used for solid waste disposal; waste water is reused; and solid waste is composted and reused.

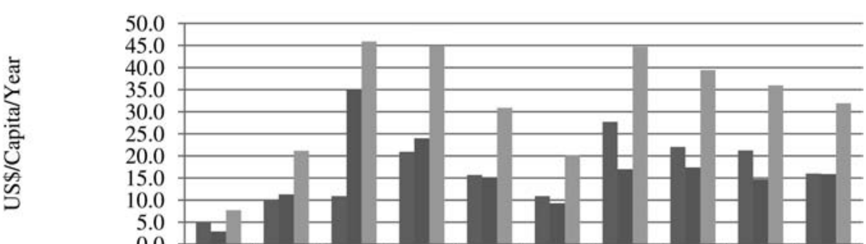
III Cost of Provision: Public and Private

The main cost components of rural sanitation that are available and considered in the sample habitations include household-level and community-level investments. At the household level, the main public investment is in the form of subsidies towards ISLs. In addition, the private households also spend on sanitation and hygiene practices such as water filtering, boiling, hand-washing, etc. In the majority of cases, household investments are part of or a result of promotional activities – like subsidies, incentives, etc. – by the department. In the case of ISLs, subsidies are provided for below-poverty households, and the contribution of households is 10 percent of the total costs. There is no subsidy for above-poverty households, and the entire cost is borne by them. However, it is observed that most of the households receive subsidy.

Household costs are integral to total sanitation costs, as the public expenditure on household sanitation is only partial (limited to subsidy). The cost estimates thus include public expenditure, including subsidies and household investments over and above subsidy or excluding the subsidy. At the community level, the major investment includes public or common toilets at schools,[1] public places, *anganwadis*, drainage systems, solid and liquid waste disposal systems, training and awareness programmes, etc. All these components are grouped under life-cycle cost components and come under public expenditure. In the case of sanitation, single pit toilets are mostly used, though double pit toilets and septic tanks are also in use in a limited way. Since technology is not found to be influencing the service performance (WSP 2010), we do not differentiate between the technologies in the case of sanitation.

Fixed Costs (CapExHrd)

The total fixed costs are about US$ 32 per capita at the state level. Fixed costs range between US$ 7.7 in the High Altitude Zone (HAZ) and US$ 46 in the Godavari Zone (GZ) (Figure 6.1). These variations are mainly due to the differences in coverage across the zones, i.e., high expenditure (government) due to higher coverage. They also reflect the differences in household expenditure. While the share of household expenditure in fixed costs is 50 percent at the state level, it is lower (about 38 percent) in the HAZ and STZ; while in the GZ, households spend as much as 78 percent of the total fixed costs – in fact, this is the only zone where households spend substantially more than the public expenditure on sanitation. Wide variations are observed across the villages within the zones (Table 6.1). Apart from the coverage, there could be other factors responsible for these variations; this is taken up separately later in the paper. The annualised fixed costs reveal a similar picture (Figure 6.2), as the normative life span of the systems does not vary much across the zones.



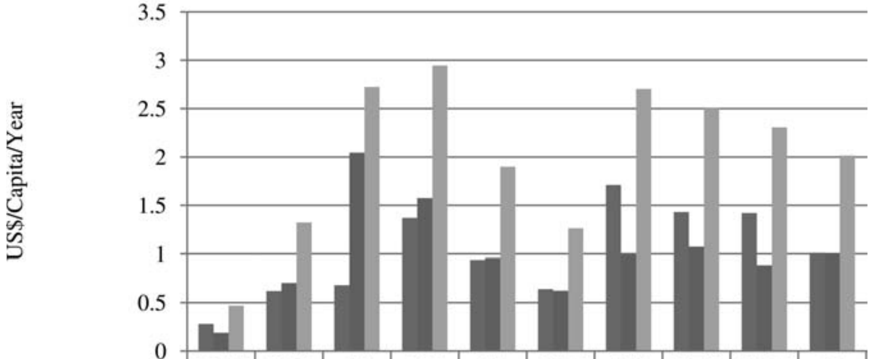
	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
■ Govt.CapExHrd	4.8	9.9	10.9	20.9	15.7	10.9	27.7	22.0	21.3	16.0
■ HHCapExHrd	2.9	11.3	35.0	24.0	15.2	9.3	17.0	17.4	14.7	15.9
■ Total Fixed Cost	7.7	21.2	45.9	44.9	30.9	20.2	44.7	39.4	36.0	31.9

Figure 6.1 Total fixed cost of provision (all households)

Table 6.1 Fixed capital costs of sanitation across agro-climatic zones (US$/capita)

	HAZ	*NCZ*	*GZ*	*KZ*	*SZ*	*SRZ*	*STZ*	*CTZ*	*NTZ*	*AP*
Govt.CapExHrd (Cum)-Avg	4.8	9.8	11	21	15.7	10.9	28	22	21	16
Median	5.0	4.9	8.7	17	12.1	7.3	19	14.5	23	11
Min	0	0	0.5	0	0	1	0	2	0	0
Max	13	49	28	122	67	33	144	73	50	144
CV	94	125	77	124	98	94	123	89	62	119
Govt. CapExHrd (Nor)-Avg	0.3	0.6	0.7	1.4	0.9	0.6	1.7	1.4	1.4	1
Median	0.3	0.4	0.6	1.1	0.6	0.4	1.1	1.1	1.5	0.6
Min	0	0	0.04	0	0	0	0	0.1	0	0
Max	0.8	3	1.9	8.2	4.6	2	9	5	3.9	9.1
CV	95	121	78	126	110	94	126	90	71	123
HHCapExHrd (Cum)-Avg	2.6	11.4	24.7	20.8	16.1	9.0	22.1	18.6	14.1	22.1
Median	0.8	7.7	30.3	22.9	13.1	8.3	23.4	13.2	13.2	23.4
Min	0	0	0	0	3.1	1.5	7.2	4.8	3.9	7.2
Max	9.7	40.6	39	40.2	38.9	20.5	31.1	45.8	34	31.1
CV	138	100	61	45	67	69	38	67	64	38
HHCapExHrd (Nor)-Avg	0.2	0.7	1.4	1.4	1	0.6	1.3	1.1	0.8	1.3
Median	0.1	0.5	1.8	1.5	0.8	0.6	1.4	0.8	0.8	1.4
Min	0	0	0	0	0.3	0.1	0.4	0.3	0.2	0.4
Max	4.4	2.5	2.3	2.6	2.4	1.4	1.8	2.8	2.1	1.8
CV	174	100	51	45	33	92	38	67	64	38

CV = Coefficient ofVariations
Cum = Cumulative per capita
Nor = Normative per capita/year

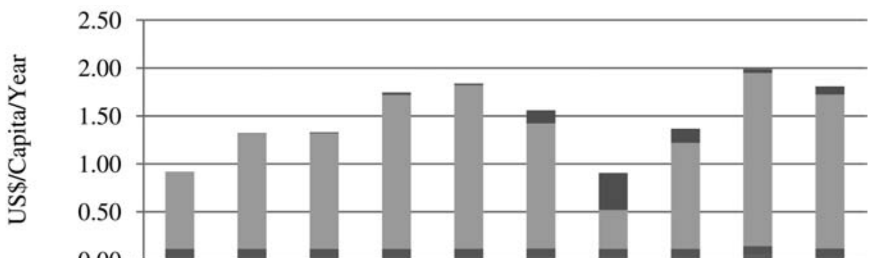


	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
Govt.CapExHrd	0.28	0.62	0.68	1.37	0.94	0.64	1.71	1.43	1.42	1.01
HHCapExHrd	0.19	0.70	2.04	1.57	0.96	0.62	0.99	1.07	0.89	1.00
Total Fixed cost	0.47	1.32	2.72	2.94	1.90	1.26	2.70	2.50	2.31	2.01

Figure 6.2 Annualised fixed costs

Recurring Costs (OpEx, CapManEx, ExDS, and ExIDS)

In the case of sanitation, recurring costs are mostly borne by the households, as very little is spent on OpEx from public expenditure (Figure 6.3). Households spend as much as 90 percent of the recurring costs. Inter- and intra-zonal variations are also high in the case of household expenditure (Table 6.2). In relative terms, when fixed and recurring costs are annualised, household expenditure accounts for almost 70 percent at the state level, while across the zones it is more than 50 percent in all except the South Telangana Zone (STZ)

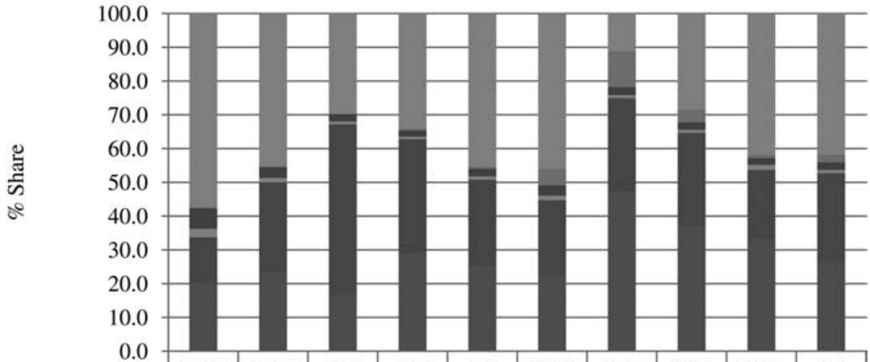


	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
Gov.Opex	0.00	0.00	0.01	0.03	0.02	0.14	0.39	0.15	0.04	0.09
HHOpEx	0.80	1.20	1.20	1.60	1.70	1.30	0.40	1.10	1.80	1.60
ExIDS	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
ExDs	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.06	0.04

Figure 6.3 Recurring costs

Table 6.2 Recurring costs of sanitation by agro-climatic zones (US$/capita/year)

	HAZ	*NCZ*	*GZ*	*KZ*	*SZ*	*SRZ*	*STZ*	*CTZ*	*NTZ*	*AP*
OpEx	0	0	0.01	0.03	0.02	0.1	0.4	0.2	0.04	0.09
Median	0	0	0	0	0	0	0.1	0.1	0	0
Min	0	0	0	0	0	0	0	0	0	0
Max	0	0	0.2	0.3	0.3	0.6	2	0.7	0.4	2
CV	0	0	357	250	336	147	145	130	247	281
HHOpEx	0.8	1.2	1.2	1.6	1.7	1.3	0.4	1.1	1.8	1.6
Median	0	1.1	1.2	1.6	1.8	1.1	0	1	1.7	1.2
Min	0	0	0	0	0.3	1	0	1	1	0
Max	4.5	6	2	2.3	2.4	3	3.5	2	3	6
CV	174	116	51	37	33	68	251	32	37	64



	HAZ	NCZ	GZ	KZ	SZ	SRZ	STZ	CTZ	NTZ	AP
■ HHOpEx	57.6	45.4	29.6	34.1	45.5	46.1	11.1	28.4	41.9	41.9
■ Opex	0.0	0.1	0.2	0.6	0.5	4.8	10.7	3.8	0.9	2.2
■ ExIDS	6.1	3.2	2.1	1.8	2.3	3.0	2.4	2.2	2.0	2.2
■ ExDs	2.5	1.3	0.9	0.7	1.0	1.3	1.0	0.9	1.5	1.0
■ HHCapExHrd	13.6	26.6	50.4	33.6	25.7	22.1	27.5	27.7	20.6	26.3
■ CapExHrd	20.2	23.4	16.8	29.2	25.1	22.7	47.4	36.9	33.1	26.4

Figure 6.4 Relative cost shares

(Figure 6.4). The share of household OpEx accounts for a major proportion, while CapEx is equally shared by the households and the government at the state level. However, there are variations across the zones in the relative shares of household expenditure. This indicates the importance of household expenditure in the case of sanitation investments, though there appears to be some complementarity between public and private (household) investments.

Sanitation expenditure seems to be closely associated with the service levels (Figure 6.5). The positive association seems to hold good especially in the case of access and use. While public capital costs and household costs complement each other, they also influence ISL usage (Figure 6.6). This is a good indication of the impact of public investment in sanitation as well. However, the consistency and robustness of this impact needs to be assessed at the disaggregated level (village). Interestingly, the use levels are only marginally high among the NGP villages when compared with non-NGP villages (Figure 6.7). This calls for a disaggregate analysis of the factors influencing sanitation service levels across the sample villages, which is taken up in the next section.

Hygiene Costs

Apart from sanitation, households spend regularly on hygiene. Household expenditure on hygiene practices includes materials for hand washing

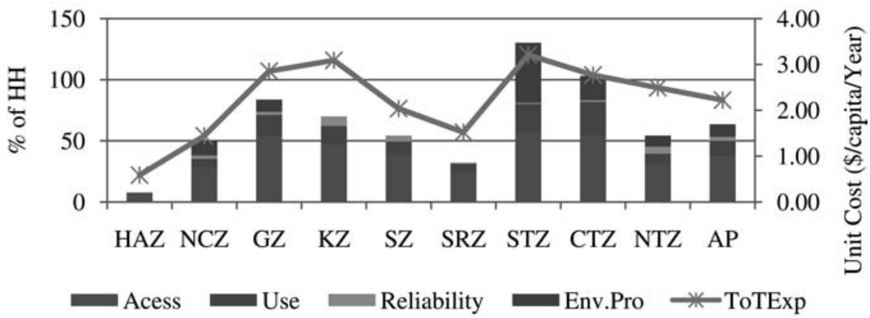


Figure 6.5 Service levels (>basic) and total expenditure

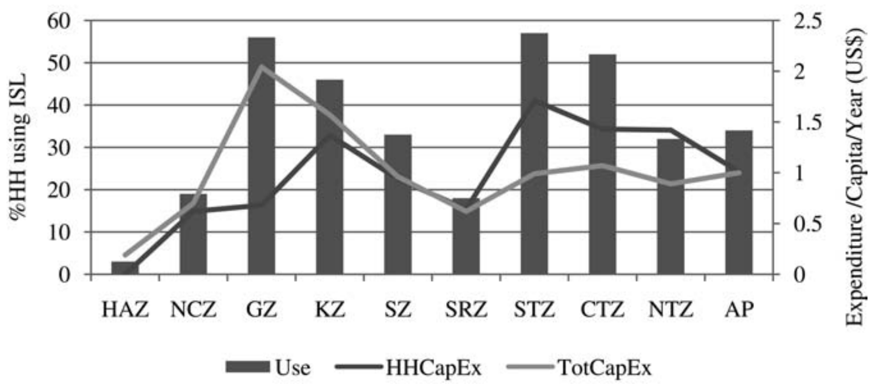
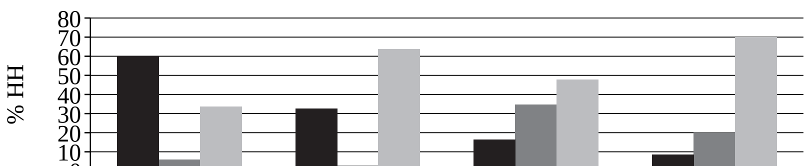


Figure 6.6 Investments in capital expenditure and ISL use across zones



	NGP	NNGP	NGP	NNGP
	ACCESS		USE	
Basic	60	33	17	9
Limited	6	3	35	20
No Service	34	64	48	71

Figure 6.7 Comparison of access and use of ISLs in NGP and non-NGP villages

Table 6.3 Household expenditure on hygiene practices across zones in Andhra Pradesh (US$/capita/year)

Zone	*Mean*	*Median*	*Range*	*CV*
HAZ	2.8	2.9	1.5–4.1	33
NCZ	3.6	3.7	0.8–7.8	51
KZ	4.4	4.3	0.9–9.4	55
GZ	5.2	5.3	3.8–6.3	15
SZ	4.6	4.5	3.5–6.2	18
SRZ	5.7	6.7	2.7–8.2	41
NTZ	5.8	5	3.8–10.8	38
CTZ	5.9	5.8	4.4–7.9	21
STZ	0	0	0	0
AP	4.6	4.6	0.9–10.8	42

Note: Hygiene costs are not available for the South Telangana Zone.

(soap, etc.), boiling and filtering of water, etc. On average, households spend US$ 4.6 per capita per year at the state level (Table 6.3). These costs range between US$ 2.8 in HAZ and US$ 5.9 in CTZ across the zones, and between US$ 0.9 and US$ 10.8 between the villages. The low expenditure on hygiene practices in HAZ reflects the poor service levels of sanitation. The low expenditure in this zone is mainly due to poverty and poor awareness levels associated with remote and inaccessible areas. In addition, the low investments from the government in sanitation as well as water could be the reason for low private investments and awareness. That is, the present public investment is not enough to attract private investment – as poor regions may need higher public investments in order to attract private investments in sanitation and hygiene.

IV Factors influencing Costs and Services

Multiple regression analysis is used to identify the factors influencing sanitation costs and service levels. Different indicators of cost and service levels are used as dependent variables, and a set of independent variables is identified from the village and household data using the correlation matrix. All the variables are standardised in per capita terms. The data set is based on 107 villages spread over nine agro-climatic zones, which have cost as well as service-level data.

Cost Drivers

In the case of sanitation, a combination of public and private expenditure is critical for providing the appropriate infrastructure as well as maintaining it; hence, the cost of sanitation includes public as well as household expenditure.

Besides, public investment is limited to a basic minimum as far as household infrastructure is concerned, and investments in waste management and community infrastructure are also limited. In fact, the coverage of household sanitation infrastructure is partial: about 65 percent. Due to the complementarity between public and private investments, it may be appropriate to term the cost of sanitation as investments in sanitation, as this captures the demand side (household costs) as well. Therefore, the terms costs and investments are used interchangeably as far as sanitation is concerned. The basic specification for cost variations is as follows:

where:

$SNCOST_{vt}$ = Sanitation provision cost in village '*v*' and time '*t*'

and

U_{vt} = Error term

The independent variables are selected based on the theoretical considerations. These were selected from an exhaustive list of indicators generated from the village and household surveys, which are primarily used to identify the important variables with the help of a simple correlation matrix. These indicators are broadly divided into five groups: social, economic, demographic, and institutional factors. Details of variable measurement and the theoretical/expected impact of the variables on unit costs are presented in Table 6.4. Five dependent variables are included: fixed per capita capital expenditure on hardware by the government (CapExHrd (Govt.)), by households (CapExHrd (HH)), and combined (CapExHrd (Govt. + HH)); and the total costs (fixed + recurring) by the government (TExp (Govt.)), and combined (TExp (Govt. + HH)) (see Table 6.4).

The independent variables under demographic factors include the size of the village in terms of number of households and household size. The size of the village is expected to have a positive impact on sanitation provision costs, as the big villages are likely to get better support for sanitation provision. On the other hand, due to the size of population, the per capita costs could be lower, due to the economies of scale. Household size also may have a negative impact, though it is not clear how effective the economies of scale would be at this level. Social indicators include the proportion of Scheduled Caste and Scheduled Tribe (SC/ST) households (percent SC/ST); Social Diversity Index (SDI);[2] and level of education (LEdu).

In the absence of *a priori* evidence on the impact of the proportion of SC/ST households and SDI indicators on unit costs, we hypothesise a positive or negative impact, which will be tested here. This is because, while the lower economic status of SC/ST households would adversely influence the household investments in sanitation, the subsidy on ISLs is targeted to these groups, and so there is a possibility for higher investments. On the other hand, the level

Table 6.4 Measurement and expected signs of the selected variables pertaining to unit costs

Variable	*Measurement*	*Theoretical/ expected impacts*
$SNCOST_{1–5}$	CapExHrd (Govt.) = per capita per year government expenditure on capital expenditure on hardware in Rs. CapExHrd (HH) = per capita per year household expenditure on capital expenditure on hardware in Rs. CapExHrd (Govt. + HH) = per capita per year total (government and household) capital expenditure on hardware in Rs. TotExp (Govt.) = per capita per year total government expenditure (fixed + recurring) per year (observed) in Rs. TExp (Govt. + HH) = per capita total per year government expenditure (fixed + recurring) per year (observed) in Rs.	Dependent variables
VS	Village size (number of households in the village)	Negative/ positive
AFS	Average family size	Negative/ positive
Percent SC/ST	Proportion of Scheduled Caste/Scheduled Tribe (lowest social category) households	Negative?
SDI	Social diversity index ranging from '0 to 1', where '0' is no diversity and '1' is high diversity. Index of social heterogeneity = $1-\sum_{i}^{n} P^2$, where P_i is the proportion of total population in the *i*th caste group.	Positive/ negative?
LEdu	Level of education (average number of years of schooling)	Positive
HHINC	Household income (Rs. per year)	Positive
FARMSIZE	Farm size (net sown area per household)	Positive
HHExp-B	Household expenditure on bottled water	Positive
HHExp-T	Household expenditure on water (tariff) (Rs./capita)	Positive
TIME	Time spent in fetching water (minutes/capita/day)	Negative
ZONE	Agro-climatic zones measured as a dummy variable [(dummy 1 = High Altitude Zone (HAZ); 2 = North Coastal Zone (NCZ); 3 = Godavari Zone (GZ); 4 = Krishna Zone (KZ); 5 = Southern Zone (SZ); 6 = Scarce Rainfall Zone (SRZ); 7 = Southern Telangana Zone (STZ); 8 = Central Telangana Zone (CTZ); and 9 = North Telangana Zone (NTZ)]	Positive/ negative?

Variable	*Measurement*	*Theoretical/ expected impacts*
GI	Governance indicator (average score)	Positive
	Institutional Space (IS), i.e., functioning of village water and sanitation committee; women/SC/ST participation in decision-making and meetings of *grama sabha* (village gathering) on WASH issues	
	Involvement in Planning (IP)	
	Involvement in Financial Management (IFM)	
	Involvement in Operation and Management of Systems (IO&MS)	
	Capacity Building Inputs (CBI)	
U_t	Error term	

of education, measured in terms of the average years of schooling per household, is expected to have a positive impact on sanitation investments because educated communities are expected to demand sanitation facilities and are also likely to invest more in sanitation.

Economic indicators include: household income (HHINC), farm size (FARMSIZE), household expenditure on bottled water (HHExp-B), and payment to water tariff (HHExp-T). All these reflect the economic status of the households at the village level, and hence, these households are expected to invest in sanitation as well as avail themselves of the public sanitation incentives. This is because economically well-off villages are expected to mobilise better funding for sanitation when compared to low-income villages. However, in the case of farm size, larger farm size is often associated with rainfed or poor regions. In this case, the impact of farm size need not be positive.

Governance is measured using 19 indicators. For the present analysis, the 19 are categorised under five groups (Table 6.5) along with an aggregate Indicator of Governance (GI). The groups are: Institutional Space (IS), including functioning of the village water and sanitation committee; women/SC/ST participation in decision-making and meetings of *grama sabha* (village meeting) on WASH issues; community Involvement in Planning (IP) (which includes the following indicators: feasibility study, technical survey, system integration, and extension); Capacity Building Inputs (CBI), including effectiveness of training and IEC activities; Involvement in the O&M Systems (IO&MS), which includes O&M of Public Stand Posts (PSPs) and HPs, water quality testing, solid waste management, waste water management, and hygiene and sanitation; and Involvement in Financial Management (FM), which includes maintaining water and sanitation records, tariff collection, and proactive disclosure.

All the six indicators (including overall governance, or GI) are used in the analysis in order to assess their relative importance in influencing the unit costs. All the governance indicators are expected to have a positive influence on

Table 6.5 Regression estimates of selected specifications: Hardware costs per capita per year

Variables	*Dependent variables*					
Independent variables	*CapExHrd (Govt.)*		*CapExHrd (HH)*		*CapExHrd (Govt. + HH)*	
	Coefficient	*VIF*	*Coefficient*	*VIF*	*Coefficient*	*VIF*
(Constant)	–172.2 (–0.51)		719.75★★ (2.22)		245.10 (0.43)	
VS	–0.3 (–1.19)	1.3	—	—	—	—
AFS	—	—	–252.25★ (–3.47)	1.7	–214.46 (–1.46)	1.4
PCI	—	—	0.02★ (3.42)	1.5	—	—
FARMSIZE	–48.6 (–1.1)	1.1	—	—	—	—
LEdu	26.61★★★ (1.68)	1.2	29.93★ (3.59)	1.6	54.38★ (3.24)	1.3
Acc.Wat	17.35★ (3.99)	1.4	—	—	20.21★ (4.34)	1.6
TIME	—	—	–0.04★ (-2.69)	1.3	—	—
HHExp-B	11.33★ (4.89)	1.5	2.25★★ (2.32)	1.4	11.39★ (5.64)	1.1
NGP/NNGP	395.97★★ (2.17)	1.4	212.7★★ (2.14)	1.9	502.61★ (2.54)	1.6
GI-FM	—	—	—	—	13.65★ (2.85)	1.7
GI-CBI	—	—	4.93★★ (2.18)	1.8	—	—
Zone (NCZ)	—	—	473.94★ (4.4)	1.3	—	—
Zone (GZ)	—	—	–193.64★★★ (–1.89)	1.2	—	—
Zone (KZ)	–429.74★★★ (–1.91)	1.4	—	—	—	—
Zone (SRZ)	383.17★★★ (1.77)	1.1	—	—	—	—
R^2	0.50		0.69		0.69	
Adjusted R^2	0.46		0.66		0.67	
N	107		107		107	

Figures in brackets are 't' values
★, ★★ and ★★★ indicate significance at 1, 5 and 10 percent level respectively

sanitation investments or costs, because governance is expected to increase awareness, efficiency due to transparency, and better management practices (Reddy *et al.* 2009). A dummy variable for the nine agro-climatic zones is also included in order to assess any zonal differences in costs.

Ordinary Least Squares (OLS) estimates were used to regress the different dependent variables ($SNCOST_{1-5}$) against the selected independent variables. Descriptive statistics of the selected variables are presented in Appendix Table A6.1. Regressions were run on cross-sectional data at the village level using the data from 107 villages (n = 107). Various permutations and combinations of independent variables were used to arrive at the best fit. Multi-colinearity between the independent variables was checked using the Variance Inflation Factor (VIF) statistic. Multi-colinearity is not a serious problem as long as the value of VIF is below 2. The best-fit specifications were selected for the purpose of the final analysis. Though we have also tried log linear estimates, only linear specifications are retained for the purpose of analysis, as the log linear specification has poor explanatory power.

The estimates indicate that all the specifications (six) explain about 50 to 70 percent of the variations in the existing unit costs across the sample villages (Tables 5 and 6). Two each of the dependent variables pertain to government and household costs per capita, and the other two are combined for the government and household costs. The costs are measured in terms of fixed hardware (CapExHrd) and total costs (fixed + recurring). It may be noted that the specifications of government costs have relatively lesser explanatory power, with fewer variables turning significant (Tables 5 and 6). All the selected variables have the theoretically expected signs, and the signs are consistent across specifications (see Table 6.5). A number of variables turned out to be significant in the selected specifications.

In the case of demographic factors, the average family or household size in the village has turned out to be significant, with a negative impact on the household capital expenditure (CapExHrd-HH) and combined (CapExHrd-Govt. + HH) investments. This indicates that larger families are less likely to invest in sanitation, though government investments are not influenced by the family size. This could be because maintenance of toilets becomes easier in small households because of smaller number of people. Given the increasing trend to nuclear families (GoI 2011), household investments in sanitation are likely to increase in the coming years.

Level of education (LEdu) has turned out to be significant, with a positive sign in four out of the six specifications. Higher education levels in the village could result in demand for sanitation facilities and investments in sanitation. Education can also help in enhancing the activities and functioning of the institutions, formal as well as informal. Informed discussions and decisions could lead to efficient allocation of resources. Thus, improving the literacy and education levels in rural areas is critical for cost-effective sanitation services. However, the level of literacy appears to have a greater impact on fixed (hardware) investments when compared to the total (fixed + recurring) investment.

Table 6.6 Regression estimates of selected specifications: Unit costs per capita per year

Variables	*Dependent variables (annualised)*					
Independent variables	*TExp (Govt.) (Fixed + Recurring)*		*TExp (HH) (Fixed + Recurring)*		*TExp (Govt. + HH) (Fixed + Recurring)*	
	Coefficient	*VIF*	*Coefficient*	*VIF*		*VIF*
(Constant)	149.76 (1.57)		979.64* (2.69)		462.39 (0.76)	
AFS	—	—	–281.96* (–3.45)	1.7	–255.5*** (–1.65)	1.4
% SC&ST	—	—	–1.75 (1.41)	1.1	—	—
Acc.Water	15.25* (3.21)	1.6	—	—	21.44* (4.35)	1.6
PCI	—	—	0.01** (2.08)	1.7	—	—
HHExp-B	8.92* (4.41)	1.1	2.65* (2.45)	1.3	12.17* (5.7)	1.1
HHExp-T	—	—	0.19** (2.15)	1.7	—	—
TIME	—	—	-0.04* (2.65)	1.3	—	—
LEdu	—	—	29.31* (3.18)	1.6	—	—
NGP/NNGP	302.86 (1.55)	1.5	229.78** (2.08)	2.0	539.57* (2.58)	1.6
GI (CBI)	9.23*** (1.92)	1.7	4.59*** (1.79)	1.9	—	—
GI (FM)	—	—	—	—	12.99* (2.56)	1.7
Zone (NCZ)	—	—	425.39* (3.56)	1.3	—	—
R^2	0.46		0.68		0.68	
Adjusted R^2	0.44		0.65		0.66	
N	107		107		107	

Figures in brackets are ‘t’ values
*, ** and *** indicate significance at 1, 5 and 10 percent level respectively

Among the economic factors, Per Capita Income (PCI), expenditure on buying water (Exp-B), and tariffs (Exp-T) turned out to be significant, with the expected positive sign. This indicates that economically better-off villages are likely to have better sanitation infrastructure. One reason could be that economically better-off villages are likely to garner more funds. Another important variable that turned out to be significant is access to water, which is measured in terms of people's perceptions on access (Acc.Water) and also the time spent fetching water (TIME). Better access to water is expected to increase the demand for sanitation investments. The positive impact of access to water on the government as well as combined investments indicates the close relation between water and sanitation. In the case of household investments, TIME was found to have a negative impact. That is, household investments are likely to be less in the villages where the time spent fetching water is high. This re-emphasises the importance of access to water in promoting sanitation investments in both public and private sectors. Two of the governance indicators – Capacity Building Inputs (GI-CBI) and Involvement in Financial Management (GI-FM) – turned out to be positively influencing sanitation investments, especially in the case of household investments. Better governance is linked to higher awareness, and hence to demand for and investments for sanitation. This is also reflected in the positive impact of the NGP on sanitation investments in five out of the six cases – the NGP villages are expected to have better governance, awareness, etc. Hence, sanitation investments are substantially higher in the NGP villages when compared to the non-NGP villages.

The analysis indicates that the North Coastal Zone (NCZ) has a positive impact on household investments. On the other hand, the Krishna Zone (KZ) has a negative impact on government expenditure, whereas the Scarce Rainfall Zone (SRZ) has a positive impact. This could be due to the relatively poor economic status of the SRZ. This only indicates that the zonal differences in government spending on sanitation are significant in some cases.

Factors Influencing Variations in Service Levels

Given the status of sanitation services in terms of infrastructure, understanding and explaining the factors that determine service levels become important; and how far the costs or investments in the sector influence the service levels needs to be assessed. For this purpose, two indicators of service levels in terms of quantity are used, as well as the qualitative perceptions of the households. Though there are four indicators of sanitation service levels (access, use, reliability and environmental protection), we restrict our analysis to access and use, as the data on the other two indicators is scanty.[3] Access is defined in two ways:

- percent of households having a toilet, which is a quantitative variable; and
- households' perception of having access to sanitation at the basic and above levels (at least one ISL per household).

These two access variables, along with the use variable are used as dependent variables. Use is also defined and measured as the proportion of households using a toilet.

The basic specification for the analysis of the service levels is as follows: where:

$SNSL_{vt}$ = Sanitation service level in village '*v*' and time '*t*';
U_{vt} = Error term

Here, also, the independent variables are selected based on the theoretical considerations. The variables are also identified with the help of a simple correlation matrix (Table 6.7) – both quantitative and qualitative indicators are generated, and most of the independent variables are expected to have a positive impact on the service levels (see Table 6.7). Of the demographic factors, the size of the village is expected to have a positive impact on service levels, especially on access, as the bigger villagers are expected to garner the public support for sanitation and hence, more people will have access to ISLs. On the other hand, household/Average Family Size (AFS) is expected to have a negative impact. As observed from the cost analysis, larger households are less likely to invest in sanitation. Similarly, the larger households are also expected to have lower use, due to higher water requirements as well as crowding. Social indicators such as SC/ST households (percent SC/ST) and Social Diversity Index (SDI) may influence service levels negatively. However, higher SDI may have a positive impact if the concentration is in favour of SC/ST, which is rare. Furthermore, the level of education (LEdu) is expected to increase the demand for sanitation in terms of access and use, as educated people tend to prefer improved sanitation and hygiene conditions.

Economic indicators include: household income (HHINC), farm size (FARMSIZE), capital expenditure of government (CapExHrd (Govt.)), household capital expenditure (CapExHrd (HH)), households buying water (% HHBUY), household expenditure on water tariff (HHExp-T), and household expenditure on bottled water (HHExp-B). All these variables are expected to have a positive influence on the service levels, though some of them (such as % HHBUY and HHExp-B) could have a negative impact, as buying water may be a consequence of poor water service. Higher expenditure by the government as well as households is expected to improve the access and use levels. Household expenditure on tariffs and bottled water reflects the economic status of the household, and hence it is expected to have a positive influence on the access and use of sanitation.

Access to water or lack of it is often assumed to be the critical factor influencing sanitation service levels. Here we have tried to capture access to water in terms of quantity (WATERqnt), % of households having house connections (%HC), source of water (SOURCE), and age of the system (AGEsyt). While water quantity is a direct measure, %HC indicates better and greater availability of water, and both are expected to have a positive impact.

Table 6.7 Measurement and expected signs of selected variables pertaining to service levels

Variable	*Measurement*	*Theoretical/ expected impacts*
$SNSL_{1-3}$	SNSLacc-o = sanitation service level in terms of accessibility measured as % of households owning a toilet	Dependent variables
	SNSLacc-p = sanitation service level in terms of accessibility measured as perception of the household	
	SNSLuse = sanitation service level in terms of accessibility (percentage of households receiving above basic accessibility)	
AFS	Average family size	Negative
VS	Village size (number of households in the village)	Positive
percent SC/ST	Proportion of SC/ST households	Negative
SDI	Social diversity index (see Table 6.5)	Positive/ negative?
LEdu	Level of education (average number of years of schooling)	Positive
% HC	Proportion of house connections	Positive
HHINC	Household income (Rs. per year)	Positive
FARMSIZE	Farm size (net sown area per household)	Positive
Govt. CapExHrd	Government capital expenditure per capita/ year (Rs.)	Positive
HHCapExHrd	Household capital expenditure per capita/ year (Rs.)	Positive
HHExp-T	Household expenditure on water (tariff) (Rs./capita)	Positive
HHExp-B	Household expenditure on bottled water (Rs./capita)	Positive
% HHBUY	Percentage of households buying water	Positive
SOURCE	Source of water dummy variable (groundwater = 0; surface water = 1)	Positive
AGESyt	Age of the system (number years since established)	Negative
NNGP/NGP	Dummy variable representing NGP/non-NGP status of the village (NGP = 1 and NNGP = 0)	Positive
GI	Governance indicators (average score)	Positive
	Institutional Space (IS)	
	Involvement in Planning (IP)	
	Involvement in Financial Management (IFM)	
	Involvement in Operation and Management of Systems (IO&MS)	
	Capacity Building Inputs (CBI)	
ZONE	Agro-climatic zones 9 (dummy 1, 2, 3, 4, 5, 6, 7, 8 and 9) (see Table 6.5)	Positive/ negative?
U_t	Error term	

Source of water is measured as a dummy variable, where surface (canal) sources are more reliable and provide greater quantities compared to groundwater sources, and we anticipate a positive impact of this variable on sanitation service level. On the other hand, water service levels decline with the age of the system (Reddy 2012); based on this, AGEsyt is expected to have a negative impact on sanitation service levels, access and use.

The dummy variable for the nine agro-climatic zones is used to test whether natural factors influence service levels or not, and we do not have any *a priori* expectation on the sign of this variable. Furthermore, all the governance variables are expected to have a positive impact on the service levels, due to better management practices. Another institution-related variable, pertaining to the Nirmal Gram Puraskar (NGP) status of the village, is also included. As this status is directly related to sanitation, it is expected that NGP villages will have a positive impact on the service levels.

Ordinary Least Squares (OLS) estimates were used to regress the different dependent variables ($SNSL_{1-3}$) against the selected independent variables. Descriptive statistics of the selected variables are presented in Appendix Table A6.1. The regression estimates of the factors influencing service levels were carried out on three different service variables and six specifications (Table 6.7). The explanatory power of the specification is quite high, i.e., above 80 percent in the case of access, and above 90 percent in the case of use. It was observed that most of the selected variables have the expected signs (Tables 6.8 and 6.9).

Access

Two indicators – the proportion of households having ISLs and the proportion of households perceiving basic and above service levels – are used to measure access. The majority of the explanatory variables turned out to be positively significant. From the policy point of view, hardware investment or cost variables – government as well as household – were found to have a strong influence on access (Table 6.8). The investment variables accounted for 20 percent of the explanatory power, as the adjusted R^2 has gone up from 0.61 to 0.84 when these variables are included. Further, it may be observed that household investments have stronger (four times) influence on access.

Among the social variables, education has a positive impact on accessibility. Despite the targeted approach of the government through providing subsidies to the socio-economically weaker sections, the percentage of SC/ST households was found to have a negative impact on accessibility. That is, the subsidy programme for constructing ISLs for these communities has not really penetrated in terms of improving the access. This could be for the following reasons:

- the allocations are not high enough to improve the access to these sections; and/or

Table 6.8 Regression estimates of selected specifications of service levels (accessibility)

Variables	*Dependent variables (accessibility)*					
Independent variables	*SNSLqt (Access – %HH with ISLs) – S1*		*SNSLqt (Access – %HH with ISLs) – S2*		*SNSLqt (Access – % HHs having above basic service)*	
	Coefficient	*VIF*	*Coefficient*	*VIF*	*Coefficient*	*VIF*
(Constant)	5.87⋆ (2.33)		16.28 (0.95)		–1.78 (–0.44)	
AFS	—	—	–6.31 (–1.49)	1.6	—	—
LEdu	—	—	1.58⋆ (3.44)	1.3	—	—
%SC/ST	–0.08⋆⋆⋆ (–1.92)	1.1	–0.16⋆ (–2.44)	1.1	–0.09⋆⋆⋆ (–1.92)	1.2
Govt.CapExHrd	0.01⋆ (3.95)	1.2	—	—	0.01⋆ (4.61)	1.2
HHCapExHrd	0.04⋆ (16.39)	1.4	—	—	0.04⋆ (16.07)	1.7
WATERqnt	—	—	—	—	0.09 (1.57)	1.5
% HC	—	—	0.17⋆ (2.73)	1.4	—	—
AGEsyt	—	—	–0.59 (–1.51)	1.1	—	—
NGP/NNGP	—	—	22.28⋆ (3.75)	2.0	—	—
GI-CBI	0.25⋆ (3.30)	1.5	0.41⋆ (2.94)	2.0	—	—
GI-IS	—	—	—	—	0.19⋆⋆ (2.18)	1.5
Zone (NCZ)	—	—	18.75⋆ (2.84)	1.3	4.71 (1.17)	1.2
ZONE (KZ)	—	—	20.96⋆ (3.76)	1.2	—	
ZONE (SRZ)	–7.41⋆⋆ (–2.21)	1.0	—	—	6.53⋆⋆⋆ (1.72)	1.2
R^2	0.85		0.64		0.87	
Adjusted R^2	0.84		0.61		0.86	
N	107		107		107	

Figures in brackets are ‘t’ values
⋆, ⋆⋆ and ⋆⋆⋆ indicate significance at 1, 5 and 10 percent level respectively

- the subsidies are either not targeted properly or are being captured by other sections, as is the case with most subsidy programmes.

This indicates that proper targeting and focused coverage of the SC/ST sections is a policy imperative as far as improving the access is concerned.

As far as access to water is concerned, house connections (percent HC) are positively associated with access to sanitation. In other words, the households with house connections are more likely to have access to sanitation, i.e., construction of ISLs. House connection indicates better access and availability of water, which is a necessary condition for maintaining the sanitation infrastructure. Of the institutional or governance indicators, capacity-building activities have a greater impact on access, followed by institutional space (GI-IS). As expected, the NGP villages have better access, due to their targeted approach to achieve full coverage. Among the agro-climatic zones, North Coastal and Krishna zones were found to have a positive impact. In the case of the Scarce Rainfall Zone (SRZ), the impact is not consistent, as it revealed a negative impact on measured access (%HH with ISLs) and a positive impact with regard to household perception of access.

Use

Understanding the factors responsible for the usage of the existing ISLs appears to be most critical for policy formulations towards improved and sustainable sanitation service delivery. The present usage levels need to be improved in order to improve the efficiency of future investments in sanitation infrastructure. Moreover, improving the access or availability may not result in real benefits as long as the usage of the infrastructure created is low. Here we analyse the factors influencing the usage of ISLs at the household level – i.e., the percentage of households using ISLs across the sample villages – with the help of three different specifications. Here also, both the cost variables have turned out to be positive and significant (Table 6.9). While costs or investments play an important role in increasing the use of toilets, it is the household investments that matter the most. It may be noted that the explanatory power of the equation changed little when government expenditure (CapExpHrd-Govt.) is dropped. This indicates that households use ISLs when they themselves invest, rather than with the support of the government: that is to say the subsidies provided by the government to the households are not as effective as the demand-driven investments from the households. However, the government subsidies may facilitate household investments, and they both seem to complement each other. Either way, creating demand for sanitation is the key for improved sanitation services.

Among the other factors, bigger villages seem to have higher usage levels. On the other hand, larger families are less likely to use ISLs when compared to smaller families. Given the declining trend in family size, usage levels should

Table 6.9 Regression estimates of selected specifications of service levels (use: percentage of HHs using ISLs)

Independent variables	*Specifications*					
	ISL use S1		*ISL use S2*		*ISL use S3*	
	Coefficient	*VIF*	*Coefficient*	*VIF*	*Coefficient*	*VIF*
(Constant)	–8.49⋆ (3.11)		–6.60⋆ (2.67)		45.03⋆ (3.11)	
VS	—	—	0.001 (0.85)	1.3	—	—
AFS	—	—	—	—	–17.41⋆ (–4.72)	1.5
% SC/ST	–0.08⋆⋆ (–2.26)	1.2	–0.07⋆⋆⋆ (1.89)	1.1	–0.15⋆ (–2.48)	1.1
SDI	—	—	—	—	20.95⋆ (2.41)	1.5
LEdu	—	—	—	—	1.84⋆ (4.10)	1.6
FARMSIZE	1.39⋆⋆ (2.24)	1.1	1.1⋆⋆⋆ (1.84)	1.1	1.88⋆⋆⋆ (1.71)	1.2
% HHBUY	0.15⋆ (3.6)	1.4	0.12⋆ (2.89)	1.6	0.27⋆ (4.01)	1.4
HHExp-T	—	—	—	—	0.01⋆⋆⋆ (1.69)	1.5
Govt. CapExHrd	—	—	0.001⋆(2.40)	1.4	—	—
HHCapExHrd	0.04⋆ (16.06)	1.9	0.04⋆ (18.01)	1.8	—	—
SOURCE	—	—	2.83 (1.33)	1.1	—	—
Water Quantity	0.09⋆ (2.29)	1.5	—	—	—	—
AGESyt	—	—	—	—	–0.94⋆ (–2.78)	1.0
GI-CBI	—	—	0.23⋆ (3.30)	1.9	0.56⋆ (5.44)	1.4
GI-IP	0.48⋆ (4.7)	1.7	0.13⋆⋆⋆ (1.82)	1.7	—	—
R^2	0.91		0.91		0.74	
Adjusted R^2	0.90		0.91		0.72	
N	107		107		107	

S1 = Specification 1
S2 = Specification 2
S3 = Specification 3
Figures in brackets are 't' values
⋆, ⋆⋆ and ⋆⋆⋆ indicate significance at 1, 5 and 10 percent level respectively

go up along with access in the coming years. It was found that usage levels are low in villages with a larger proportion of SC/ST households when compared to villages with more heterogeneous social composition (SDI). Literacy is an important factor in influencing usage, as it influences costs as well as access. All the economic factors – such as farm size (FARMSIZE), proportion of households buying water (%HHBUY), and household expenditure on water tariff (HHExp-T) – have a positive impact on usage. Economic development in the rural areas is likely to improve sanitation services. However, the indications are that rural areas are lagging behind, due to poor viability of agriculture.

Better water supplies in terms of volume per capita would help increase the use of ISLs. Increasing supplies at the household level, either through pumping more water or reducing wastage (unaccounted water), would improve sanitation and hygiene conditions at the household as well as community level. The latter option would be more efficient, given that there is 40–50 percent wastage of water in the rural areas.[4] Such improvements may not require huge investments, and may only need better governance in most cases. Investments in terms of capital maintenance (CapManEx) would help in maintaining the efficiency of the systems irrespective of their age. In the absence of CapManEx, the service levels decline with the system's age. This is reflected in the negative relation between the age of the system (AGEsyt) and the use of ISLs. On the other hand, governance indicators such as capacity building (GI-CBI) and institutional space (GI-IP) have a positive impact on use. These indicators, especially capacity building, are likely to increase awareness and demand for sanitation facilities and use as well.

V Conclusions

Sanitation is the most nagging developmental issue in the Indian growth story. Though the achievements so far may suffice for meeting the millennium development goals, they do not reflect India's achievements in other sectors. Is this due to misplaced priorities in resource allocation or poor understanding of the sanitation sector? It appears that the present policy is faltering on both accounts, as sanitation is often considered as an add-on to drinking water for all policy purposes. Moreover, the programmes designed for sanitation are mostly supply-sided, as if sanitation is a pure public good. While the low policy priority and poor resource allocation have constrained sanitation coverage to 45 percent at the national level, the supply-sided policies have been ineffective in improving the use of the limited sanitation infrastructure created at the household level. Given the use levels at less than 60 percent at best, effective sanitation service levels are limited to a quarter of the population. In the case of Andhra Pradesh, the usage is as low as 30 percent. Given the fact that coverage is less than 50 percent, effective sanitation coverage in terms of use is less than 15 percent.

The present analysis of real expenditures suggests that the entire allocations for sanitation are going towards creating infrastructure (ISLs) with little or no expenditure for IEC activities. Hence, allocations towards various important components need to be assessed. The Life-Cycle Cost Approach (LCCA) would help in arriving at a balanced allocation.

Households invest as much as the government in the construction of ISLs. Given the present coverage of 50 percent, investments need to be doubled in order to create even the infrastructure sufficient to provide 100 percent access. Furthermore, the maintenance (OpEx) is entirely carried out by the households – public investments towards waste (solid and liquid) disposal are very limited in the rural areas. When these costs are included, the allocations towards sanitation need to be increased substantially. The analysis of factors influencing costs and services indicates that literacy, governance and economic development are critical for improving investments in sanitation and service levels, and household investments are critical for improving the use of ISLs. Hence, increasing the demand for sanitation at the household level is more effective than public investment in improving the use of the infrastructure created. Public investment may be viewed as a facilitator to attract private investment, as they complement each other. Proper targeting of public investment to benefit the backward regions and communities would improve overall access.

It may be argued, based on the analysis, that creating and improving the demand for sanitation at the household level is the key for improved sanitation services. While sanitation at the household level needs to be treated as a private responsibility, public support should be limited to creating the infrastructure required for safe disposal of waste, institutions for governance, awareness building, etc., apart from supporting vulnerable sections. Given the magnitude of investments, mainstreaming sanitation with separate allocations and planning should be taken up as a priority. As far as Andhra Pradesh is concerned, reviving the dormant Village Water and Sanitation Committees (VWSC) and grooming them into professional institutions (Chapter 2) also ought to be taken up as a priority. A focused approach using professional marketing methods promote to communities the importance of sanitation and hygiene should be central to the WASH policies.

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Appendix

Table A6.1 Descriptive statistics

Variables	*Mean*	*Minimum*	*Maximum*	*CV*
VS	327	17	1718	87
AFS	4	3	6	12
% SC & ST	31	0	100	84
SDI	0	0	1	46
FARMSIZE	2	0	8	75
PCI	17135	5551	43524	36
LEdu	22	11	32	19
%HC	30	0	88	105
%HHBUY	14	0	100	185
Access (%HH with ISL)	37	0	100	74
CapExHrd (Govt.)	47	0	388	117
CapExHrd (HH)	41	0	123	78
CapExHrd (Govt. + HH)	87	0	471	80
TExp (Govt.)	47	0	394	117
TExp (HH)	45	0	178	76
TExp (Govt. + HH)	92	0	477	80
WATERqnt	42	26	72	21
Access (%HH saying yes)	40	0	100	73
USE (%HH)	34	0	100	86
SOURCE	0	0	1	177
HHExp-B	39	0	368	192
HHExp-T	510	0	2478	89
TIMESPENT (min. per day)	14	6	53	42
AGESyt	6	1	22	81
NGP/NNGP	0	0	1	203
GI-IS	25	0	76	59
GI-IP	31	0	80	52
GI-CBI	17	0	75	101
GI-IO&MS	22	1	57	52
GI-FM	17	0	79	99

7 Nirmal Gram Puraskar and Sanitation Service Levels: the Curse of Slippage

M. Snehalatha, V. Anitha Raj, P. Busenna and M. Venkataswamy

I Introduction

It is estimated that only by building 112,300 toilets every day can India ensure access to toilets for every household (website of the drinking water ministry). India needs to build 78 toilets a minute to meet the MDGs (Ghosh 2011). To meet this demand, the Government of India has allocated more than US$ 250 million – for implementing the programme, and with the involvement of more than 5,000 villages, community contributions have exceeded US$ 215 million (WaterAid 2011). However, majority of these investments are turning out to be dead investments as the intended levels of sanitation services have not been achieved by these villages. The Government of India has introduced an incentive-based (cash prize) programme, 'Nirmal Gram Puraskar' (NGP), as part of the Total Sanitation Campaign (TSC), in October 2003 (see Chapter 2 for details). A 'Nirmal Gram' is an 'Open Defecation Free' (ODF) village where all houses, schools and *anganwadis* have sanitary toilets and have raised awareness amongst the community on the importance of maintaining personal and community hygiene and clean environment. This was started with the spirit that an incentive strategy can motivate the Panchayati Raj Institutions (PRIs) in taking up sanitation promotional activities on priority.

The villages are being judged upon four criteria:

- all households have access to toilets with full use and no open defecation;
- all schools have sanitation facilities, which are also put to use, and all co-educational schools have separate toilets for boys and girls;
- all *anganwadis* have access to sanitation facilities; and
- there is general cleanliness in the settlement.

The clean village award has proved to be an important motivating force in many states, as evidenced by the dramatic increase in the number of awards each year since its inception in 2003. In 2004–2005, about 40 awards were given across six states; in 2005–06, about 769 awards were given across 14 states; and in 2006–07, about 4,959 villages across 22 states received the award. The number of applications in 2007–08 exceeded all expectations, reaching nearly 40,000 (UNICEF 2009). Though there is momentum in the number of villages aspiring to this award, the number of villages actually qualifying is very low – most of these villages are applying in pursuit of financial incentives although they do not qualify for this award. According to estimates by the Water and Sanitation Programme (WSP), by 2010 approximately 55,785 local government institutions had applied and sought verification of their ODF status, but only 22,745 (41 percent) of these received the NGP award (Aiyar 2011). Besides, many NGP villages are found to have high levels of non-use of toilets (34 percent), and only 34 percent of schools have separate toilets for girls and boys. Moreover, it was observed that in most villages, there has been a severe drop in the efforts towards social mobilisation and monitoring of the ODF status after the NGP award has been received (UNICEF 2008). Slippage, often synonymous with water supply, is now widely observed in sanitation, bringing the issue of sustainability as a priority issue to be addressed even in the case of sanitation.

Though software is flagged as a paradigm shift in TSC, the field implementation of the Information Education and Communications (IEC) activities are not effective towards the behavioural change process. In a study conducted by Water Aid, it was reported that if spending is taken as an indicator, even after the initial five years of spending on IEC, sanitation coverage remains a meagre 7.14 percent. In most cases IEC activities have been limited to street plays, jingles and songs, posters and pamphlets, wall paintings and slogans. As is evident from the communities' response, the recall factor for IEC is low, with only a few people recalling the nature, content and message of the IEC campaign (Water Aid 2011). Besides, the expenditure on sanitation continues to be hardware-focused, with more money being spent on infrastructure provision, neglecting the software activities (see Chapter 6 above).

Mainstreaming sanitation is the utmost priority activity if India has to achieve the MDGs, and on the road towards achieving this goal, two major issues stand out:

- low allocations or under-funding of sanitation; and
- improper utilisation of the allocated funds, as reflected in the low usage of toilets and slippage in the NGP villages.

Addressing the second issue with proper scaling up is critical for increasing the allocations and their effectiveness. Though TSC and NGP are being promoted through well-defined policies and programmes, the actual budget allocations for sanitation are quite low: The share of sanitation in the WASH sector has declined from 8 percent in 2004–05 to 4 percent in 2008–09 (Reddy *et al.* 2010). As pointed out by the Minister for Drinking Water and Sanitation, Shri Jairam Ramesh, 'Sanitation is a single most important need in India today. If you look at the filth and the hygiene in our country, you can only say that sanitation programme is the most important programme and it is severely under-funded' (2012). Keeping this background in view, the WASHCost project assessed the implementation of the TSC and NGP on the ground, and the present chapter analyses the access and use of toilets in NGP villages, the reasons for toilets not being used, and the solid and liquid waste disposal systems. The analysis highlights the reasons for slippage in NGP status and what needs to be done in order to sustain the ODF status of the NGP villages. Specific objectives include:

- to measure the status of sanitation in NGP villages using the sanitation service ladder;
- to compare the status of sanitation among NGP and non-NGP villages;
- to explore the factors for better sanitation from the best-performing NGP villages.

II Approach and Methodology

The analysis is based on the household data collected from 35,000 sample households from 107 villages spreading over nine agro-climatic zones of Andhra Pradesh, India. Among these, about 7,800 households were covered from 21 villages that have received the NGP award during the years 2007, 2008 and 2009 (details are given in Table A7.1 at the end of this chapter). In all 107 villages, all the households are covered for assessment of household water and sanitation-related assets (tap, motor, toilet, etc.) apart from socio-economic parameters, while 50 households from each village have been selected for a detailed analysis of the service levels. To measure the sanitation services at the household level, pre-tested questionnaires were administered using personal interviews. Further, Qualitative Participatory Assessments (QPA), focus group discussions and personal observations were used to measure the service delivery parameters at community level. Information about investments/expenditure of the government on sanitation was collected from the Department of Rural Water Supply and Sanitation at various levels, specifically, the panchayat (village-level governance body), sub-district, district, and state levels.

For analysing the service delivery parameters such as access, use, reliability and environmental protection, the service delivery ladder developed by WASHCost (Potter *et al.* 2011) is used. The sanitation service ladder has been adapted to suit to the Indian policy context reflecting the various service levels varying from 'no service' to 'improved service' – the TSC norm is considered to be the 'basic service' level (see Chapter 4 for details). As part of QPA, the perceptions of the community are measured using scoring options ranging from 0 to 100. Further, these scoring options are matched with the sanitation service ladder levels of 'no service' to 'improved service'. Details of the service ladder are shown in Table 7.1.

Table 7.1 Overall sanitation service delivery – India

Service level	*ISL access*	*ISL use*	*Reliability*	*Environmental protection*
Improved	Sufficient number of toilets proportionate to the number of family members (or more than one toilet)	All family members use toilets, and infant faeces is also disposed into the toilet	Rs.1000 + spent on O&M	Waste water is reused. Solid waste is composted and reused.
Basic	One ISL	All the members of family use toilet	Rs.500 + spent on O&M	Drains are well maintained. Dumps used for solid waste disposal.
Limited/ Sub-Standard	Shared	Some family members use the toilet	Rs.1–500 spent on O&M	Drains are there but are poorly designed and maintained. Dumping area for solid waste exists, but is not used.
No Service	No ISL	All open defecation	Households did not spend any amount	No solid or liquid waste management.

III Status of Access to and Use of Sanitation in NGP Villages

Using the service ladder approach, various indicators such as access, use, reliability, and solid and liquid waste disposal systems have been analysed. The analysis of the data from the selected NGP villages reveals that in most of the villages the households do not have access to a toilet. In five out of the 21 villages, more than 50 percent of the households do not have access to a toilet (Figure 7.1). In many of the NGP villages, the toilets are either not built at all or have been only partially built (e.g., no superstructure/door/pit), thus making them unfit for use. Discussions with the households revealed that no/low subsidy, untimely supply of the raw material, low quality materials supplied, lack of space to construct the toilet, lack of awareness, affordability, no/low priority given to sanitation by the households, and a culture of defecating openly are the reasons for non-construction or partial construction of the toilets. In only six villages (28 percent) – Jagannadhapuram, V. Dasaripeta, Boduvalasa, Venkatapuram, Medipally and Gangadevipally – it was observed that there is above 90 percent access to toilets, indicating that only these villages are close to qualifying as NGP villages, since they satisfy the criteria of all the households having access to a toilet. In these villages the households either have their own toilets or share the toilets of their relatives or friends. During

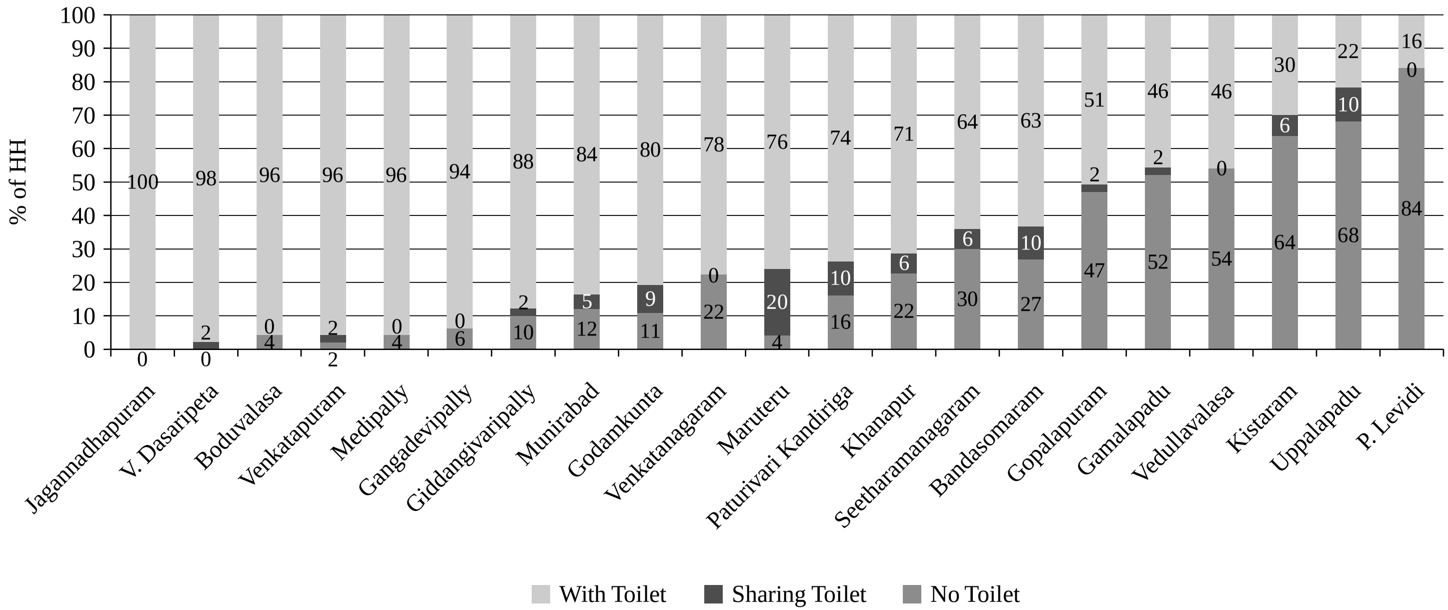


Figure 7.1 Access to toilets in NGP habitations (Source: Data collected by WASHCost Study (2011))

the interactions with households it was found that high awareness levels, the peri-urban location of the villages, non-availability of land for open defecation, and pressure by panchayats through social watching, good leadership, effective trainings and awareness-generation programmes are the reasons for the construction of toilets.

These findings clearly raise questions about the process of qualifying and declaring the NGP awards. Focus group discussions with the communities revealed that political and social factors influenced the award-winning process. Further, the evaluation process was not stringent, and the villages were not evaluated/observed for longer periods of time before declaring them qualified for the award. In some NGP villages, the villagers neither knew that their village had received the award, nor knew details of where and how the award money was spent. In one village the toilets were built by a local NGO without considering water availability; all these toilets are presently non-functional, leaving a huge dead investment in unused toilets.

Usage of Toilets in NGP Villages

Having access to a toilet is not a reliable indicator for ODF status; only usage of a toilet is an indicator that reflects effective sanitation service. This is because 'access to a toilet does not always mean usage'. According to the NGP qualifying criteria, all the households in the sample villages should have access to toilets and should be using the toilets, and there should be zero open defecation when the award is declared.

We considered zero open defecation as the baseline, and compared the present data collected from the field (Figure 7.2) on usage of toilets. It was found that almost all the NGP villages had open defecation, indicating the slippage. In seven out of the 21 villages, more than 60 percent of the households are practicing open defecation, indicating that they have either never used the toilets or have reverted to open defecation. Open defecation in villages where there is no access to a toilet can be understood, but villages where more than 50 percent of the households have access to toilets also show 'no usage'; this brings out clearly the issue of slippage in sanitation. Discussions with households revealed that the reasons for non-use of toilets are:

- lack of monitoring or stopping of watch and ward on open defecation by the panchayat/VWSC after receiving the award;
- lack of continued awareness and IEC activities to sustain behavioural change;
- faulty technical design of toilets;
- complaints of bad smell and suffocation in using a closed cabinet; and
- lack of water.

Further, for the households that have access to toilets, but do not use them safe sanitation remains an unfelt need, due to notions such as 'pit might fill' and the

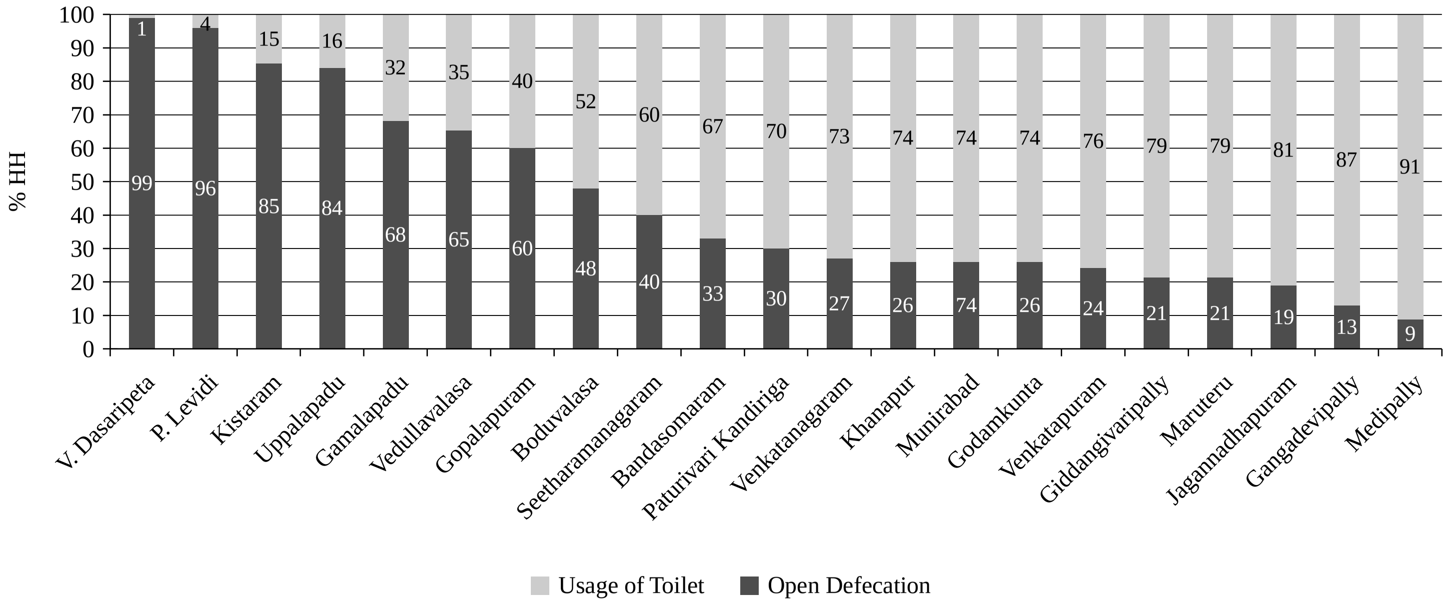


Figure 7.2 Usage of toilets in NGP habitations (Source: Data collected by WASHCost project (2011))

habit/culture of open defecation (which continues to persist even after winning the NGP award) and not being exposed to safe sanitation practices.

In some of the NGP villages, coercive tactics were used to promote sanitation behaviour. The need for such tactics suggests that sanitation and hygiene awareness campaigns failed to reach and/or significantly impact all social groups. Clearly, social pressure applied by the GP members (who tend to be elites) on the poorer social groups is difficult to justify, even though it can effectively lead to an NGP award. The big problem with coercion based on humiliation and fear is that it does not lead to behavioural change, and may hence result in slipping back to old practices (Batchelor *et al.* 2012).

Usage of Toilet by Different Categories of Household

To know more about the usage pattern of toilets, a detailed analysis on who used the toilets was conducted among the different social and gender categories. Toilet usage by different caste categories indicates that a high percentage of households belonging to the Other Caste (OC) category use the toilets, while only 20 percent of these households openly defecate (no service) (Figure 7.3). On the other hand, among Scheduled Tribe (ST) households open defecation is as high as 71 percent, and among Scheduled Caste (SC) households 45 percent practice open defecation. The high toilet usage among the OCs can be attributed to their greater awareness of safe sanitation, better exposure to urban life, ability to afford to own and maintain toilets, and high education levels (the analysis in Chapter 6 also supports this). A similar pattern is observed in the case of landholding size (Figure 7.4).[1] The situation of the landless/poorest of the poor remains the same, despite the subsidies and incentives; this group continues to be deprived of better services, and the reasons mentioned above hold good for the differences across landholding sizes as well.

The usage pattern by gender clearly shows that women and adolescent girls are those who use the toilets most, while most of the men and children practice open defecation (Figure 7.5). In some of the NGP villages, only 10 percent of the men use toilets; the rest defecate openly, while in almost all the NGP villages the percentage of children using toilets is below 50 percent. This usage pattern shows the skewed targeting of IEC activities and the lack of focus on monitoring and sustaining the behavioural change on a long-term basis.

Generally, women are the default target groups for training and awareness, where personal factors such as pride, dignity, shame and fame are used to motivate them towards behavioural change. Though women are early adopters, and therefore it is good to target them, given the dominant patriarchal society that India has, men need to be targeted as well, because they take the decision on constructing and using the toilets. During discussions in the villages, adolescent girls revealed that they failed to convince their fathers to construct toilets, while some women remarked that their husbands did not bother when they requested toilets, but responded immediately to their adolescent daughters' requests and built toilets. In another case, the head of the family constructed a

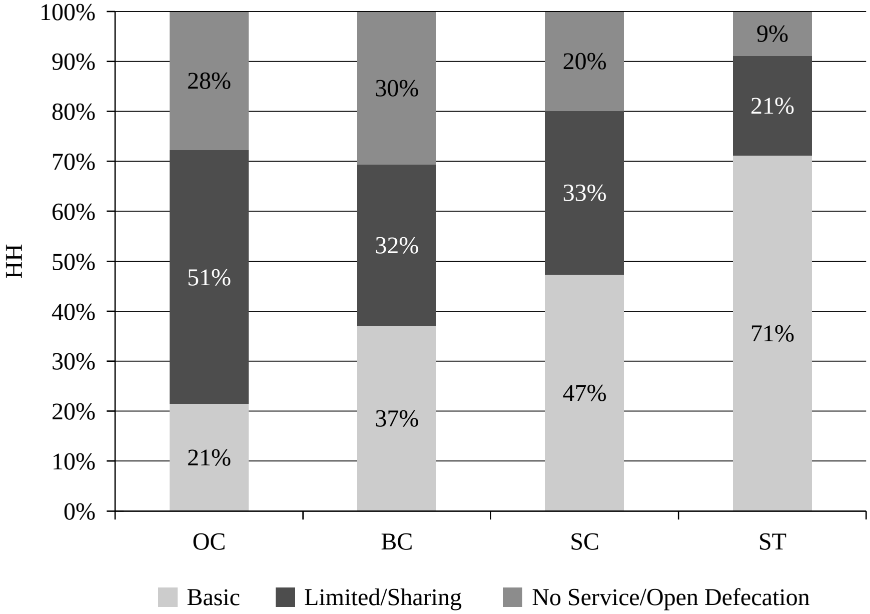


Figure 7.3 Caste-wise usage of toilets (Source: Data collected by WASHCost project (2011))

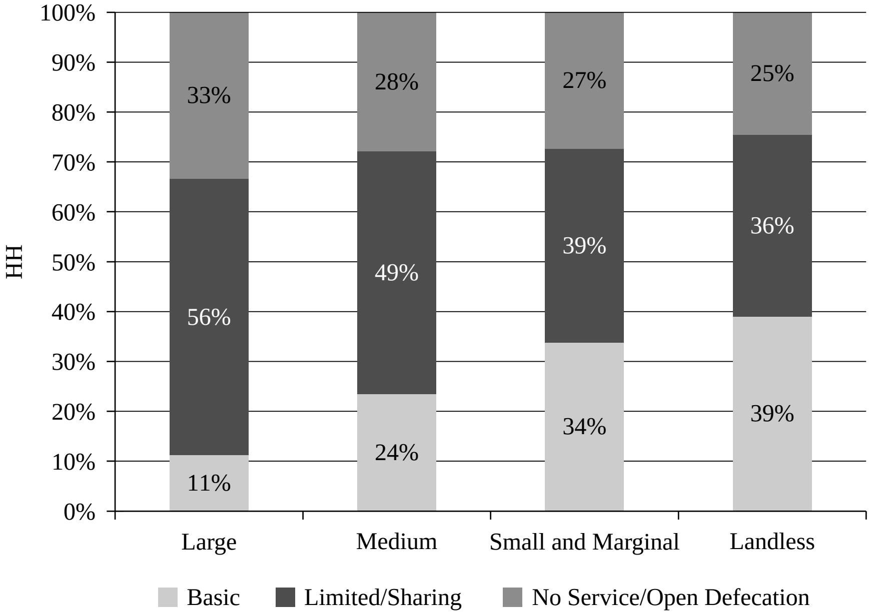


Figure 7.4 Influence of landholding size on usage of toilets (Source: Data collected by WASHCost project (2011))

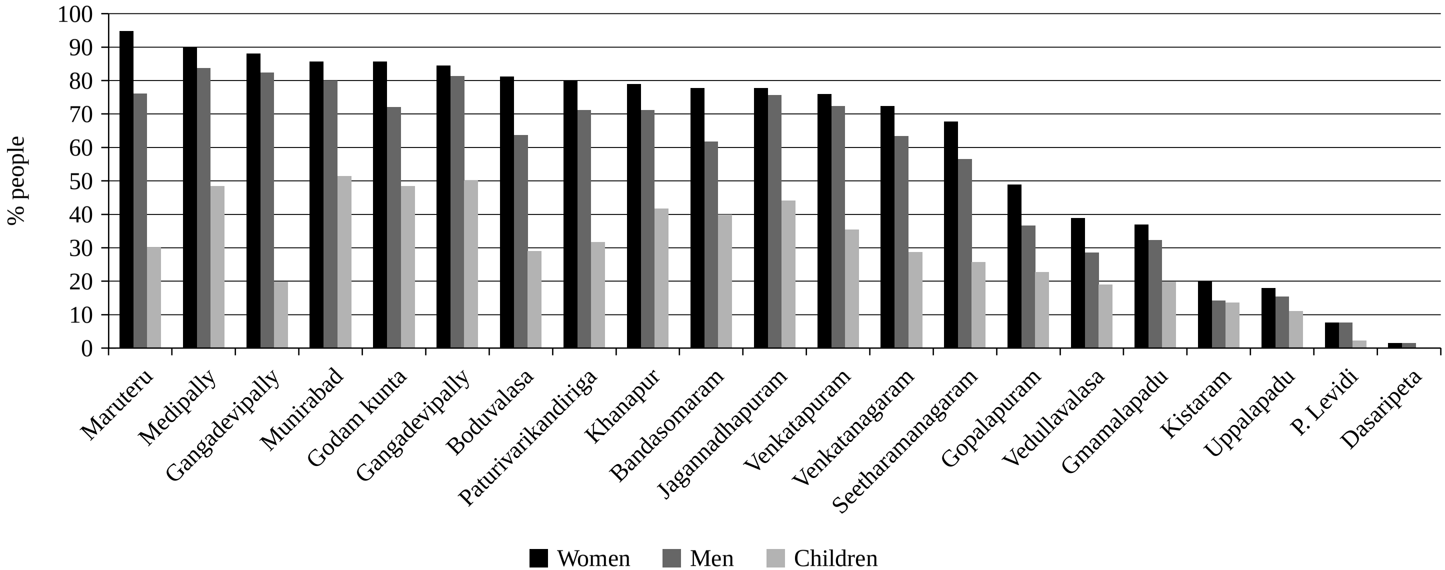


Figure 7.5 Gender-wise and children's usage of toilets (Source: Data collected by WASHCost project (2011))

toilet because his aged parents could not walk for defecation. This clearly reveals that there are different reasons for motivation and change; hence, strategies need to be woven around these points to secure effective behavioural change. IEC activities therefore need to target men and children, with special emphasis on the risks of environmental pollution, ill-health, and economic loss resulting from unsafe sanitation.

The gender bias in targeting IEC activities needs to be removed by co-ordinating and harmonising the efforts of all the departments responsible for sanitation and hygiene promotion. Achieving sustainable sanitation is a distant dream unless there are intensive and integrated efforts from the government, households, as well as the community, and each should take up their responsibility at their own level.

Maintenance and Pit Emptying of Toilets in NGP Villages

Household surveys indicated that the constructed toilets are either new or are not being used; hence, the issues related to operation and maintenance or reliability are not the main concerns. However, some of the reasons the households gave for not using the toilets are related to perceptions about the reliability of the infrastructure – such as fear of the toilet pit filling up, no (or low) awareness regarding shifting to the second pit constructed, no reliable organisation or agency being responsible for emptying the toilets (even if they exist, no one knows about them), and disposal of the emptied faecal matter without causing environmental pollution. A very few respondents revealed that they had approached a private service provider to empty the toilet, at a cost of around Rs.4000 (US$ 80). The second-generation issues related to sanitation, such as groundwater pollution, health impacts, etc., require immediate attention, and the solutions need to be in place in order to contain the economic loss.

Box 7.1 Environmental protection

No service

No solid and waste water management in the village – there are stagnant pools of water and garbage or running water through streets.

Limited

Garbage is thrown mostly in the common dumping area in the village, but some households do not bother to take their rubbish to the dump site. Though drains are there, they are badly designed, broken or blocked; hence, there are stagnant pools of water, or water running through streets.

Basic

All households take their rubbish to the common dump site, or some individuals or groups in the village collect the rubbish from all households and put it in the common dump site. Drains are there, well-designed, cleaned regularly, and working properly; there is no stagnant water in the village. However there is no re-use for vegetation (e.g., kitchen gardens).

Intermediate

Households segregate their wastes and give their organic waste for composting; all recyclable non-organic waste (e.g., glass, plastic, paper, metal) is sold, given to collectors, or buried periodically in a landfill site outside the village. All the waste water is discharged into leach pits or re-used for vegetation; no waste water is discharged directly into fresh water bodies (e.g., lakes, ponds, streams), and waste water is filtered for re-use.

Solid and Liquid Waste Disposal Systems in NGP Villages

One of the parameters critical to qualifying for a NGP award is a safe solid and liquid waste management system. Data reveals that most NGP villages showed poor levels of solid and liquid waste disposal systems. The households dump solid waste on the streets, while liquid waste water gets onto the streets in many NGP villages. For measuring the solid and liquid waste management and its impact on the environment, four levels of environmental protection have been used (Box 1). These are measured using the QPA options that are designed to match the service ladder levels for the score range 0–100.

A clear risk of environmental pollution is observed in the NGP villages, as the majority (72 percent) of them have limited or no service in terms of solid and liquid disposal arrangements (Figure 7.6). In only 28 percent of the NGP villages is there some system of solid waste management where household waste is brought to a common dumping site, either by the households themselves or by the panchayat (hired rickshaw). However, the drains are poorly managed, resulting in stagnation of waste water. Further, it was observed in many villages that waste water drainage lines were laid without following any slope/contour, and often these drains are not linked to a common drainage outlet, resulting in blockages. This frequently leads to mosquitoes breeding, increasing the risk of disease spread. Interactions with the department officials and panchayats revealed that the funds allocated for drainage and solid disposal are very low, and the fund flow is irregular; hence, an *ad hoc* approach to building and maintaining waste disposal systems is adopted.

Sanitation including the drainage systems costs double the normal cost. It is estimated that Rs.14,000 (US$ 306) per capita was spent on sanitation, including underground drainage systems, in one of the WASHCost survey

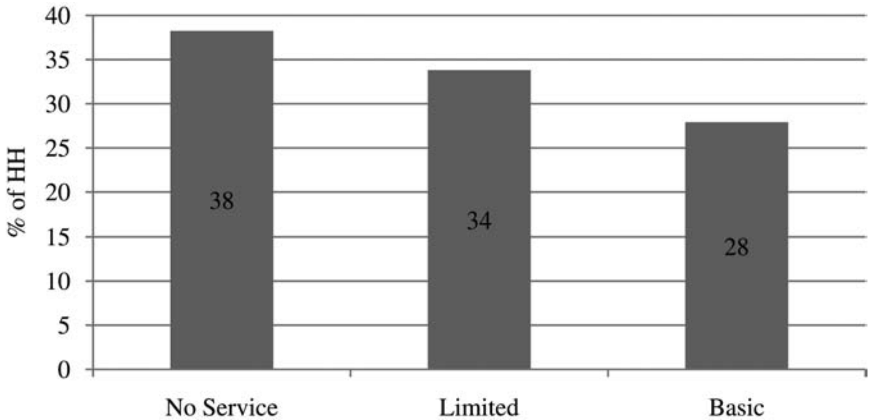
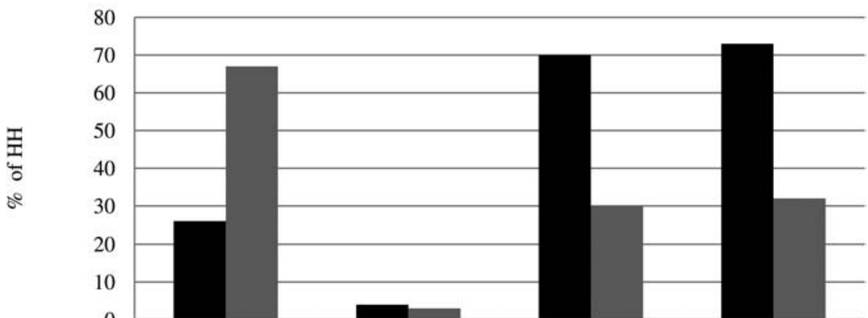


Figure 7.6 Environmental protection service levels in NGP villages (Source: Data collected by WASHCost project (2011))

villages (WASHCost (India) 2010). This finding is also supported by a study conducted by Water Aid in five states (Water Aid 2010).

IV Comparison of Sanitation Access and Use in NGP and Non-NGP Villages

Sanitation status in non-NGP villages is much worse than in NGP villages. Findings reveal that 67 percent of the households in non-NGP villages do not



	No Toilet	Shared Toilet	Individual Sanitary Toilet	Using Toilet
■ NGP	26	4	70	73
■ Non - NGP	67	3	30	32

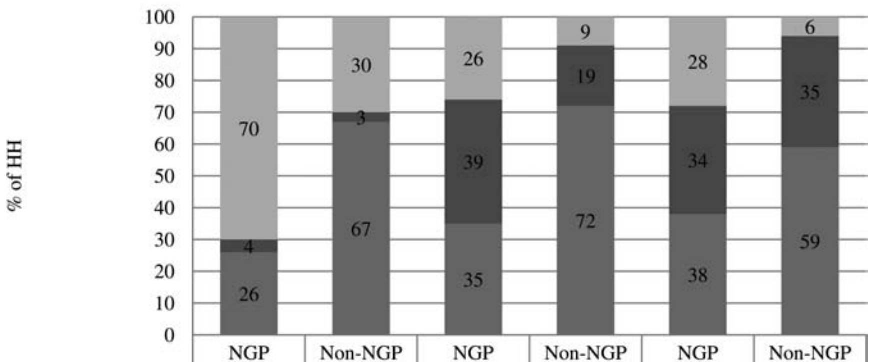
Figure 7.7 Comparison of household access and usage of toilets in NGP and non-NGP villages (Source: Data collected by WASHCost project (2011))

have access to a toilet, and 4 percent of the households are sharing toilets (Figure 7.7). These findings are in line with the latest census data (2011), which reveal that the toilet coverage at the all-India level is about 47 percent. Andhra Pradesh, for instance, has claimed sanitation coverage in the TSC to the extent of 77 per cent, but it had only 35 percent coverage according to the Census 2011. This is similar to our finding where only 30 percent of non-NGP households have access to toilets.

Similarly, the usage of toilets was observed to be better in NGP villages than in non-NGP villages, as 68 percent of non-NGP households are defecating openly, compared to only 27 percent in NGP villages (actually, in NGP villages this percentage should be close to zero). The better performance of some of the best NGP villages is due to continuous and strict monitoring with watch and ward on open defecation, prestige among other panchayats to win the prize, continuous persuasion from the local leaders, and support of a local NGO through continuous awareness and training programmes.

Overall Sanitation Service Levels in NGP and Non-NGP Villages

Sanitation service levels in NGP villages are observed to be better, with 70 percent of the households having a 'basic' service level for access, compared to the 30 percent of the households having 'basic' service level in the non-NGP villages (Figure 7.8). Similarly, the use parameter shows that 72 percent of the households are in the 'no service' category (i.e., defecating openly) in the non-NGP villages, compared to 26 percent in the NGP villages. Further, more



	Access		Use		Environmental Protection	
	NGP	Non-NGP	NGP	Non-NGP	NGP	Non-NGP
Basic	70	30	26	9	28	6
Limited/Sharing	4	3	39	19	34	35
No Service	26	67	35	72	38	59

Figure 7.8 Sanitation service levels in NGP and non-NGP villages (Source: Data collected by WASHCost project (2011))

than 50 percent of the non-NGP villages are on the 'no service' level for environmental protection, indicating that there are no systems for solid and liquid disposal. Better performance in some of the NGP villages does indicate that there were different approaches and systems in place for increased coverage and use, which can be spread to the non-NGP villages. These lessons from the best NGP villages can be used in promotional strategies with intensive IEC programmes.

V Factors Contributing to Better Situation in Selected NGP Villages

When we look at what contributes to the success or failure of the NGP villages, the study clearly brings out that the local leadership, governance, transparency with proper accounts and records, and involvement of all the community groups play important roles in triggering the demand generation and continued monitoring and support from external NGOs/CBOs that seem so crucial for sustained behavioural change. Some of the important factors are discussed below:

Leadership

In four of the NGP villages (i.e., Gangadevipally, Jagannadhapuram, Giddangivaripally and Medipally), where access and usage are above 90 percent, there are committed leaders to lead and campaign for safe sanitation. The continued persuasion and monitoring, assigning of the responsibility for piped water supply distribution to the village level sub-committees, watch and ward on open defecation, tariff collection, and solid and liquid disposal are crucial to achieve the NGP. The strong leadership in such villages has created a positive attitude to the effective functioning of the systems to ensure equitable service delivery across all the community groups. Irrespective of the political benefits, these leaders stood for the cause and helped their villages reach the goal. Many of the non-performing NGP villages did not have such charismatic leaders. If we have to scale up the success principles for replication in non-NGP villages, we need to give priority to identifying villages with such leadership, as it is easy to groom good leaders.

Awareness and Training Programmes

In NGP villages expenditure on training is comparatively higher, and if we convert the time invested by the leaders and members into money, then the unit costs of the NGP villages are higher than what is presently allocated/incurred. Further, the sequence of software and hardware activities, backed up by monitoring and support from time to time, helped in achieving this status. In many poor-performing NGP villages, it was reported that the toilet hardware/material was provided, or toilet provision was mandatory under the government housing scheme (Indiramma Housing Scheme), and therefore the toilet was constructed, although many of the residents do not know how to use the toilets and why. Further, regular face-to-face interactions and household visits made by resource persons/NGO staff to promote toilet access and use were effective; these activities were not reported in the non-performing NGP villages.

Data from the field shows that the households that received training use the toilets, and that sanitation behaviour is sustained among those households. Only six out of the 21 villages have received good IEC activities (Figure 7.9). In these six villages – Gangadevipally, Giddangivaripally, Jagannadhapuram, Maruteru, Medipally and Venkatanagaram – more than 80 percent of the households have received training, and toilet usage is also more than 85 percent. This clearly brings out the direct relationship between effective IEC and behavioural change in sanitation. In the remaining 15 villages the proportion of households that received IEC activities ranged between 10 and 30 percent, and the usage is also low. Except in some urban fringe villages (Godumakunta and Khanapur), where the households are using the toilets under compulsion, the usage levels are generally low.

Though there is a perceived positive impact of IEC activities, they are planned in an *ad hoc* manner, and there is no co-ordination among the different departments promoting them. The NGOs that could play a crucial role in building the capacities were not mainstreamed in this process. Intensive IEC activities with a focus on proper operation and long-term maintenance of toilets would reduce the lack of awareness about things that need to be done – if latrine pits fill up, if a broken pan needs to be changed, etc. In the opinion of various stakeholders, promoting awareness of water and sanitation-related practices in general and at specific times, such as just before the onset of rainy season, would help promote long-term sustainability.

Presence of an Active VWSC/Panchayat

The NGP villages that were performing better had an active VWSC/panchayat with effective governance systems. Regular meetings were conducted on WASH issues, and the response to the problems was quick. Further, the most successful NGP villages have distributed responsibilities (activities) between sub-committees (for e.g., water, solid waste, accounts, etc.) for decentralized responsibilities with effective monitoring. Since most of the households are members of one committee or another, it helps them realize the importance of safe sanitation. The training also helped in convincing the other villagers.

Accounts and Records Maintenance

Another key factor for success is transparent maintenance of the accounts and records. The panchayat/VWSCs were successful in gaining the confidence of

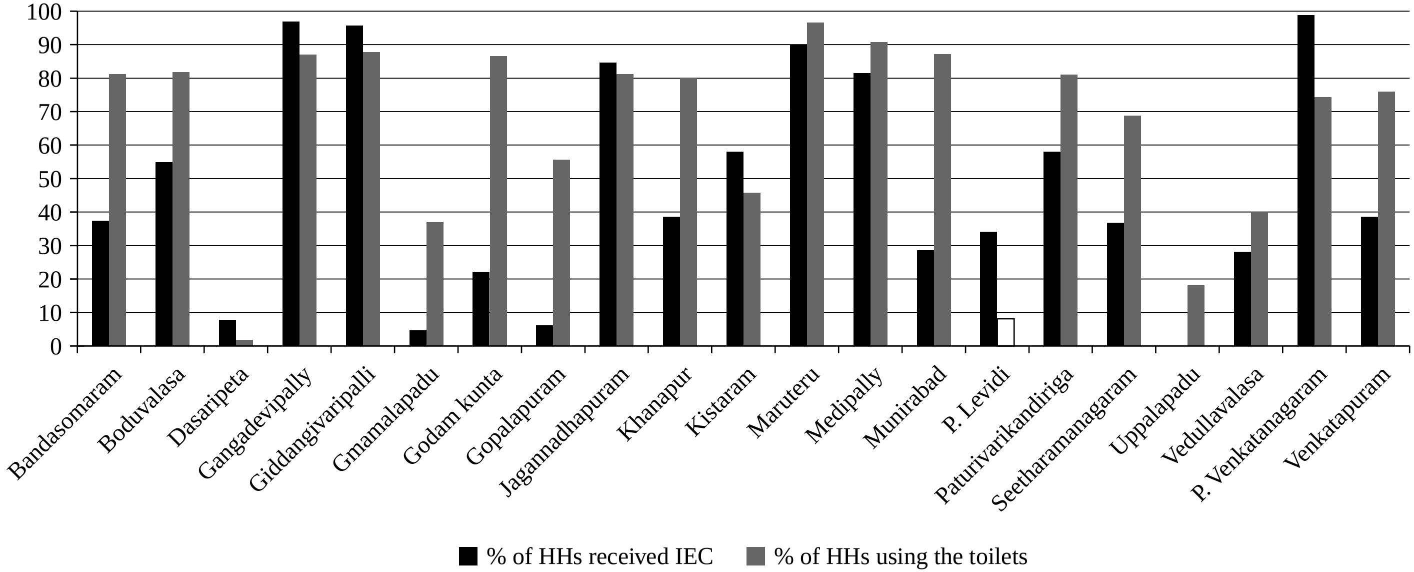


Figure 7.9 Percentage of households that received training and use the toilet (Source: Data collected by WASHCost project (2011))

the households, as each rupee paid by them or received by the government was accounted for and publicly displayed. Further, this practice helped the VWSCs to raise the household contributions during emergencies, as every household is aware of how the money is spent on the purpose it is raised for, to improve service delivery. Most of the non-performing NGP villages did not have any accounts; even the panchayat secretaries could not provide details of the money received under the Twelfth Finance Commission, let alone details of how it is being spent (Table A7.2 in the Appendix).

Participation of Women and the Poor in Decision-making

In most of the successful villages women were involved as volunteers for door-to-door/face-to-face interactions with households for sanitation service delivery. In Jagannadhapuram, the women played a very important role in providing better services to the SC/ST households on a priority basis, addressing the issue of inequity and discrimination. Similarly, in Gangadevipally more time and resources were provided to the poor for reaching the targets, and subsidies were also provided to achieve safe sanitation in their village.

Support from NGOs/CBOs

In all the successful NGP villages the role played by the support organisations or NGOs is phenomenal. The NGOs handheld the communities by building their capacities and helping them organize themselves to take up the responsibilities of WASH. Further, most of these villages had problems of fluoride and scarcity of water, which made them come together to ensure safe drinking water and sanitation. Further, the NGOs helped VWSCs to receive funds from the government and other agencies, and in time this played an important role, apart from the effective monitoring of the process in order to ensure service delivery from time to time.

VI Conclusions and Recommendations

While the status of sanitation is poor in general, the preceding analysis reveals that even in award-winning NGP villages the usage is alarmingly low. Solid and liquid waste disposal systems are just not in place, despite this being the key parameter for qualifying for the NGP award. Though the NGP awards are helping to motivate the villages towards better sanitation, the short-sighted rush to win a cash award does not sustain the behavioural change among the households, leading to slippage. Hence, the criteria for evaluating ODF status must be stringent, and the phased approach for rewards should be mandated. While NGP's evaluation methods are far from perfect, it has tried to introduce innovations such as panchayat peer review in recent years. Partly as a result of improved evaluation, the number of NGP awardees actually fell from 12,227 in 2008 to 4,558 in 2009–10 (Aiyar 2011). Such innovative approaches, along with phased incentives for each component of the NGP criteria, help in avoiding slippage.

Lessons learnt from the best NGP villages indicate that community mobilisation and participation underlie success in taking forward sanitation. To achieve sustainable sanitation, status efforts are needed to build and strengthen the local institutions or VWSCs through decentralising management responsibilities to various sub-committees for effective results. Further, for effective change, long-term behavioural change programmes need to be designed to ensure that each specific age and gender group (adolescent girls, women, schoolchildren, elderly men, adolescent boys) is targeted with specific messages on safe sanitation. Integration of hardware and software components is mandatory with demand-generation activities followed by fund disbursal. Regular monitoring to ensure effective results in sanitation behavioural change at the household, school and community levels is equally important.

Leadership and community management play an important role in addressing the issues of equity and inclusion. Disadvantaged groups require not only monetary support, but also the space to build the toilets. Hence, taking the community requirements into account is essential to ensure better ownership and management. The capacities of the community must be built towards achieving good governance, operation and minor repair management, and systems for cost recovery, etc. The community should take active responsibility in solid and liquid waste disposal systems with involvement in planning and design. Further, household-level mapping of sanitation service levels should be an integral part of the WASH design, along with a social auditing process, as this helps to highlight skewed and inequitable access to toilet facilities and to prioritise service provision to these unserved groups.

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Appendix

Table A7.1 NGP Villages – WASHCost (India) – study

Agro-Climatic Zone	*District*	*Habitation*	*Status awarded in*
Southern Telangana Zone	Ranga Reddy	Godumakunta (NGP)	2008
		Munirabad (NGP)	2007
		Khanapur (NGP)	2009
	Nalgonda	Bandasomaram (NGP)	2008
		Gopalapuram (NGP)	2008
	Mahabubnagar	Kistaram (NGP)	2008
Central Telangana Zone	Warangal	Gangadevipally (NGP)	2007
	Khammam	Medipally (NGP)	2008
		Jagannadhapuram (NGP)	2008
		Venkatapuram (NGP)	2008
Scarce Rainfall Zone	Ananthapur	Uppalapadu (NGP)	2009
Krishna Zone	Guntur	Gamalapadu (NGP)	2008
	Prakasham	Seetharamanagaram (NGP)	2008
Southern Zone	Nellore	Paturivari Kandriga (NGP)	2007
	Kadapa	Giddangivaripally (NGP)	2008
Godavari Zone	East Godavari	Venkatanagaram (NGP)	2008
	West Godavari	Maruteru (NGP)	2008
North Coastal Zone	Visakhapatnam	Boduvalasa (NGP)	2009
	Vizianagaram	V. Dasaripeta (NGP)	2009
	Srikakulam	Vedullavalasa (NGP)	2008
High Altitude Tribal Zone	Vizianagaram	P. Levidi (NGP)	2009

Table A7.2 Scores on some parameters contributing to the success/failure of NGP villages

NGP Village	*Partici-pation*	*Tariff*	*Record maintenance*	*Women in DM*	*VWSC functioning*	*T and A*	*Training*	*IEC*
Bandasomaram	73	75	58	55	0	62	6	48
Boduvalasa	68	37	27	64	12	36	0	49
Gamalapadu	46	16	42	42	21	26	20	50
Gangadevipally	93	86	78	87	60	73	62	88
Giddangivaripally	69	8	37	63	1	24	18	78
Godumakunta	45	66	63	38	8	18	40	26
Gopalapuram	0	26	13	37	0	1	0	15
Jagannadhapuram	70	50	50	60	4	38	52	83
Khanapur	49	0	47	60	0	30	17	48
Kistaram	27	28	26	29	0	16	18	46
Maruteru	61	0	56	79	0	73	58	84
Medipally	89	89	67	83	34	79	46	91
Munirabad	23	55	43	49	0	19	21	82
P. Levidi	15	0	31	32	0	20	0	37
Paturivari Kandriga	34	0	40	43	0	13	0	62
Seetharamanagaram	11	3	2	18	0	5	1	61
Uppalapadu	22	0	3	54	0	3	12	11
V. Dasaripeta	34	0	26	0	0	0	5	32
Vedullavalasa	29	0	33	10	0	3	0	40
Venkatanagaram	43	55	85	70	0	50	0	80
Venkatapuram	52	35	50	67	0	17	56	71
Grand Total	**48**	**30**	**42**	**50**	**7**	**29**	**21**	**57**

8 Cost of Provision and Managing WASH Services in Peri-Urban Areas

G. Alivelu, V. Ratna Reddy, P. Busenna and V. Anitha Raj

I Introduction

Urbanisation in India is on the high growth path, and this is expected to continue due to the sustained high growth of the economy projected for the coming years. Presently, India has the lowest level of urbanisation (percentage of urban population) among comparable countries in the world. By the year 2000 urbanisation in India had reached 27.7 percent, as against 37.5 percent in Asia. India–China differences in urbanisation are likely to widen by 2020: 34.7 percent in India, compared to 53.4 percent in China. Urbanisation in India is projected to reach 40.1 percent by 2030 (www.un.org/population/publications). Compared to the last five decades, the growth of urbanisation will be much faster during the next two decades if India continues to be a services economy (Reddy 2006). However, growth in urbanisation is also shifting from metropolitan cities to secondary towns over the years. Most of the towns in this category have recorded faster growth than larger cities (GoI 2001). It is observed that the bulk of population growth in India is expected to occur in small towns with populations greater than 100,000 (Scott *et al.* 2004).

This fast-paced urbanisation has associated costs, among them increased demand for basic amenities: water, sanitation, power, etc. Strongest is the demand for water for domestic and commercial purposes and sanitation services. The problems associated with water and sanitation are more severe in the peripheral areas of the towns, as these areas are often not part of the initial town planning. These locations are termed 'peri-urban' as they are not directly served by (conventional) urban utilities but are located on the periphery of, or very close to, urban areas; most poor communities are in these locations.

Providing water and sanitation services to the expanding peri-urban locations is a challenge. As they were not taken into account in the design of the urban water systems, they become an additional burden on the existing systems. Furthermore, in the absence of proper investments for upgrading the systems, these areas are provided with scanty services, which are often informal, *ad hoc* and uncertain. Hence, the service levels and the associated costs are expected to be different in these areas. This chapter attempts to assess the unit costs and service levels of water and sanitation in selected peri-urban locations. Specific objectives include:

- Estimating the cost of service provision across peri-urban locations for drinking water and sanitation.
- Estimating the relative expenditure on different cost components in reality against the existing norms.

II Approach

As in the case of rural areas, LCCA is used to assess the costs in the peri-urban locations. Both public and household expenditure are included in the analysis, as households may be investing more in water and sanitation infrastructure, due to the poor service levels. The analysis is carried out using data collected from 18 peri-urban locations spread over nine agro-climatic zones of Andhra Pradesh (Chapter 4). The data is generated at two levels: At Level One, the cost data were obtained from 18 municipalities (two from each zone) from the official records of the Public Health and Engineering Department (PHED); and at Level Two, detailed household-level data on socio-economic aspects – along with information pertaining to drinking water and sanitation – were gathered from 550 households, and general household information from all the households (5,122 in number) in the selected wards of the 11 municipal towns. While the cost data was obtained from the municipal records of the selected towns, service levels were assessed based on the selected location (ward) within the town.

The costs have been divided on the basis of population (per capita), and it is assumed that they are appropriate across all locations. In some of the wards the service levels may not be commensurate with unit costs. Though this looks like overestimation of costs in comparison with the service levels, such assumption is reasonable in most towns. This is because in most towns, the service levels are unevenly distributed across the locations irrespective of their peri-urban nature. In fact, in towns like Vikarabad, even some of the wards in the centre of the town get poor water supplies for various reasons. Further, there may not be hardware investments in all the wards; and due to the absence of hardware (at some place in the town), they may not receive any water. Despite the reality that peri-urban areas are add-ons to the existing water supply investments and service lines, the authorities are expected to increase their investment by adding distribution lines or even overhead tanks to facilitate add-on peri-urban areas. However, in the absence of such investments, the service levels suffer, because the services are not equitably distributed to these colonies/wards.

Profile of Peri-Urban Locations

The sample wards differ in size and socio-economic composition of the households (Table 8.1). In all the peri-urban towns except Vikarabad,

Table 8.1 Profile of the sample peri-urban locations

Zone	*Town*	*Total population (2009)*	*Ward*	*No. of HHs*	*Social composition (SC/BC/OC) (%)*	*Economic composition (L/M/H) (%)*	*% Literacy*
Southern Telangana	Vikarabad	43,862	9	267	20/30/50	90/9/1	59
	Miryalguda	12,1440	17	665	14/63/23	29/57/14	82
	Gadwal	81,000	20	554	3/72/25	39/52/9	87
Central Telangana	Jangaon	54,648	2	408	5/72/23	26/63/11	71
North Telangana	Bodhan	101,200	6	380	33/66/1	31/59/10	64
Scarce Rainfall	Guntakal	134,596	33	462	81/14/5	25/41/33	71
Krishna	Sattennapalli	62,744	20	535	11/49/40	31/52/17	55
Southern	Venkatagiri	48,921	3	430	8/86/34	24/63/13	59
Godavari	Peddapuram	50,600	22	444	1/97/3	76/20/4	58
North Coastal	Bheemunipatnam	49,862	2	376	50/40/10	55/29/16	71
High Altitude	Saluru	54,188	14	601	6/61/17	65/29/6	62

SC= Scheduled Caste BC= Backward Caste OC= Other Caste
L= Low Income M= Middle Income H= High Income.

Source: Based on the information collected from the sample habitations.

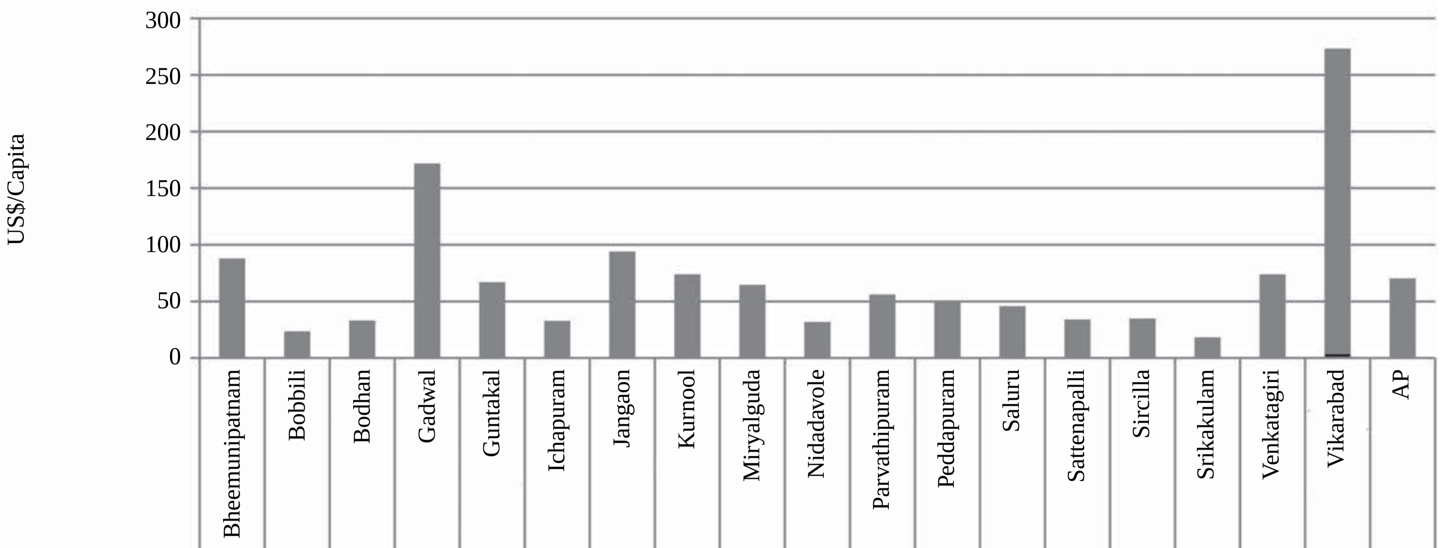
Guntakal and Bheemunipatnam we find that the percentage share of Backward Castes (BCs) is very high compared to the Scheduled Castes (SCs) and Other Castes (OCs). The proportion of the SC population is highest in Bheemunipatnam, while that of the OC population is the highest in Vikarabad. On the other hand, economic composition shows that Vikarabad has the highest share of households in the low-income group, followed by Peddapuram and Bheemunipatnam. In the remaining eight peri-urban towns, the percentage of middle-income households is high, while in Guntakal, we find a slightly higher share (33 percent) of high-income households compared to the other towns (Table 8.1). It was observed that the literacy rate is highest in Gadwal.

III Cost of Provision: Water

Fixed Costs (CapEx)

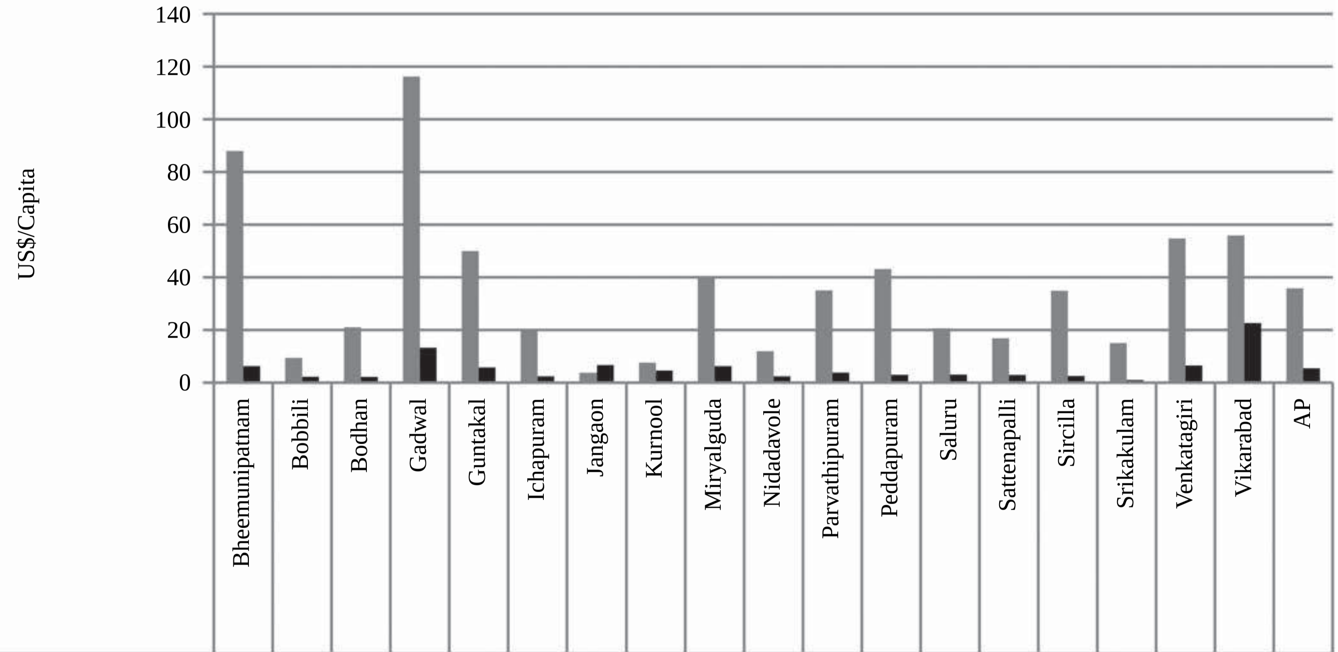
The total fixed costs (CapEx) over the years range between US$ 18 (Rs. 828) per capita in Srikakulam to US$ 94 (Rs. 4,324) per capita in Jangaon (Figure 8.1). Within the capital costs, almost the entire amount is spent on infrastructure, and the expenditure on CapExSft (planning and design) is either absent or negligible in all the sample locations. The planning and design component is visible only in towns with high capital expenditure, such as Vikarabad and Gadwal, but even in these cases, the allocations are hardly 1 percent. At the aggregate level,[1] these costs are US$ 70 (Rs. 3,220) per capita. When these costs are annualised, the unit costs range between US$ 1 (Rs. 46) per capita per year in Srikakulam and US$ 23 (Rs. 1,058) in Vikarabad when normative life of the system is assumed (Figure 8.2). However, in reality, the system's life span is much less than the norms, as reflected in unit costs when the observed life span is taken in to account, i.e., the costs range between US$ 4 (Rs. 184) in Jangaon to US$ 88 (Rs. 4,048) in Bheemunipatnam. At the state level, the annualised costs range between US$ 36 (Rs. 1,656) and US$ 5 (Rs. 230) when observed and normative life spans are used. This indicates clearly that the observed life span of the systems is much less than the normative life span, which forms the basis for allocating the resources. In other words, unit costs in reality are much higher than the norms fixed by the Rural Water Supply and Sanitation (RWSS) department. There are wide variations across the locations, irrespective of the life span, though the variations are slightly higher in the case of the actual life span (Table 8.2).

The high costs in some of the peri-urban areas like Gadwal, Bheemunipatnam, Vikarabad, etc., are due to resource provision costs, as they depend on surface water sources. While Vikarabad has been traditionally supported by a tank, Gadwal depends on the Krishna River water, for which huge infrastructure has been specifically created. In Bheemunipatnam, we observe that the town is dependent on surface water, resulting in huge infrastructure costs. In addition,



	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
CapExHrd	88	23	33	171	67	33	94	74	65	32	56	50	46	34	35	18	74	270	70
CapExSft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 8.1 Cost of provision across peri-urban locations (CapEx per capita in US$) (Source: Computation, based on data from various municipalities)



	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
CapEx-Observed	88	9	21	11	50	20	4	8	40	12	35	43	21	17	35	18	55	56	36
CapEx-Normative	6	2	2	13	6	2	7	5	6	2	4	3	3	3	3	1	7	23	5

Figure 8.2 Actual vs. normative fixed costs across peri-urban locations (Source: Computation, based on data from various municipalities)

Table 8.2 Annualised cost of provision (fixed and recurring) in peri-urban locations (US$ per capita)

	CapEx	*CapManEx*	*CoC*	*ExDS*	*ExIDS*	*OpEx*	*Total*
Bheemunipatnam	88	0.1	0.0	0.2	0.5	3.1	91.8
Bobbili	9	0.0	0.0	0.2	0.5	2.8	12.8
Bodhan	21	0.0	0.0	0.2	0.5	7.2	28.8
Gadwal	116	0.0	7.4	0.2	0.5	16.9	141.2
Guntakal	50	0.0	0.0	0.2	0.5	8.6	59.1
Ichapuram	20	0.0	0.0	0.2	0.5	6.1	27.2
Jangaon	4	0.2	0.0	0.2	0.5	3.0	7.5
Kurnool	8	0.2	0.0	0.2	0.5	3.6	12.0
Miryalguda	40	0.1	0.0	0.2	0.5	2.7	43.2
Nidadavole	12	0.0	0.0	0.2	0.5	3.1	15.8
Parvathipuram	35	0.0	0.0	0.2	0.5	2.2	37.8
Peddapuram	43	0.7	0.0	0.2	0.5	7.2	51.6
Saluru	21	0.1	0.0	0.2	0.5	3.5	24.8
Sattenapalli	17	0.0	0.0	0.2	0.5	2.9	20.4
Sircilla	35	0.0	0.0	0.2	0.5	3.7	39.2
Srikakulam	15	0.0	0.0	0.2	0.5	3.3	18.9
Venkatagiri	55	0.2	0.0	0.2	0.5	4.1	59.7
Vikarabad	56	0.0	4.0	0.2	0.5	7.2	67.7
Average (AP)	36	0	1	0	0	5	42
Median	27.9	0.0	0.0	0.2	0.5	3.5	33.3
Range (min–max)	4–116	0–0.7	0–7.4	0.2–0.2	0.5–0.5	2.2–16.9	7.5–141
CV	82.5	166.8	305.1	0.0	0.0	69.8	79.3

Source: Computation, based on data from various municipalities.

as the old water pipes are not able to take the water pressure, they are replaced with the new ones, resulting in escalation of costs.

Household Costs

Apart from public expenditure, the households also spend on fixed infrastructure in order to improve or complement the service levels. Household expenditure ranges between US$ 3 (Rs. 138) in Gadwal and US$ 37 (Rs. 1,702) in Saluru (Figure 8.3). These costs are substantial, at 25 percent of the public expenditure, and do not seem to be linked to public expenditure. Perhaps it is linked to the service levels or even the economic status of the households; however, despite the poor economic status of the households, they are forced to spend, as these investments are necessary for getting minimum service levels. However, a more detailed analysis is required to arrive at a meaningful conclusion.

Recurrent Costs (CapManEx, OpEx, CoC, ExDS and ExIDS)

Recurring costs include CapManEx, CoC, OpEx, ExDS and ExIDS. Recurring costs are estimated at US$ 6.1 (Rs. 281) per capita per year. Of this, US$ 4.7 (Rs. 216) is spent towards OpEx (Table 8.3). The OpEx costs range between US$ 2.8 (Rs. 129) in Parvathipuram and US$ 23.8 (Rs. 1,095) in Gadwal; and the OpEx ranges between US$ 2.1 (Rs. 97) and US$ 15.7 (Rs. 722) in the same locations (Figure 8.4). Capital maintenance is incurred in seven out of the 18 sample locations; CoC is reported only in Vikarabad and Gadwal towns.

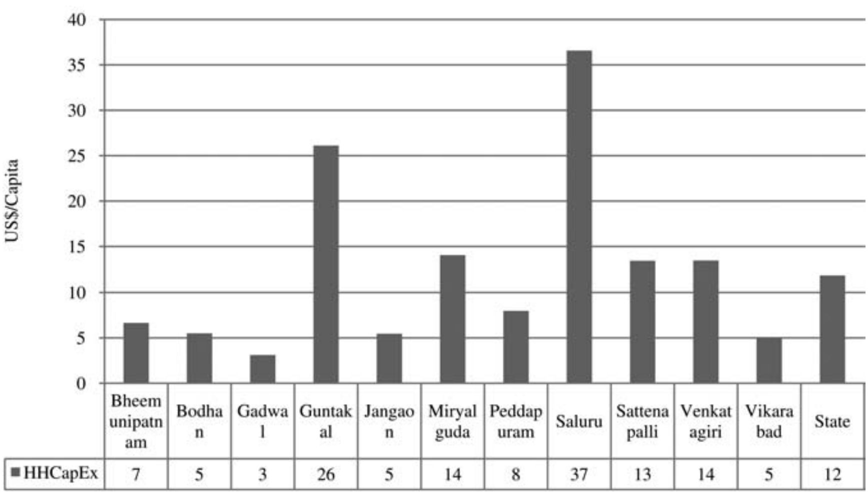


Figure 8.3 Household capital expenditure across peri-urban locations (US$ per capita) (Source: Computation, based on data from various municipalities)

Table 8.3 Measurement and expected signs of the selected variables

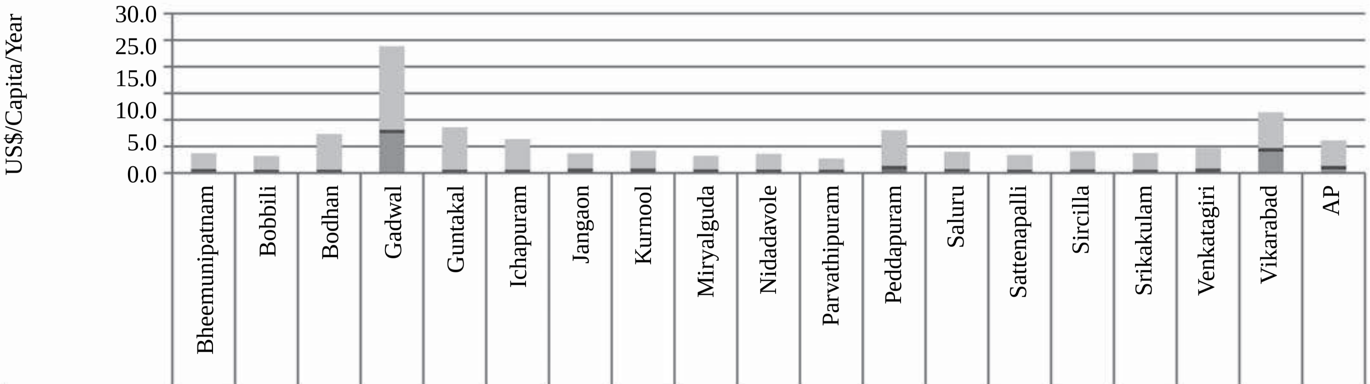
Variable	*Measurement*	*Theoretical/ Expected Impacts*
DWSL	Domestic Water Service Level in lpcd per household	Dependent Variable
Per household income	Income per household per year	Positive
Household expenditure	Capital expenditure on hardware per year per household in actual life span period (INR)	Positive
PHC	Proportion of households having tap connections	Positive
Opportunity cost	Opportunity cost of Time (Rs./ capita/day)	Positive/negative
HHEXP	Household expenditure in INR/year	Positive
TFM	Total number of family members	Negative
Social group	Proportion of SC/ST households	Positive/negative
U_t	Error term	

Among the recurring costs, OpEx takes the lion's share: 80 percent of all recurring costs at the state level. Across the locations, the relative share of OpEx is as high as 93 percent in Guntakal and as low as 59 percent in Vikarabad. Support costs account for about 14 percent of the recurring costs, while capital maintenance accounts for 2 percent (Figure 8.5). The low capital maintenance costs could be due to high OpEx costs. At the same time, the observed life span of the systems is very low. In other words, while major breakdowns are avoided due to high maintenance costs, complete breakdowns are more common and could be due to other reasons not related to regular maintenance. As a result, source failure and the resultant expenditure on CapManEx are negligible in the peri-urban locations. On the other hand, OpEx costs are substantial in peri-urban areas, followed by support costs and CoC. Though the households also incur some expenditure on OpEx, the costs are marginal.

It was observed that the total costs (fixed + recurring) per capita per year range between US$ 7.5 (Rs. 342.9) and US$ 141 (Rs. 6,446.5) for Jangaon and Gadwal respectively, while the state average is US$ 42 (Rs. 1,920.2) (Table 8.2). In relative terms, fixed costs account for 80 percent of the costs at the state level. Of the recurring costs, OpEx accounts for 16 percent, while the remaining costs are negligible (Figure 8.6). Thus, peri-urban locations are characterised by high capital costs as well as maintenance costs. Whether these high costs result in better service levels or not is examined next.

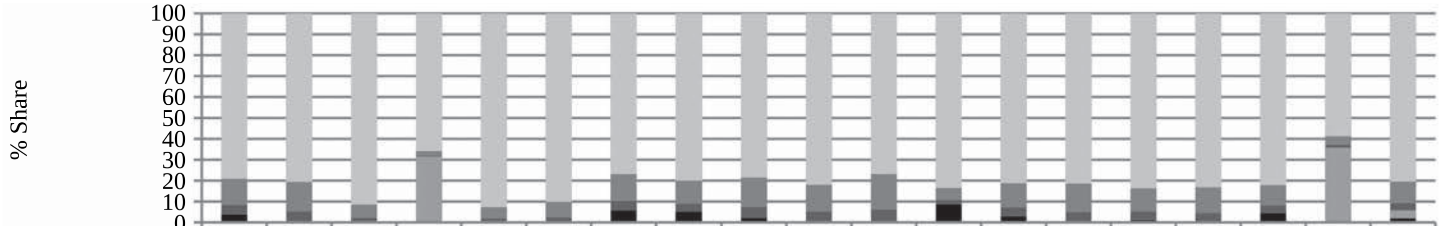
IV Service Levels: Water

Water infrastructure is critical for service delivery. At the household level, having one's own tap provides easy access to water. However, having a house



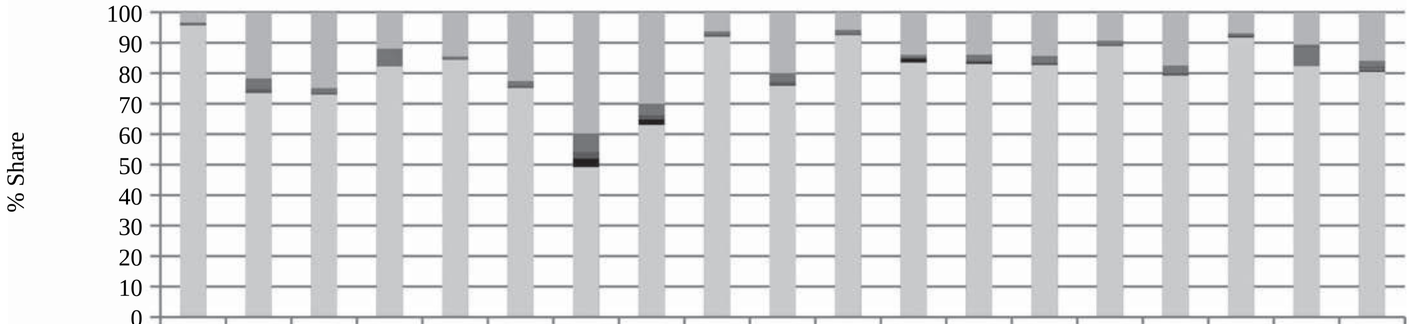
	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
OpEx	2.9	2.6	6.7	15.0	8.0	5.7	2.8	3.3	2.5	2.9	2.1	6.7	3.2	2.7	3.4	3.1	3.8	6.7	4.7
ExIDS	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ExDS	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
CoC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CapManEx	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.2	0.0	0.1

Figure 8.4 Recurring cost of provision in peri-urban areas (US$/capita/year) (Source: Computation, based on data from various municipalities)



	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
OpEx	79	81	91	66	93	90	77	80	79	82	77	84	81	81	84	83	82	59	80
ExIDS	12	14	6	2	5	7	13	0.5	14	13	17	6	12	14	11	12	10	4	10
ExDS	5	5	2	1	2	3	5	0.2	5	5	6	2	4	5	4	4	4	1	4
CoC	0	0	0	31	0	0	0	0.0	0	0	0	0	0	0	0	0	0	35	4
CapManEx	4	0	0	0	0	0	6	0.2	2	1	0	9	3	0	1	0	5	0	2

Figure 8.5 Relative share of recurring costs across peri-urban locations (percentage) (Source: Computation, based on data from various municipalities)



	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
OpEx	3	22	25	12	14	23	40	30	6	20	6	14	14	14	9	17	7	11	16
ExIDS	0.5	3.6	1.6	0.3	0.8	1.7	6.1	3.8	1.1	2.9	1.2	0.9	1.8	2.2	1.2	2.4	0.8	0.7	1.9
ExDS	0.2	1.3	0.6	0.1	0.3	0.6	2.2	1.4	0.4	1.0	0.4	0.3	0.7	0.8	0.4	0.9	0.3	0.2	0.7
CoC	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.6
CapManEx	0.2	0.0	0.0	0.0	0.0	0.0	2.6	1.8	0.2	0.1	0.0	1.4	0.5	0.0	0.1	0.0	0.4	0.1	0.4
CapEx	96	73	73	82	84	75	49	63	92	76	93	83	83	83	89	79	92	82	80

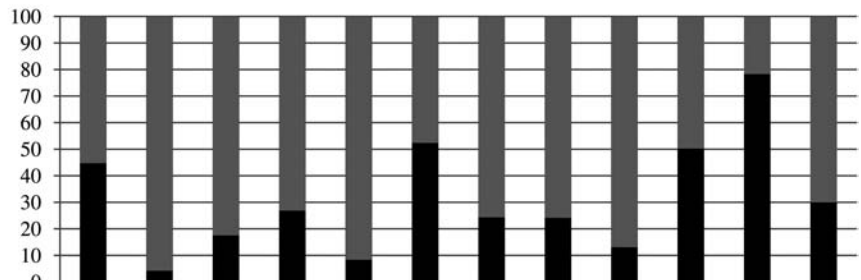
Figure 8.6 Relative share of fixed and recurring costs (percentage) (Source: Computation, based on data from various municipalities)

connection does not ensure good service, as it is an end and not the means of service delivery. Good service depends on other factors, such as quality of infrastructure, source of water, management of the system in terms of reliability and predictability. Besides, buying water is also common in the peri-urban locations, especially in locations where public service delivery is poor. Here we look at some of these aspects of water service delivery and the service levels at the household level.

It was seen that Vikarabad has the highest proportion (78 percent) of households with a tap connection, followed by Miryalguda (52 percent), and Venkatagiri (50 percent); Bodhan has the least percentage (around 4 percent), followed by Jangaon (nearly 8 percent). At the aggregate level it is a dismal picture, as only 30 percent of the households have their own tap connections (Figure 8.7). In the respective wards of Bodhan, Guntakal, Venkatagiri and Bheemunipatnam, a large percentage of household taps are connected to the surface level, while in Peddapuram, Jangaon and Saluru, they are connected to a pit. In some locations like Guntakal and Sattennapalli, house connections are connected to motors (booster pumps) (Figure 8.8) to extract more water from low-pressure systems or to pump water to overhead tanks. Such illegal connections are observed in 29 percent of the sample households in Sattenapalli and 19 percent of the sample households in Guntakal (Figure 8.8). However, such illegal extraction results in poor or no supply to the downstream households, forcing these households to buy water.

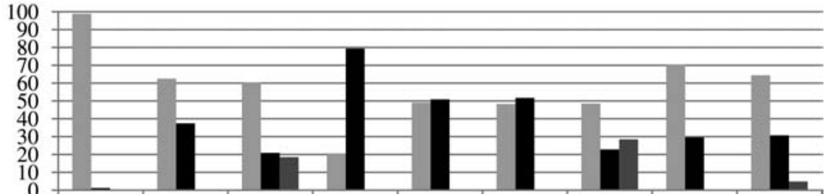
Multiple Sources of Water

Having a house connection does not necessarily mean that it is the only source of water. Households rely on multiple sources for their water requirements. A higher percentage of households depend on household taps as the major source of water in the respective wards of Vikarabad (around 68 percent),



	Bheem unipat nam	Bodha n	Gadwa l	Gunta kal	Jangao n	Miryal guda	Pedda puram	Saluru	Satten apalli	Venkat agiri	Vikara bad	AP
■ No	55	96	82	73	92	48	76	76	87	50	22	70
■ Yes	45	4	18	27	8	52	24	24	13	50	78	30

Figure 8.7 Details of tap connections to sample households (percentage) (Source: Computation, based on the information collected from the sample habitations)

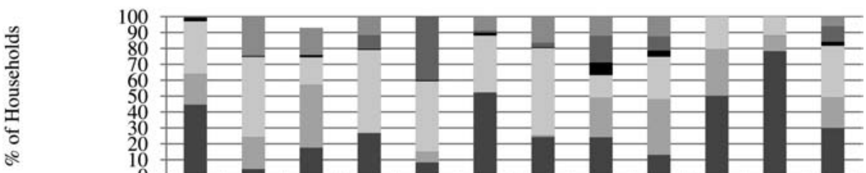


	Bheemunipatnam	Bodhan	Guntakal	Jangaon	Peddapuram	Saluru	Sattenapalli	Venkatagiri	AP
Surface	99	63	60	21	49	48	49	70	64
Pit	1	38	21	79	51	52	23	30	31
Motor	0	0	19	0	0	0	29	0	5

Figure 8.8 Nature of tap connections (percentage of households) (Source: Based on field survey)

Note: Data for Vikarabad, Miryalguda and Gadwal is not included as this specific information was not collected during the field visit.

Miryalguda (48 percent), and Venkatagiri (31 percent). In Bodhan, Guntakal, Peddapuram and Bheemunipatnam, for majority of the households, the source of water is Public Stand Posts (PSPs). Around 40 percent of the households in Ward 20 of Gadwal Town, and 35 percent of the households in Ward 20 of Sattennapalli, depend on Hand Pumps (HPs) for their water needs. Hence, the data clearly shows that in all the 11 towns, major water sources are HPs and PSPs. Only in Jangaon Town do we see that nearly 45 percent of the households buy water, though nearly 44 percent of them have access to PSPs – this indicates poor quality of supply (Figure 8.9).



	Bheemunipatnam	Bodhan	Gadwal	Guntakal	Jangaon	Miryalguda	Peddapuram	Saluru	Sattenapalli	Venkatagiri	Vikarabad	AP
Nearby house	7	26	17	17	1	13	18	21	17	11	1	14
Buying	7	1	0	9	45	1	3	17	9	1	0	10
Open/Bore Well	2	0	1	1	1	2	1	8	4	3	4	3
PSP	33	50	17	52	44	36	55	14	27	25	18	32
HP	19	20	40	0	7	0	1	25	35	29	10	19
HH Tap	45	4	18	27	8	52	24	24	13	50	78	30

Figure 8.9 Source of water (percentage) (Source: Based on field survey)

Water Infrastructure

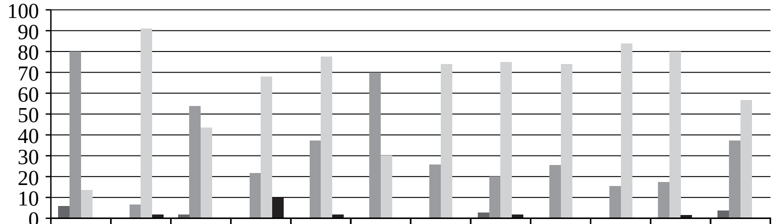
In Vikarabad, Gadwal, Sattenapalli and Bheemunipatnam all the PSPs are in working condition; while in Jangaon only two out of 52, and in Guntakal, one out of 42 PSPs are not in working condition. However, in Saluru, it is observed that about 50 percent of the PSPs are not working. In Miryalguda 12 PSPs are abandoned and four of the 43 PSPs are not working. With regard to HPs, in the respective wards of Gadwal, Venkatagiri and Bheemunipatnam, the majority are in working condition; while in Saluru, Jangaon, Bodhan, Peddapuram, Miryalguda and Sattenapalli, many HPs are not in working condition. This again takes us back to the question of dependence on water sources, especially in Bodhan and Jangaon, where a large number of households depend either on PSPs or HPs. This increased dependency on fewer water infrastructure assets may further reduce the functioning of these assets and the quality of service. As a result, households have to resort to buying water, as the situation in Jangaon shows (Figure 8.9).

Service Levels of Water

The service ladder approach is used to assess the water service levels in terms of quantity, quality, reliability and accessibility. Additionally, households' perceptions of levels of service are elicited and scored – in five categories: no service, sub-standard, basic, intermediate and high – for summer as well as non-summer periods.[2] With regard to water quantity, it is observed that in seven peri-urban towns (Jangaon, Bodhan, Guntakal, Venkatagiri, Peddapuram, Sattenapalli and Saluru) a majority of the households rate the water quantity as 'basic', while in Vikarabad, Miryalguda, Bheemunipatnam and Gadwal the water quantity is rated as 'sub-standard' (Figure 8.10); it is observed that none of the locations have 'high' service levels.

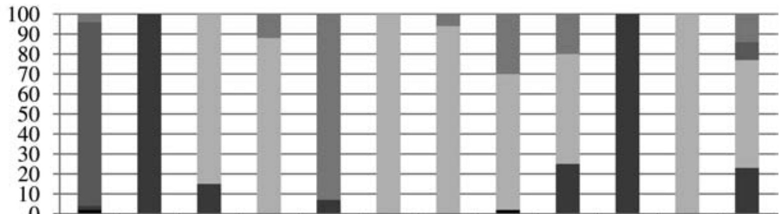
Water quality is scored as 'basic' in seven of the 11 peri-urban locations, while in Bodhan and Venkatagiri it is sub-standard (Figure 8.11). The households' perceptions of accessibility to water score it as either 'no service' or 'sub-standard' in the majority of the wards mentioned in the 11 peri-urban towns. At the aggregate level accessibility to water scored as 'no service' (Figure 8.12). Water reliability is scored as 'basic' by a majority of the households in the respective wards of the 11 municipalities (Figure 8.13).

At the state level, it is observed that during summer, the households perceived the service level as above 'basic' in terms of quality (77 percent) and reliability (83 percent), while 16 percent of them perceived it as above 'basic' in terms of accessibility. In terms of quantity, we do not find any household scoring above 'basic' service level (Figure 8.14). During non-summer, 14 percent of the households perceived service as above 'basic' level in terms of reliability and quality, while 36 percent reported this level in terms of quantity and 11 percent in terms of accessibility (Figure 8.15). When these service levels are compared with unit costs, it is seen that there is no one-to-one correspondence between



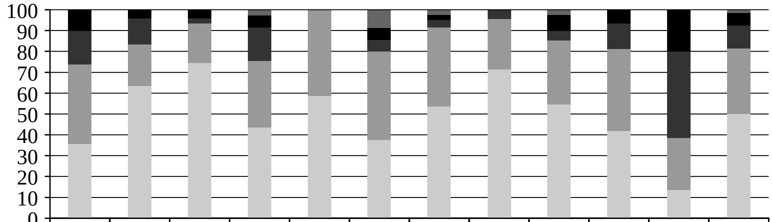
	Bheemunipatnam	Bodhan	Gadwal	Guntakal	Jangaon	Miryalguda	Peddapuram	Sattenapalli	Saluru	Venkatagiri	Vikarabad	AP
No service	6	0	2	0	0	0	0	3	0	0	18	4
Sub-standard	80	7	54	22	20	70	26	20	26	16	80	38
Basic	14	91	44	68	78	30	74	75	74	84	2	57
Intermediate	0	2	0	10	2	0	0	2	0	0	0	0

Figure 8.10 Quantity of water supplied (excluding for livestock) during summer (Source: Based on field survey)



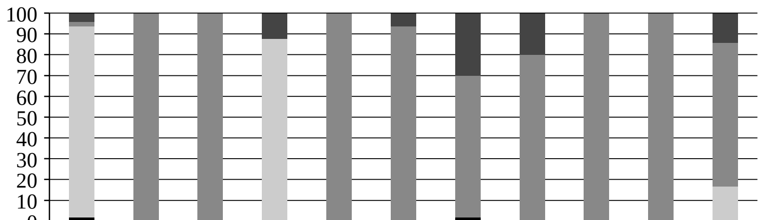
	Bheemunipatnam	Bodhan	Gadwal	Guntakal	Jangaon	Miryalguda	Peddapuram	Saluru	Sattenapalli	Venkatagiri	Vikarabad	AP
BW	4	0	0	12	93	0	6	30	20	0	0	14
Intermediate	92	0	0	0	0	0	0	0	0	0	0	9
Basic	0	0	85	88	0	100	94	68	55	0	100	54
SS	2	100	15	0	7	0	0	0	25	100	0	23
NS	2	0	0	0	0	0	0	2	0	0	0	0

Figure 8.11 Water quality (during summer) (Source: Based on field survey)
NS – No Service
SS – Sub-Standard
BW – Buying Water



	Bheemunipatnam	Bodhan	Gadwal	Guntakal	Jangaon	Miryalguda	Peddapuram	Saluru	Sattenapalli	Venkatagiri	Vikarabad	AP
High	0	0	0	2	0	8	2	0	2	0	0	1
Intermediate	10	4	4	6	0	6	2	0	8	6	20	6
Basic	16	12	2	16	0	6	4	4	4	12	41	11
Sub-standard	38	20	19	32	41	42	38	24	31	40	25	32
No service	36	64	75	44	59	38	54	72	55	42	14	50

Figure 8.12 Water accessibility (during summer) (Source: Based on field survey)



	Bheemunipatnam	Bodhan	Gadwal	Guntakal	Miryalguda	Peddapuram	Saluru	Sattenapalli	Venkatagiri	Vikarabad	AP
Buying water	4	0	0	12	0	6	30	20	0	0	14
Basic	2	100	100	0	100	94	68	80	100	100	69
Sub-standard	92	0	0	88	0	0	0	0	0	0	17
No service	2	0	0	0	0	0	2	0	0	0	0

Figure 8.13 Water reliability (during summer) (Source: Based on field survey)

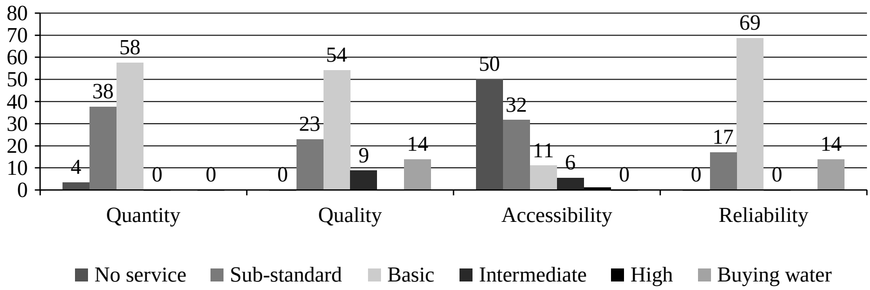


Figure 8.14 Water quantity, quality, accessibility and reliability (during summer) (Source: Based on field survey)

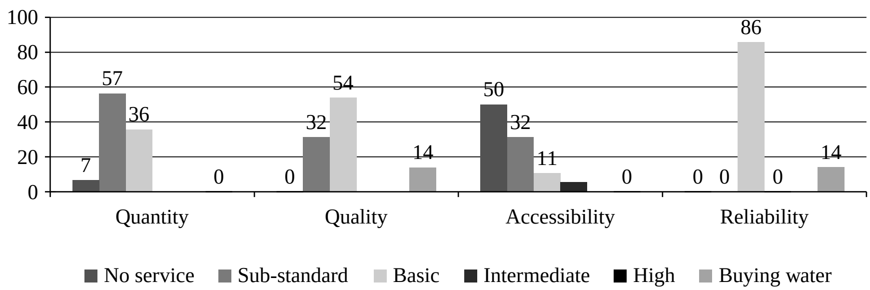


Figure 8.15 Water quantity, quality, accessibility and reliability (during non-summer) (Source: Based on field survey)

them (Figure 8.16). In fact, none of the service level indicators are associated with unit price.

Factors Influencing Water Service Levels

Here we examine the factors determining the variations in water service levels across sample wards in 11 municipal towns. For this purpose multiple regression analysis was adopted, using a number of indicators that influence service levels. The basic specification is as follows:

The independent variables are selected based on the theoretical considerations. These were selected from an exhaustive list of indicators, generated from the household survey, which are primarily used to identify the important variables with the help of a simple correlation matrix. The details of variable measurement and their theoretical/expected impact on the service levels are presented in Table 8.3. Most of the selected variables are expected to have a

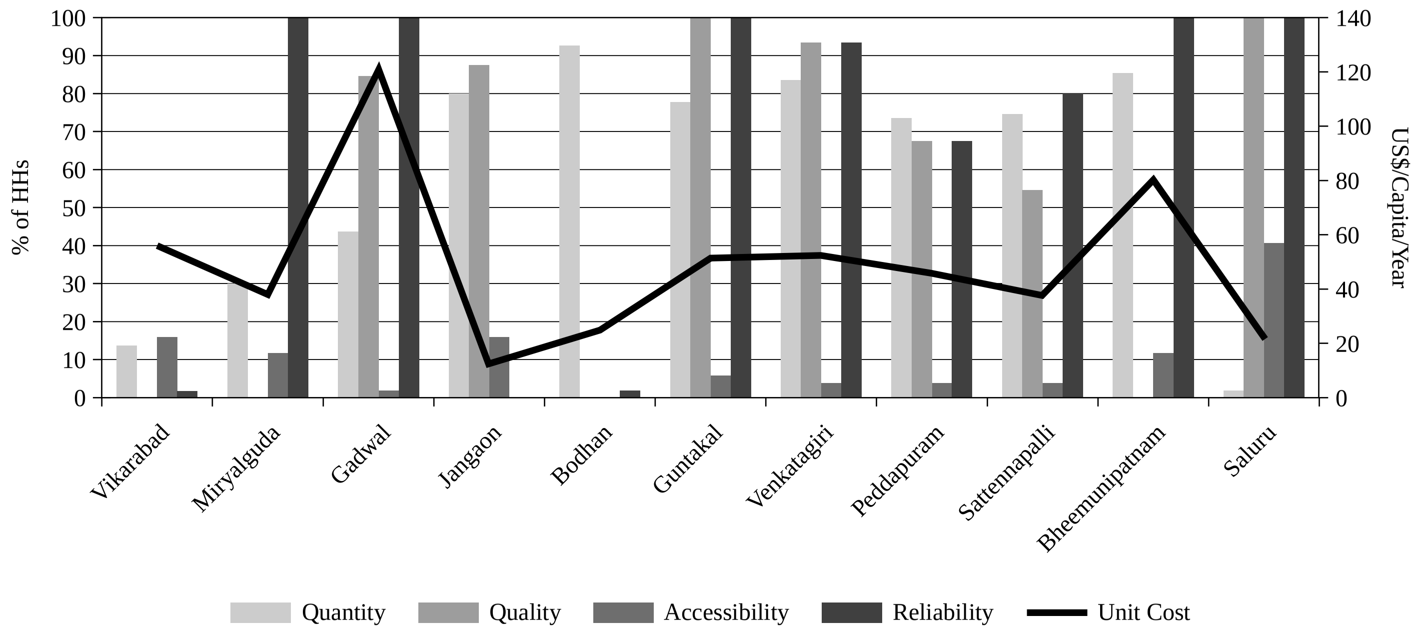


Figure 8.16 Service levels and unit costs across peri-urban locations (Source: Computation, based on secondary and primary data)

positive impact on service levels. The only variable expected to have a negative impact is the size of the family.

Average household expenditure represents the economic status of habitation. It is expected that wards with higher economic status (expenditure/HH) will have better service levels. Social indicators, such as SC/ST households (percentage of SC/ST HHs), may influence service levels negatively, as the socially disadvantaged communities are expected to receive poor services. Opportunity cost may have a positive or negative impact, since we are not sure of the causality between service levels and the time variable. This is because households may have to spend more time fetching water, due to the poor service levels; on the other hand, a household's service level may be higher because it spends more time fetching water. Similarly, higher-income households and wards close to markets are expected to have higher demand for water.

Ordinary Least Squares (OLS) estimates are used to regress the dependent variable (DWSL) against the selected independent variables. Regressions are run on cross-sectional data at the ward level. Data on all the indicators are available for 556 households (n = 556). Various permutations and combinations of independent variables are used to arrive at the best fit. Multi-colinearity between the independent variables is checked using the Variance Inflation Factor (VIF) statistic. Multi-colinearity is not a serious problem as long as the value of 'VIF' is below 2. The best-fit specifications representing summer and non-summer service levels are selected for the purpose of final analysis.

Most of the selected variables have the expected signs (Table 8.4). Important factors that turned out to be significant for both summer and non-summer periods include household expenditure, PHC, opportunity cost, size of family, and social group. Their signs are consistent in both the periods indicating the

Table 8.4 Factors influencing water service levels: Regression estimates of selected specifications

Variable	*Summer*	*VIF*	*Non-Summer*	*VIF*
Constant	6.788* (35.145)	—	7.078* (36.342)	—
Per household income	0.060* (4.069)	1.125	0.075* (4.891)	1.118
Per household expenditure	0.045* (14.034)	1.461	0.046* (13.462)	1.552
PHC	0.177* (5.436)	1.403	0.204* (5.907)	1.438
Opportunity cost	0.145* (8.130)	1.693	0.152* (8.898)	1.827
Size of family	-0.067* (-3.756)	1.232	-0.055* (-2.557)	1.209
Social group	-0.058* (-2.716)	1.095	-0.066* (-29.71)	1.095
R^2	0.511		0.533	
Adjusted R^2	0.506		0.522	

Note: Figures in brackets are 't' values

* and ** indicate significance at 1 and 5 percent level respectively

robustness of the estimators. Of these, per household income, per household expenditure, PHE, and opportunity costs were found to have a positive impact, while social group and size of family were found to have a negative impact. With every one-percent increase in household income, service levels increased by 0.06 percent; likewise, with every percent increase in household expenditure, service levels increased by 0.05 percent. The proportion of households having tap connections had the greatest impact on the service levels compared to the other factors, with a coefficient of 0.18 percent. The positive impact of economic status and house connections could be interlinked, though there is no multi-colinearity between them. Economically well-off wards are likely to have a higher density of house connections, and house connections provide the highest level of service in normal conditions. Households with large family size tend to get relatively poor service levels. On the whole, the analysis brings out clearly that the influence of provision costs on service levels is limited; non-cost factors like house connections, household expenditure, time spent for fetching water, etc., are more important for improving the service levels.

V Cost of Sanitation

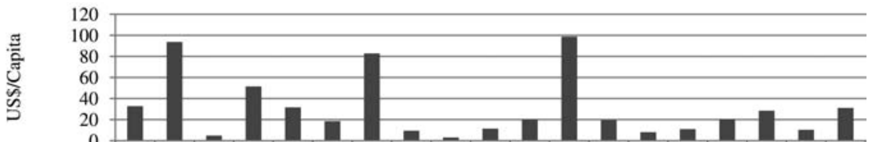
Sanitation and hygiene includes construction of toilets/urinals at the community level, subsidy on individual toilets, provision of drainage facilities (sewer lines, etc.), solid waste management, and insect and disease control. In the peri-urban locations it is seen that 50 percent of the areas do not have proper drainage, while the remaining area has sewer lines (covered as well as uncovered). It is observed that sanitation coverage is not as equitous as drinking water coverage, since poor colonies get neglected in the provision of sanitation facilities. Therefore, sanitation costs may not reflect comparable service levels across locations – some locations are better served than others. More importantly, sanitation at the household level is the responsibility of the household. However, the government is providing subsidy to build individual toilets for households living below the poverty line. The subsidy is worked out on the basis of the unit cost of an ISL, which ranges from US$ 83 (Rs. 4000) to US$ 207 (Rs. 10,000). Public expenditure on sanitation therefore includes the subsidy amount on the ISLs along with other components listed above. It is observed in our sample locations that only 20 percent of the households owning toilets have received subsidy. Households, for their part, spend more than their required contribution, as the amounts fixed for ISL (unit) cost are often less than the market price. In addition, households also spend extra money for improved facilities, like tiles, etc., although such additional investments are made only by economically better-off households. Therefore, expenditure on sanitation is a combination of public and private investments, and so, unlike the case of drinking water, there may not be any service in the absence of household investments in sanitation.

Fixed Costs (CapEx)

The per capita public cost of sanitation in the peri-urban locations is US$ 31 (Rs. 1426) at the state level. The unit costs range between US$ 5 (Rs. 230) in Bodhan and US$ 99 (Rs. 4,554) in Peddapuram (Figure 8.17). There are wide variations across urban locations, which could be due to variations in coverage, apart from other amenities like drainage, underground drainage, etc. For sanitation, annualisation is done using the normative life span only, as the systems are relatively new (less than five years old), and so the observed life span is not relevant. When annualised, these costs range between US$ 0.2 (Rs. 9) in Miryalguda and US$ 6.6 (Rs. 304) in Peddapuram (Figure 8.18). It may be noted that there is no expenditure on planning and design of the systems.

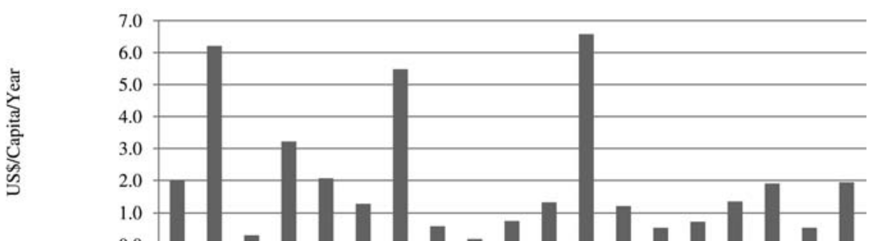
Household Costs

Over and above the public expenditure on sanitation, the households spend substantial amounts: At the state level, the households spend about



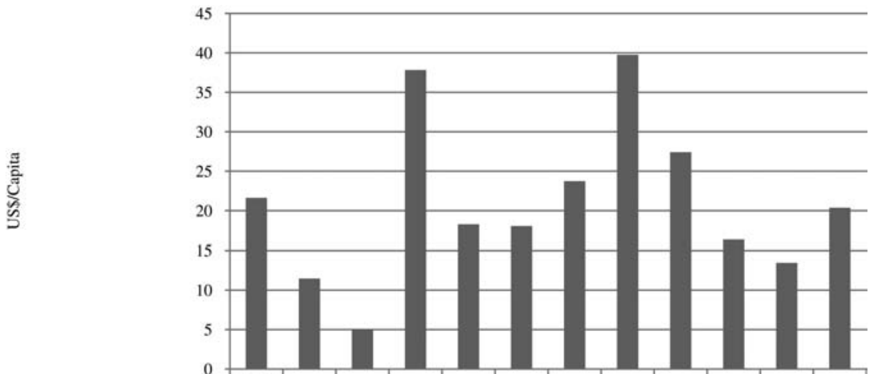
	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
■ CapEx/cap	33	94	5	52	32	19	83	9	3	11	20	99	19	8	11	20	28	10	31

Figure 8.17 Fixed public cost of sanitation peri-urban locations (US$ per capita) (Source: Computation, based on data from various municipalities)



	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
■ CapEx/Cap/Year	2.0	6.2	0.3	3.2	2.1	1.3	5.5	0.6	0.2	0.8	1.3	6.6	1.2	0.5	0.7	1.3	1.9	0.5	1.9

Figure 8.18 Annualised fixed costs across peri-urban locations (Source: Computation, based on data from various municipalities)



	Bheemunipatnam	Bodhan	Gadwal	Guntakal	Jangoan	Miryalaguda	Peddapuram	Saluru	Sattenapalli	Venakatagiri	Vikarabad	State
■ HHCapEx(including subsidy)	22	11	5	38	18	18	24	40	27	16	13	20

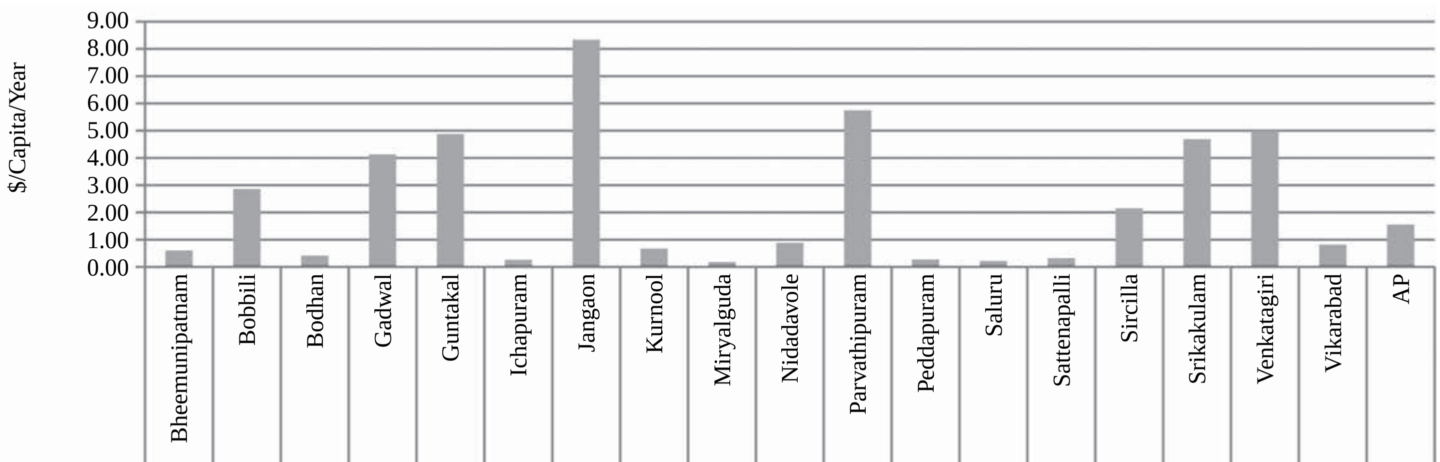
Figure 8.19 Household capital expenditure on sanitation (ISLs) in peri-urban locations (US$/capita) (Source: Computation, based on data from various municipalities)

US$ 20 (Rs. 920) on average. So, together with public expenditure, the capital cost is about US$ 46 (Rs. 2,116) or 43 percent of the capital cost at the aggregate level. Across the locations, household costs range between US$ 5 (Rs. 230) in Gadwal and US$ 40 (Rs. 1,840) in Saluru (Figure 8.19). The share of household capital expenditure ranges between 70 percent in Saluru and 10 percent in Gadwal. In Gadwal, public expenditure is high due to the provision of drainage.

Recurring Costs (CapManEx, OpEx, ExDS and ExIDS)

There is no capital maintenance and CoC allocation, as nothing was spent on these components. Further, direct support costs mostly include the salary component and very little expenditure on IEC, etc., which are more important for sanitation, rather than for drinking water. The major expenditure in the recurring costs is on OpEx, and expenditure on other components is negligible (Figure 8.20). On an average, at the state level, US$ 1.55 (Rs. 71) is spent on recurring costs by the government, of which US$ 1.49 (Rs. 69) is for OpEx. The households spend about US$ 0.7 (Rs. 32) on OpEx, with a range of between US$ 0.1 (Rs. 5) in Gadwal and US$ 1.9 (Rs. 87) in Guntakal (Figure 8.21). On the whole, more than US$ 2 (Rs. 92) is spent on OpEx at the state level. There are wide variations across the peri-urban locations, as the recurring costs range between US$ 8.20 (Rs. 377) in Jangaon and US$ 0.18 (Rs. 8) in Miryalguda (Figure 8.20).

Most of the public expenditure is on infrastructure, and includes subsidies on individual toilets. The relative shares of various components indicate that



	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
OpEx	0.5	2.8	0.3	4.0	4.8	0.2	8.2	0.6	0.1	0.8	5.6	0.2	0.1	0.2	2.0	4.6	4.9	0.7	1.4
ExIDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ExDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure 8.20 Recurring costs of sanitation in peri-urban locations (US$/capita) (Source: Computation, based on data from various municipalities)

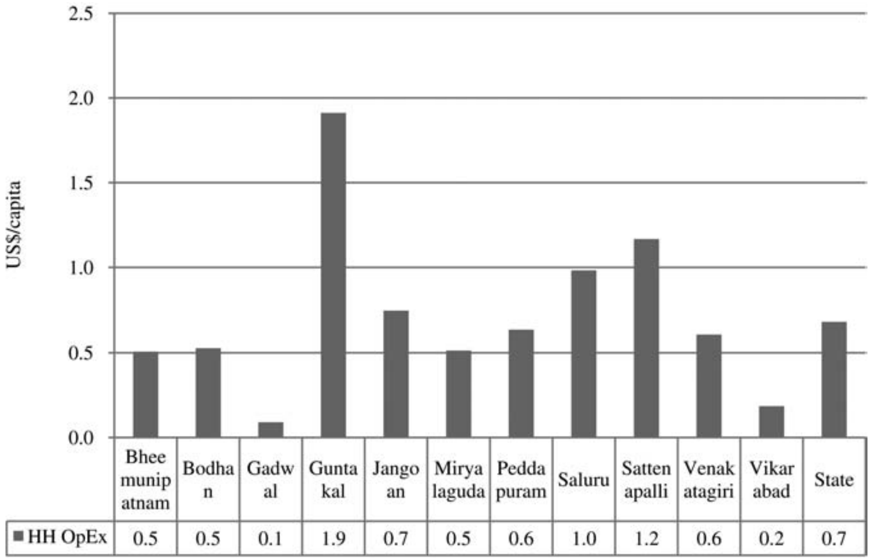


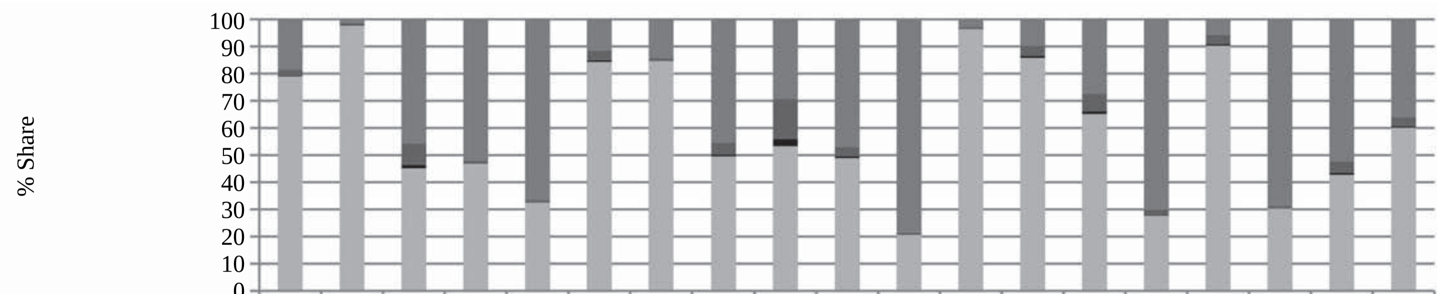
Figure 8.21 Household expenditure on OpEx across peri-urban locations (US$/capita) (Source: Computation, based on data from various municipalities)

CapExHrd accounts for 60 percent of the cost at the state level, while recurrent costs account for 40 percent (Figure 8.22). The share of CapEx ranges between 21 percent in Parvathipuram and 98 percent in Bobbili. These high variations could be due to the coverage status. When household expenditure is included, the relative share may alter, since the share of HHCapEx is about 40 percent in the peri-urban areas.

VI Service Levels: Sanitation

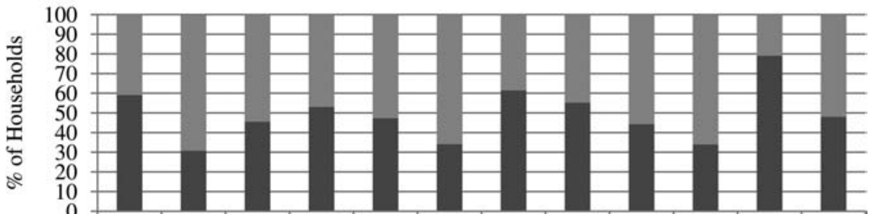
The service levels are assessed using the service ladder approach where household perceptions of four indicators of sanitation – access, use, reliability and environmental protection – are recorded according to four service level categories: no service, limited/sub-standard, basic, and improved. About 50 percent of the households in the peri-urban locations of the state own toilets, though there are wide variations, with a large proportion having either single pit toilets or septic latrines. Vikarabad has the highest proportion of households owning toilets (79 percent), while Bodhan has the lowest (around 31%) (Figure 8.23). The field survey clearly shows that the male members of the households still resort to open defecation.

On average, at the state level, 39 percent of the men and women use toilets in 11 peri-urban towns, while only 21 percent of the children use toilets. The percentage of women using toilets is the highest in Guntakal (46 percent),



	Bheemunipatnam	Bobbili	Bodhan	Gadwal	Guntakal	Ichapuram	Jangaon	Kurnool	Miryalguda	Nidadavole	Parvathipuram	Peddapuram	Saluru	Sattenapalli	Sircilla	Srikakulam	Venkatagiri	Vikarabad	AP
OpEx	19	1	46	52	67	12	14	45	29	47	78	3	10	27	70	6	69	52	36
ExIDS	2	1	8	1	1	3	1	4	15	3	1	1	4	6	2	4	1	4	3
ExDS	0	0	1	0	0	1	0	1	3	1	0	0	1	1	0	1	0	1	1
CoC	79	98	45	47	32	84	85	50	53	49	21	96	86	65	28	90	30	43	60

Figure 8.22 Relative share of fixed and recurring costs across peri-urban locations (in percentage) (Source: Computation, based on data from various municipalities)

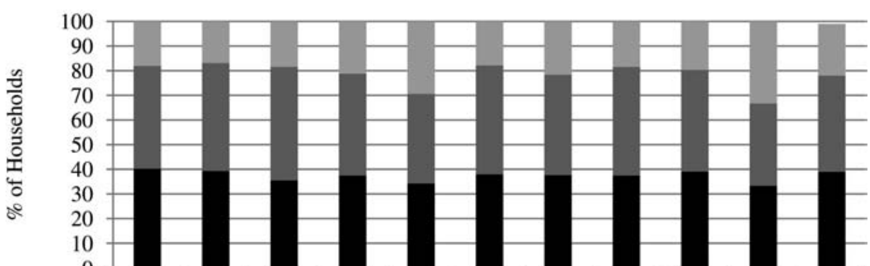


	Bheemunipatnam	Bodhan	Gadwal	Guntakal	Jangaon	Miryalguda	Peddapuram	Sattenapalli	Saluru	Venkatagiri	Vikarabad	AP
No	41	69	55	47	53	66	39	45	56	66	21	52
Yes	59	31	45	53	47	34	61	55	44	34	79	48

Figure 8.23 Households owning a toilet (in percentage) (Source: Based on the information collected from the sample households)

followed by Peddapuram and Sattennapalli (44 percent), while only 21 percent of children use toilets at the state level (Figure 8.24).

The data on open defecation shows that it is the highest in Bodhan (73 percent), followed by Venkatagiri (67 percent) and Miryalguda (64 percent) (Figure 8.25). At the aggregate level open defecation to a large extent takes place in bushes or open places (around 74 percent) and is highest in Bodhan (95 percent), compared to the other peri-urban locations.



	Bheemunipatnam	Bodhan	Guntakal	Jangaon	Miryalguda	Peddapuram	Saluru	Sattenapalli	Venkatagiri	Vikarabad	AP
Children	18	17	18	21	29	18	22	18	20	33	21
Women	42	44	46	41	36	44	41	44	41	33	39
Men	40	39	36	37	34	38	38	37	39	33	39

Figure 8.24 Usage of toilets by men, women and children (Source: Own calculations)

Note: Gadwal data not included, as specific information was not collected during field visit.

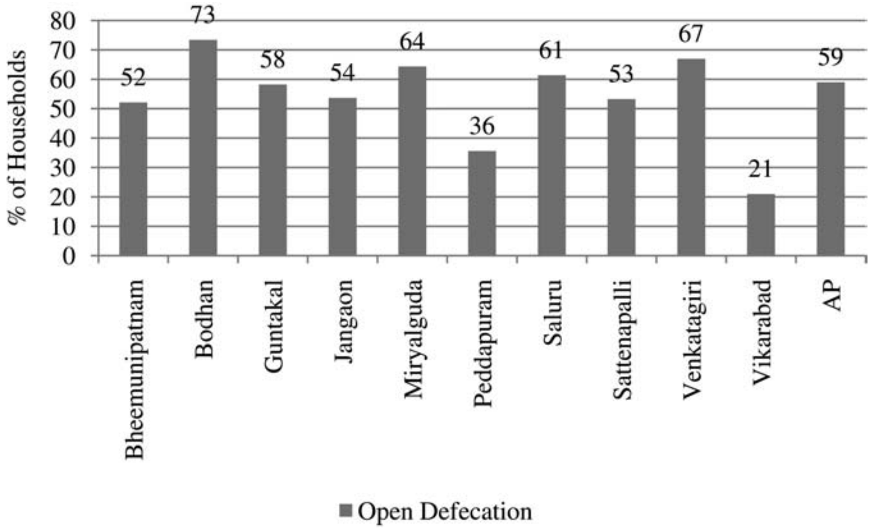


Figure 8.25 Extent of open defecation (percent) (Source: Based on information collected from the sample households)

Note: Gadwal data is not included, as specific information was not collected during the field visit.

Analysis of Sanitation Service Levels

As mentioned earlier, sanitation service levels are assessed on four indicators, and except in the case of accessibility, a majority of the households reported below basic service at the aggregate level (Table 8.5). While Gadwal, Bheemunipatnam and Bodhan scored higher for 'no service' in terms of accessibility to sanitation, the households in towns like Guntakal, Jangaon, Miryalguda, Peddapuram, Saluru and Sattennapally, have a 'basic' score for sanitation services. In terms of sanitation use, Gadwal rates the highest for 'no use', followed by Venkatagiri, while the other towns use toilets in a 'limited' manner. On reliability, almost all the peri-urban towns tilt towards 'no service' or 'sub-standard' service. With regard to overall sanitation service levels, around 55 percent of the households in the 11 peri-urban locations say that there is no service in terms of reliability, while around 72 percent say there is limited service in terms of environmental protection. Around 57 percent of the households score accessibility to sanitation service as 'basic' (Figure 8.26).

On the sanitation service ladder, at the aggregate level, all the indicators except access showed limited or no service; only the access indicator scored basic service level (Figure 8.26). When service levels are plotted against the unit cost, there appears to be no association between the two (Figure 8.27), especially in the case of use. Further, reliability is very low. The higher level of environmental protection could be due to reasons other than unit costs.

Table 8.5 Sanitation service ladder across peri-urban locations

Ward	*Accessibility*			*Use*			*Reliability*			*Environmental protection*	
	No service	*Limited*	*Basic*	*No service*	*Limited*	*Basic*	*No service*	*Sub-standard*	*Basic*	*No Service*	*Limited*
Bheemunipatnam	42	6	52	42	50	8	72	24	4	0	100
Bodhan	64	4	32	64	30	6	68	30	2	0	100
Gadwal	71	4	25	94	2	4	90	10	0	0	100
Guntakal	16	0	84	16	68	16	16	40	44	100	0
Jangaon	25	9	66	32	48	20	39	55	7	0	100
Miryalguda	16	20	64	22	60	18	40	60	0	0	100
Peddapuram	28	14	58	28	56	16	76	8	16	0	100
Saluru	38	4	58	40	40	20	46	48	6	0	100
Sattenapalli	31	2	67	33	43	24	41	53	6	0	100
Venakatagiri	48	12	40	56	38	6	64	34	2	100	0
Vikarabad	20	2	80	24	14	63	57	43	0	100	0
Andhra Pradesh	36	7	57	41	41	18	55	37	8	27	73

Source: Based on the information collected from the sample households.

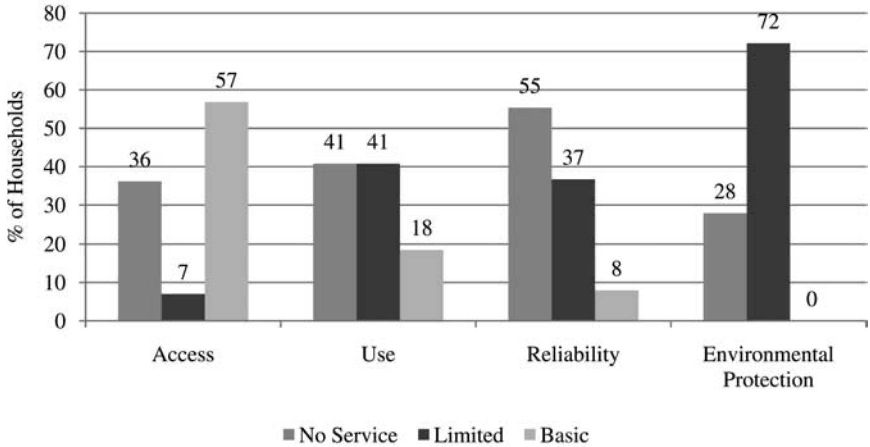


Figure 8.26 Sanitation service levels in peri-urban locations of Andhra Pradesh (Source: Based on information collected from the sample households)

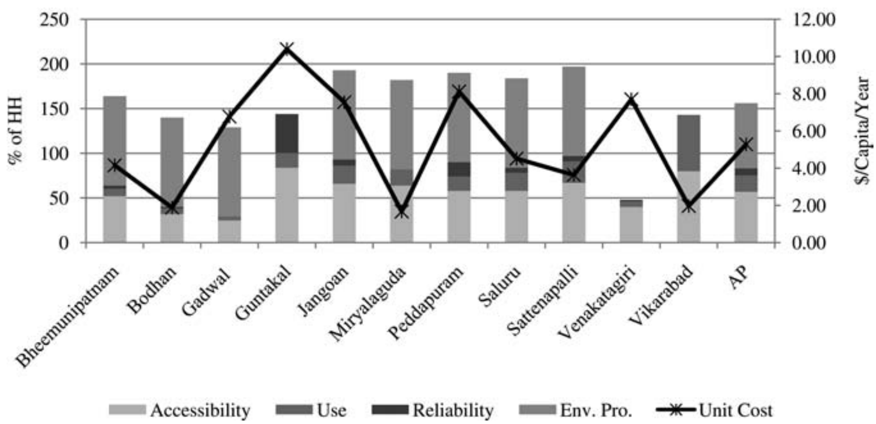


Figure 8.27 Service levels and unit costs across peri-urban locations (<basic) (Source: Based on information collected from the sample households)

Factors Influencing Sanitation Service Levels

As there is no clear relationship between service levels and sanitation costs, we attempt here to examine the factors that determine the variations in service levels across sample wards. We have adopted multiple regression analysis, using a number of indicators that influence service levels. The basic specification is as follows:

Ordinary Least Squares (OLS) estimates are used to regress the dependent variable (SSL) against the selected independent variables. Regressions are run

Table 8.6 Measurement and expected signs of variables

Variable	*Measurement*	*Theoretical/expected impacts*
SSL	% of households using ISL	Dependent variable
Size	Size of the household	Positive
PHC	% of HHs having tap connection	Positive
Usage of soap	Per capita usage (yes/no)	Positive
EIEC	Effectiveness of IEC activities (QIS scoring – high scoring indicates better conditions)	Positive
Toilet cleaning	Materials used for cleaning toilet	Positive
HHEXP	Average HH expenditure (Rs./year)	Positive
Y	Household income	Positive
O&M	O&M on sanitation per household	Positive/negative?
U_t	Error term	

on cross-sectional data at the habitation level. Multi-colinearity between the independent variables is checked using the Variance Inflation Factor (VIF) statistic. Multi-colinearity is not a serious problem as long as the value of 'VIF' is below 2.

All the variables have expected signs; however, when we look at the coefficients of usage of soap and toilet cleaning, the signs are negative instead of positive. However, since the *t* value is insignificant, not much importance can be attached to the sign. But the per capita O&M has a negative sign, indicating that along with HH O&M, the O&M expenditure should happen

Table 8.7 Factors influencing sanitation service levels: Regression estimates of selected specifications

Variable	*Usage*	*VIF*
Constant	0.151** (1.056)	—
Size	0.008 (0.420)	1.170
Per household income	0.011 (0.755)	1.213
Per household expenditure	0.009* (2.664)	1.973
PHC	0.069 (2.401)	1.294
EIEC	0.298* (6.364)	1.431
Usage of soap	–0.004 (1.034)	1.250
Toilet cleaning	–0.005 (0.589)	1.075
Per household O&M	–0.081* (-29.689)	1.236
R^2	0.682	
Adjusted R^2	0.678	

Source: Based on the information collected from the sample households.

Note: Figures in brackets are 't' values
*, ** and *** indicate significance at 1, 5 and 10 percent level respectively

at the macro level in the form of repairs of drainage, environmental hygiene, etc. Mere household O&M expenditure on sanitation will not lead to usage of toilets. Important factors that turned out to be significant include EIEC and per household expenditure (PHE). Of these, EIEC has the maximum impact compared to the other two, with a coefficient of 0.3 percent. This implies that, with every one percent increase in EIEC, the sanitation service levels increase by 0.3 percent. EIEC has a positive impact, indicating the importance of creating awareness across the households that would lead to improvement in the sanitation service levels.

VII Summary and Conclusions

In the case of peri-urban water, the total fixed costs over the years range between US$ 18 (Rs. 828) per capita in Srikakulam and US$ 94 (Rs. 4324) per capita in Jangaon. Within the capital costs, almost the entire amount is spent on infrastructure, and the expenditure on CapExSft is either absent or negligible in all the sample locations. Household expenditures are substantial, at 25 percent of the public expenditure. At the aggregate level, fixed costs account for 80 percent of the costs. Of the recurring costs, OpEx accounts for 16 percent, while the remaining costs are negligible.

At the state level, during summer, the households scored above basic services in terms of quality (77 percent) and reliability (83 percent), while 16 percent of the households scored above basic services in terms of accessibility. We do not find any household which scored above basic service levels for quantity. During non-summer, 14 percent of the households scored above basic in terms of reliability and quality, while 36 percent of the households reported basic service in terms of quantity and 11 percent in terms of accessibility.

Cost drivers of water show that with one percentage increase in household income and household expenditure, the service levels increase by 0.06 percent and 0.05 percent respectively. The proportion of households having tap connection has the greatest impact on the service levels, when compared to the other factors, with a coefficient of 0.18 percent. The per capita public cost of sanitation in the peri-urban locations is US$ 31 (Rs. 1,426) at the state level. The unit costs range between US$ 5 (Rs. 230) in Bodhan and US$ 99 (Rs. 4,554) in Peddapuram. There are wide variations across urban locations, which could be due to variations in coverage of sanitation, apart from other amenities like drainage, underground drainage, etc. At the aggregate level, households spend about US$ 20 (Rs. 920) on an average. The share of household capital expenditure ranges between 70 percent in Saluru and 10 percent in Gadwal; the major expenditure in the recurring costs is on O&M, while the other components are negligible. On average, at the state level, US$ 1.55 (Rs. 71) is spent on recurring costs by the government; of this US$ 1.49 (Rs. 69) is spent on O&M. The households spent about US$ 0.7 (Rs. 32) on OpEx at the state level, ranging between US$ 0.1 (Rs.5) in Gadwal and

US$ 1.9 (Rs.87) in Guntakal. On the whole, more than US$ 2 (Rs. 92) is spent on OpEx at the state level.

Vikarabad has the highest proportion of households owning toilets (79 percent), while Bodhan has the lowest (around 31 percent). The field survey clearly shows that male members of the households still resort to open defecation. On an average, at the aggregate level, 39 percent of men and women use toilets, while only 21 per cent of children use toilets. Data on open defecation shows that it is the highest in Bodhan (73 percent), followed by Venkatagiri (67 percent) and Miryalguda (64 percent). On the sanitation service ladder, at the aggregate level, for all the indicators except access, which is scored as basic, we observe limited or no service with respect to use, reliability, and environmental protection. Important factors that turned out to be significant for sanitation service levels include EIEC and PHE. Of these, EIEC has the maximum impact compared to the other two, with a coefficient of 0.3 percent.

Important key messages that arise from the above analysis are:

- Expenditure on O&M in the peri-urban water sector is quite substantial, and it may check major system failures. Distribution of water across locations could be ensured by making allocations towards planning and design of the systems.
- Allocations towards capital management, along with proper design and governance of the systems could help reduce the gap between normative and observed life spans of the infrastructure.
- *Ad hoc* investments or allocations towards extension and upgrading of the water assets should be avoided. Adaptation of LCCA could help to minimise *ad hoc* and wasteful expenditure on infrastructure and would also facilitate judicious allocation of resources to different components.
- Improving literacy and education levels would not only help to reduce the unit costs and improve service levels of drinking water but would also augment competence in other related sectors, like hygiene, health, education, etc.
- With regard to sanitation, a major concern is the use of ISL at household level. Proper propaganda/IEC activities would contribute to better environmental practices by households.
- Existing governance structures appear to be inadequate to exert any influence on unit costs; but they seem to have a positive impact on service levels. Improving the performance and efficacy of the governance indicators, such as water and sanitation committees, could be a feasible policy alternative in this context.

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9 Skewed and Inequitable Access to Rural Water Supply and Sanitation Services

M. Snehalatha and James Batchelor

I. Introduction

According to UNICEF's Joint Monitoring Programme (JMP), 88 percent of India's population of 1.2 billion had access to drinking water from improved sources in 2008, as compared to 72 percent in 1990 (WHO/UNICEF 2010). An improved source is defined by UNICEF as one that, by the nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter. However, these JMP figures do not tell the whole story. These figures ignore or mask inequitable access to water supply services within villages. Also the percentage of India's population that has reliable access to adequate drinking water of adequate quality is less than this 88 percent, in part because of the phenomenon of slippage (Pearce 2012). Slippage means that WASH services slip back from a higher to a lower level over a period of time.

While some of the earlier chapters above (Chapters 5 and 6) have highlighted inter-village variations in WASH services, this chapter looks into intra-village variations (between households). Inadequate WASH service (or no service at all) is both a cause and a symptom of poverty. It is a cause of poverty because it leads to high incidence of sickness, inability to work, expenditure on medicines, time and effort wasted collecting water, or high expenditure on buying water, persecution and loss of dignity of women defecating in the open, etc. Similarly, it is a symptom of poverty because SCs/STs suffer from social exclusion from water points, and because the poor – and particularly poorest of the poor and women – lack the power to influence water-related decision-making, are invisible during planning processes, lack money to purchase water or complement the Government investments, have no means of countering the dominance of elites, etc. The National Rural Drinking Water Programme (NRDWP) framework for action (GoI 2010) and the Total Sanitation Campaign (TSC), now revised as NBA (Nirmal Bharat Abhiyan) guidelines (GoI 2012), puts emphasis on reaching the poor and ultra-poor, with a paradigm shift from just engineering services to delivering water services to users and moving from infrastructure-focused development to ensuring source sustainability. However, the implementation has yet to make an impact on the ground, and many poor and needy groups are still unable to access basic water and sanitation facilities. This chapter focuses on the distribution aspects of WASH services at the household level across locations and socio-economic groups.

II Approach

Equity in WASH sector, in the present context, is assessed from socio-economic and spatial (location) variations in service delivery. Equity is assessed in terms of access, type and nature of WASH services across socio-economic communities in the sample villages. The findings are fostered and illustrated with the help of a study. Households often depend on multiple sources of water, some of which are protected and more convenient than others. Distribution of households in terms of their access to different sources brings out the equity in terms of access to protected water.

Economic equity is assessed using the proxy indicators of poverty. Based on the government of India categorisation of per capita annual income, the households are grouped as Below Poverty Line (BPL) families (< Rs. 20,000 or US$ 437) and Above Poverty Line (APL) families (> Rs. 20,000 or US$ 437). However, this criterion is less than reliable, due to reporting biases concerning the household income. We have used a land-based criterion as a better proxy for poverty in the rural areas. Using this, the households are divided into four categories: landless (zero land), small and marginal (less than 5 acres), medium (between 5 and 10 acres) and large (over 10 acres) farmers. While the landless are considered as the poorest, the large farmers are the richest. Though both the indicators (income and land) are consistent, the land criterion is retained for the purpose of final analysis, because our focus is on rural areas. Social equity is assessed using social categorisation based on caste. The various categories of caste are already defined at the national level, and those definitions are followed here, i.e., Schedule Tribes (STs), Scheduled Castes (SCs), Backward Communities (BCs), and other Castes (OCs).[1]

Using these poverty and social indicators, the households were accurately mapped into the Geographic Information Systems (GIS) indicating their access to WASH infrastructure and services. The habitation level base maps were prepared using the Google maps for initial identification of roads, buildings, train tracks, etc. These maps were then printed and taken to the field for validation and additional features, such as the name of the households, WASH infrastructure, functional and non-functional Public Stand Posts (PSPs), drainage lines, pipe network systems, etc. This information was mapped in consultation with the households and cross-verified in the village. A unique GIS ID code was given to each household, to link the data to the map in order to demonstrate the distribution of households and the service received. Further, the service delivery data was linked to the households to demonstrate variations/inequities, if any, in infrastructure owned, services received, and infrastructure created in localities where poor households reside.

The analysis is based on the data collected from 187 villages selected through stratified random sampling across the nine agro-climatic zones in Andhra

Pradesh (see Chapter 3 for details). From these villages a total of 34,976 households were listed in order to assess the WASH assets, while about 5,232 households were interviewed for in-depth understanding of service delivery issues. In 20 sample villages the households were mapped using the GIS. One of these villages is the focus of the case study presented later. Qualitative methods such as Focus Group Discussions (FGDs) and personal interviews with households, communities and department staff have been used to validate and verify the quantitative data collected using questionnaires at the village and household level. The WASH infrastructure varied from village to village and included Hand Pumps, Direct Pumping systems (DPS)/ Mini Piped Water Supplies (MPWS), Single-Village Schemes (SVS), Multi-Village Schemes (MVS), MPWS + SVS, MPWS + MVS, SVS + MVS and MPWS + SVS + MVS.

III Distribution of Services

The income status of the households across social and farm size (land-holding) categories indicates that the highest proportion of households below the poverty line are landless, and the smallest proportion are large farmers (Figure 9.1). The general perception is that social categorisation is linked to income: i.e., the SC and ST households are expected to be the poorest of the social groups. In our sample households, while poverty (proportion of households falling below the poverty line) is observed to be high among the ST households, the same is not true with SC households. A lower proportion of households is observed to be poor among SCs when compared to the OCs and BCs (Figure 9.1). Though this does not reflect the income distribution across social groups, it raises doubts about the official poverty classification.

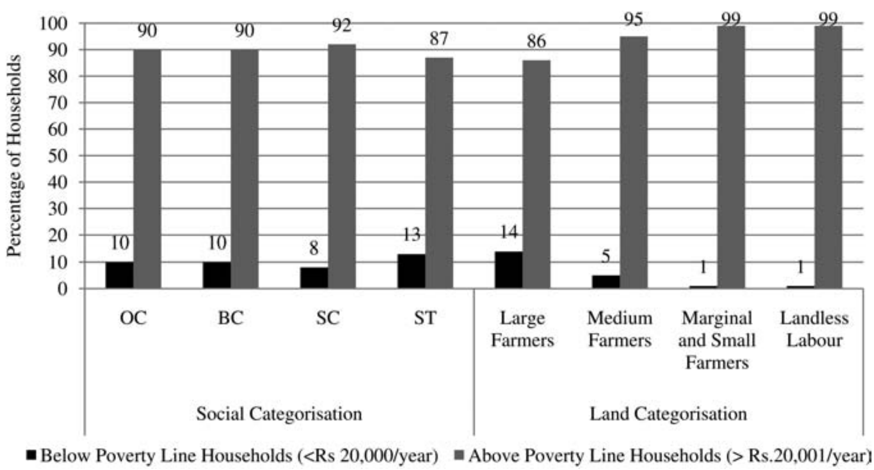


Figure 9.1 Distribution of households in terms of poverty line (Source: WASH Cost data)

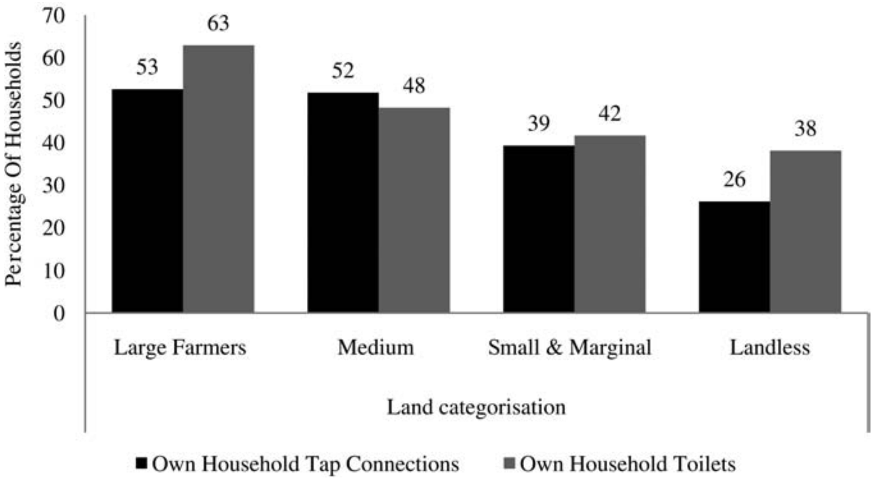


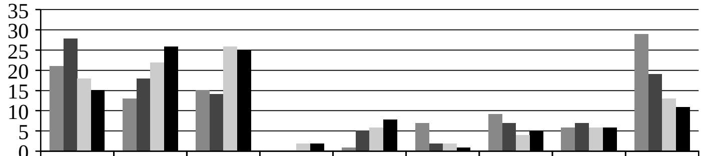
Figure 9.2 WASH assets owned by economic categories (Source: WASHCost data)

In the present analysis we use the social categorisation to assess the social inclusiveness of WASH services and farm (land-holding) size to assess the economic inclusiveness of WASH service delivery.

Distribution across Economic Groups

The distribution of WASH services across the economic groups indicates that 53 percent of the large-farm-size households have their own household connections, compared with only 26 percent of the landless and 39 percent of the small and marginal farmers (Figure 9.2). Similarly, it is observed that 63 percent of the large farmers own their own toilets, as against 38 percent of the landless and 42 percent of the small and marginal farmers. This clearly reveals that the large farmers have better access to WASH infrastructure facilities due to their income and awareness levels, and there is a substantial gap between the rich and poor in terms of access to infrastructure.

The households use multiple sources. Of all the sources, household connections are the safest in terms of external contamination and the most convenient, followed by the PSPs. Bottled water is also becoming common in the rural areas due to the poor quality of the supplied water. It is observed that of large-farmer households the highest proportion (29 percent) depend on bottled water, with those having household connections for drinking purposes as the next highest (Figure 9.3). On the other hand, a large proportion of landless and small and marginal farmer households depend on Hand Pumps (HPs) and PSPs. As a result, these households end up spending time and effort in fetching water. On the other hand, the rich (large-farmer households) spend more money on buying water. It is observed that more than 10 percent of the



	HHs connection	PSP	HP	Open well	Community well	Bore well and agricultural wells	Canals/streams/ tanks	Others (neighbor's house)	Buying water
■ Large	21	13	15	0	1	7	9	6	29
■ Medium	28	18	14	0	5	2	7	7	19
■ Small and Marginal	18	22	26	2	6	2	4	6	13
■ Landless	15	26	25	2	8	1	5	6	11

Figure 9.3 Drinking water supply systems used by different economic categories (Source: WASHCost data)

landless and small and marginal farmer households are also buying water, due to water quality problems, despite their poor economic status. A considerable proportion of large farmers have their own household tap connections, and they take advantage of the piped water supply by installing booster pumps, use large diameter pipes and construct big overhead storage tanks within the house to abstract more water from the public water-supply system. As a result, the tail-end users often do not receive the water, or receive low pressures.

The WASH services received across economic groups are analysed using the WASHCost service delivery parameters (see Chapter 3 for details). The sanitation service levels received across economic groups indicate that 63 percent of large-farmer households are in the basic service category, as against 34 percent of the landless and 39 percent of the small and marginal farmer households (Figure 9.4). This indicates that the task ahead for the government is more challenging to reach these 60 percent plus of all households that do not own a toilet within their house or compound. The usage figures indicate that 65 percent of the small and medium households and 70 percent of the landless households are defecating openly, despite having access to toilets. This indicates that the awareness-generation and Information Education and Communication (IEC) activities of Total Sanitation Campaign (TSC) have not been able to reach to all social groups, or they have been ineffective.

Though the usage seems to be better among the large-farm households in terms of basic and limited-service (29 percent + 38 percent) and medium (15 percent + 31 percent) farm category households, a lot still needs to be done to achieve improved sanitation for all. For assessing the reliability indicator, the amount spent by the households for operation and maintenance of the toilets is taken as a proxy. Findings indicate that 70 percent of the landless households are not spending any amount, both because the usage of toilets is very limited

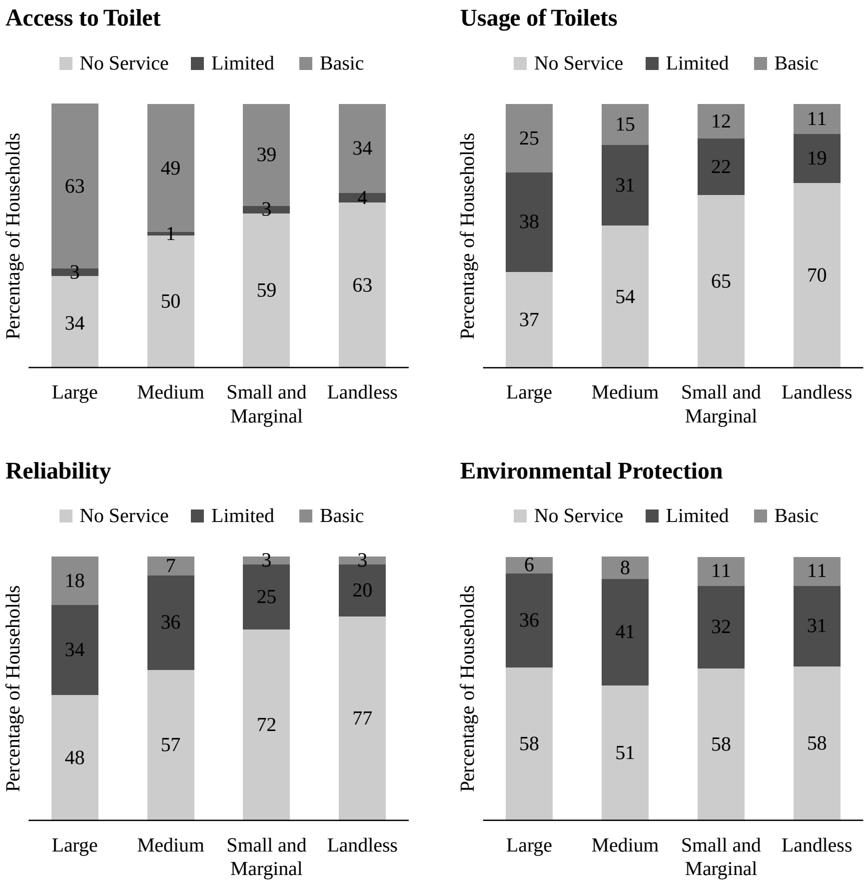


Figure 9.4 Sanitation service levels across economic categories (Source: WASHCost data)

among these sections and because the infrastructure is relatively new, and so requires little maintenance. Further environmental protection indicates that more than 50 percent of the households across all social groups are in the 'no service' category, reflecting the poor management of solid and liquid waste around their houses and at the community/village level. There could be marginal differences across groups or locations, but the FGDs at the community level failed to capture these.

Similarly in the case of water, service levels vary between the large-farmer and the landless households, though they are not as distinct as in the case of sanitation (Figure 9.5). Despite having a number of sources, including buying water, about 40 percent of the large-farmer households are reporting below basic services in terms of quantity, and more than 50 percent in terms of

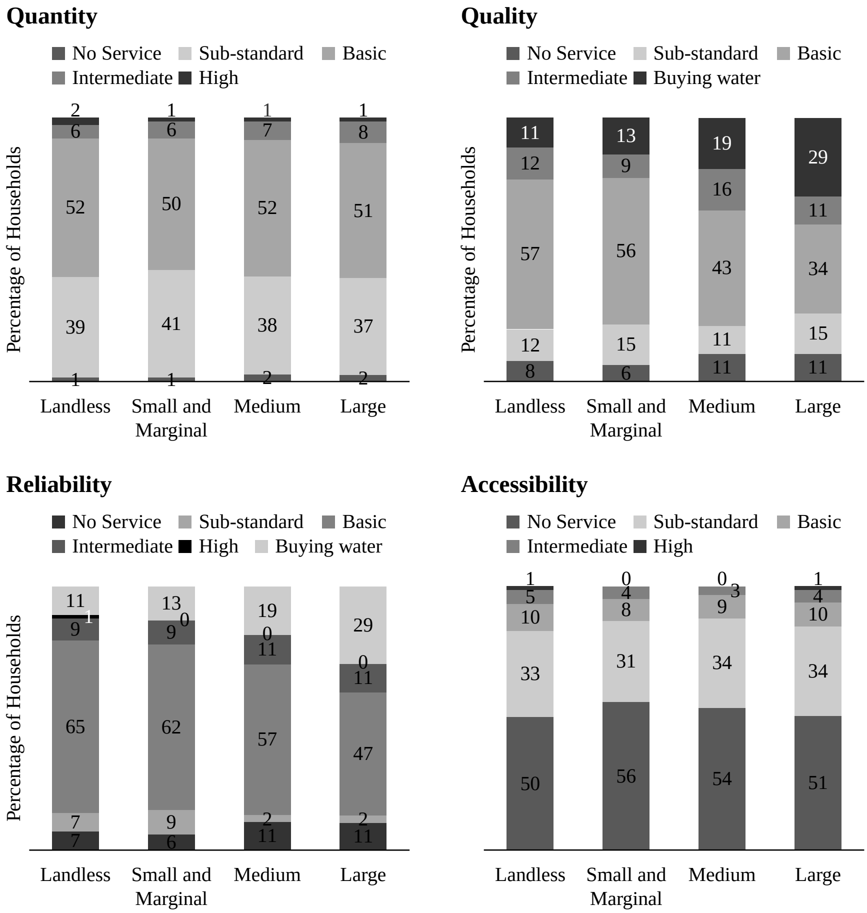


Figure 9.5 Water service levels across economic categories (Source: WASHCost data)

accessibility. This suggests that mere investment (Figure 9.6) does not ensure better services, though private investments seem to improve quality and reliability to some extent. The discrepancy could also be due to differences in the measurement of service and income indicators. The following analysis of social inclusiveness in water services may provide some explanation.

Distribution by Social Categories

The distribution of WASH infrastructure and services across the social groups reveals that 44 percent of the OCs had their own household tap connections, while only 14 percent of the ST households and 29 percent of the SCs have

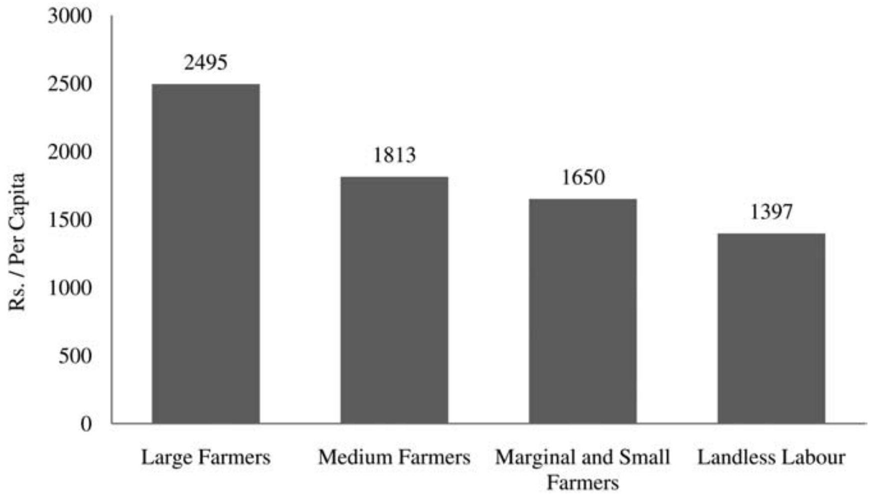


Figure 9.6 Household investments on water infrastructure (CapExHrd) by economic category (Rs./capita) (Source: WASHCost data)

household tap connections, which are the most convenient source of water (Figure 9.7). In the case of sanitation the situation is worse, with only 9 percent of ST households owning household toilets, followed by SC households (25 percent), while 63 percent of the OC households have their own toilets. This clearly indicates the social bias in the distribution of WASH services at the village level. The evidence seems to suggest that social bias is more conspicuous than economic bias, which could be due to the changes in income levels over the years. The social elite get to know about the government schemes and subsidies, and they use their influence to benefit from the programmes, especially the subsidies on sanitation.

The data on different types of sources used for meeting the drinking and domestic needs of the households shows that a higher proportion of the OC households has household tap connections in addition to their own bore wells and agricultural wells (Figure 9.8). Further, 16 percent of the OCs buy water to overcome poor water quality and water scarcity at village level, compared to 2 percent of the ST households. The OC households are both willing and able to buy water to improve their services. SC households are also not much behind, as a higher proportion of SC households are using improved sources like household tap connections, PSPs and HPs. Besides, 13 percent of SC households buy water to overcome quality issues. On the other hand, 20 percent of ST households depend on canals and streams for their water needs. This situation was observed mostly in the tribal villages of the sample. This indicates that either the government has not reached these remote places or the households are ignorant of the problems of consuming unsafe drinking water,

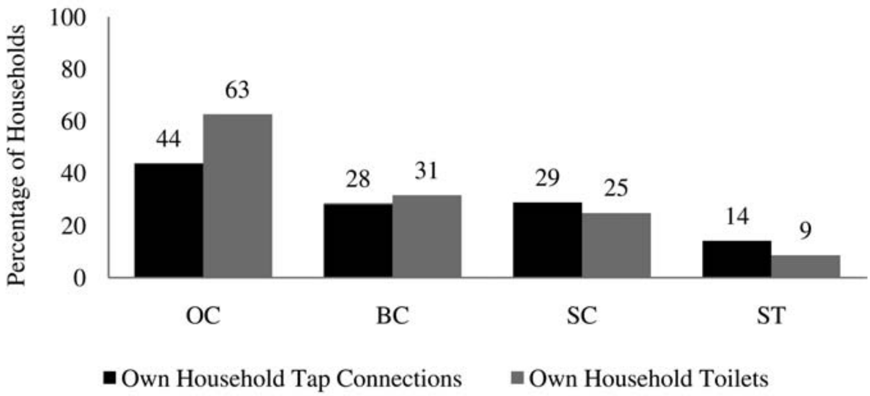
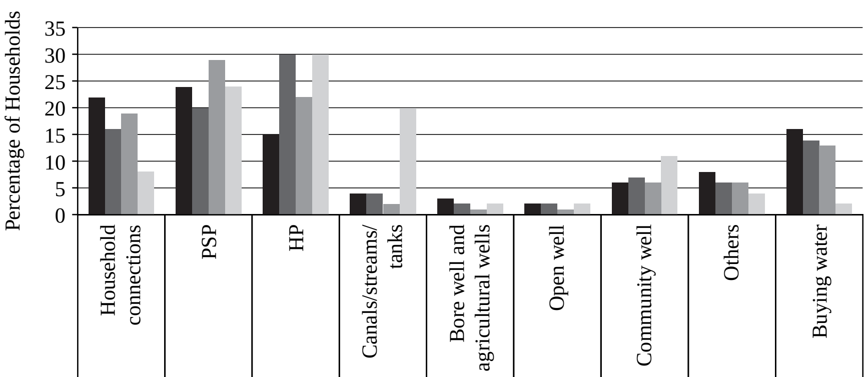


Figure 9.7 Distribution of water and sanitation infrastructure across social groups (Source: WASHCost data)



	Household connections	PSP	HP	Canals/streams/ tanks	Bore well and agricultural wells	Open well	Community well	Others	Buying water
OC	22	24	15	4	3	2	6	8	16
BC	16	20	30	4	2	2	7	6	14
SC	19	29	22	2	1	1	6	6	13
ST	8	24	30	20	2	2	11	4	2

Figure 9.8 Main type of water-supply technology used by different social groups (Source: WASHCost data)

despite the services provided. Often these two issues are interlinked. It appears that, while the SC communities are receiving explicit attention in terms of accessing the services, this is not always the case with ST communities.

Analysis of the service levels clearly shows that the OCs are having better service levels as compared to the BCs and the SCs/STs (Figure 9.9). About 54 percent of OCs have 'basic service' (own toilets), compared to 15 percent in the case of STs and 34 percent in the case of SCs. Usage of toilets shows a dismal figure, with very few households falling under the basic service

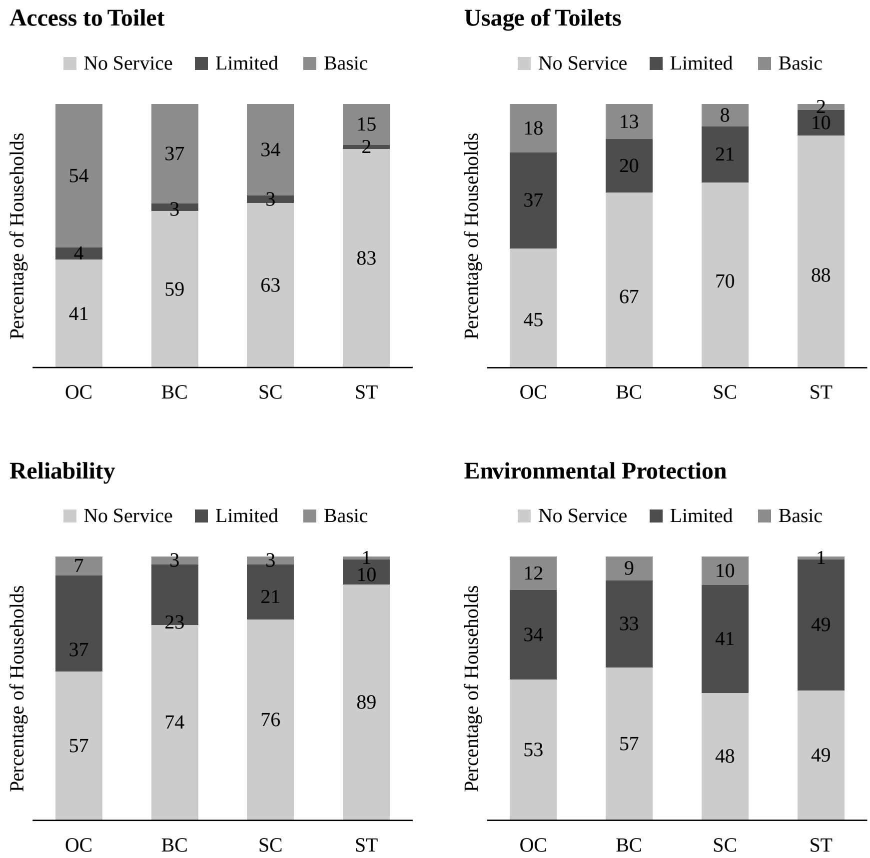


Figure 9.9 Sanitation services received by different social groups (Source: WASHCost data)

(all family members using the toilet) across all the social categories. But, here again, OC families are better off, with 18 percent of all family members and 37 percent of some family members using the toilet, whereas the figures are only 2 percent and 10 percent respectively in the case of ST households. Similarly in SC households only 8 percent of all family members use the toilets, and in 21 percent of households only some family members use the toilet.

Given a dedicated TSC, a flagship programme of the government of India with its decade-long efforts to reach the poor or BPL families through the provision of subsidies, it is observed that it has not made any impact in terms of providing coverage to the SC/ST households. The reasons for such poor progress can be attributed to the low level of subsidy provided to the households as incentive.[2] A subsidy of Rs. 2,700 (US$ 59) accounts for 90 percent of the government's norm for the cost of a toilet, which is Rs. 3,000 (US$ 66), and the beneficiaries are expected to contribute the remaining 10 percent, i.e., Rs. 300 (US$ 6.5). However, in reality this estimate is unrealistic, as the households are investing much higher sums, ranging from Rs. 3,500 to Rs.30,000 (US$76–656) (see Chapter 6). Apart from the low level of subsidy, households reported that other factors responsible for poor sanitation services were lack of space near the house, lack of awareness and lack of interest in getting the subsidy benefits, and no/low IEC campaigns. Access and usage are high among OC households due to their ability to spend or invest, high awareness, education levels, etc. It is disheartening to observe in the field that the toilets constructed under the government's housing schemes for the poor households are not being used as intended and have either been dismantled or are being used for other purposes, such as store rooms for livestock/fuel/grains or as bathrooms. In-depth discussions during household surveys revealed that the households do not even know how to use the toilets, and they do have a lot of misconceptions about the use and maintenance of toilets. Improved sanitation is not a felt need for many households, and the IEC activities have failed to impress and convince people on the benefits of improved sanitation.

The water service delivery analysis, too, reveals a similar story, though the service levels are better. Since water is a basic human need, households are making concerted efforts to meet basic service levels by using multiple sources and investing significant time and effort achieving a desired service level. In terms of quantity, about 69 percent of OC households are receiving basic and above basic services levels, compared to the 43 percent and 60 percent of ST and SC households respectively (Figure 9.10). While the quality of the water indicates that the majority of the households are in the category of basic and above. A substantial proportion (more than 10 percent) of all the social categories buys water for drinking purposes, except for STs (only 2 percent buy water). This reflects both willingness and ability to pay for improved water services. Accessibility figures reveal that only 48 percent of OC families are spending more than 60 minutes a day fetching water, in comparison to 67 percent of ST and 52 percent of SC families. One reason could be that more OCs have their own household tap connections and/or other sources at home, and so they are spending little less time fetching water compared to SC/ST families. Though there are specific efforts to target SCs and STs, much still needs to be done to narrow the social inequities. One of the main reasons for this is the locational disadvantage of these communities. In fact, ST households are spending more than SC households to overcome the disadvantages of living in remote hilly areas or tail-end or peripheral areas of the villages (Figure 9.11). However, despite their low ability, they do invest (albeit less than the OCs and BCs).

Income and Investment

It is evident from the analysis that a combination of ability and willingness of households to invest in WASH services determine the standard of service

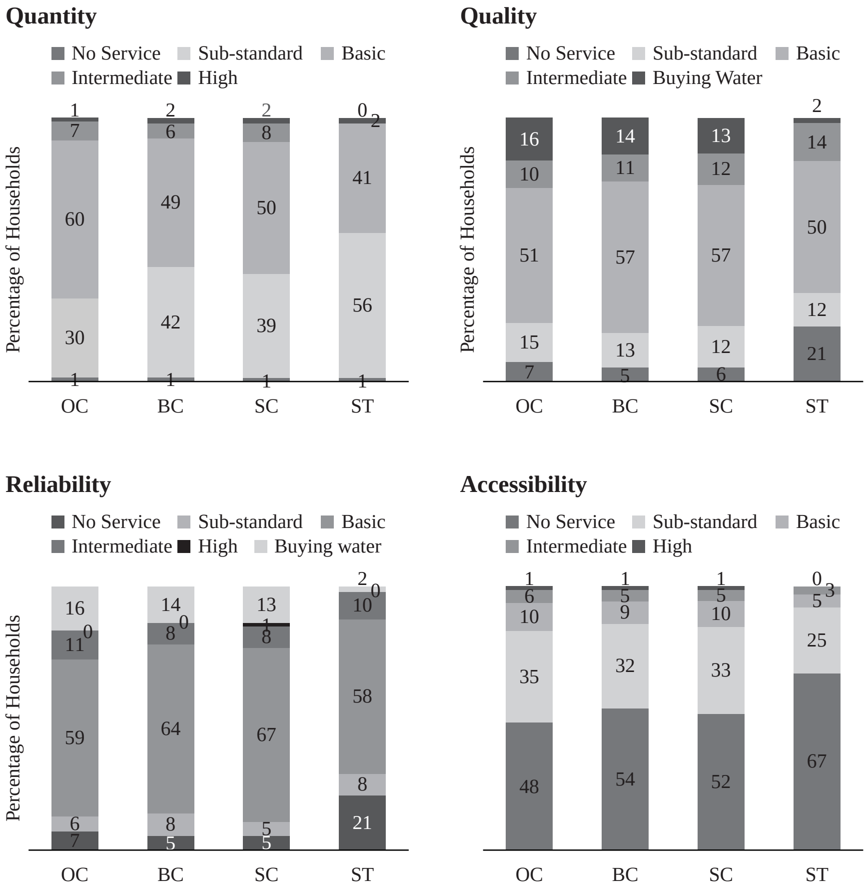


Figure 9.10 Water services received by different social groups (Source: WASHCost data)

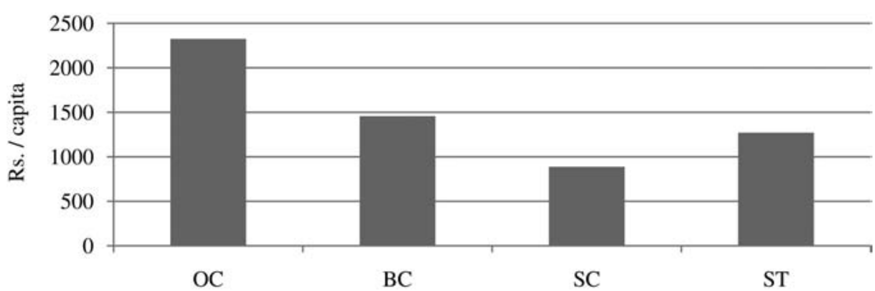


Figure 9.11 Household expenditure on water infrastructure (CapExHrd) across social groups (Source: WASHCost data)

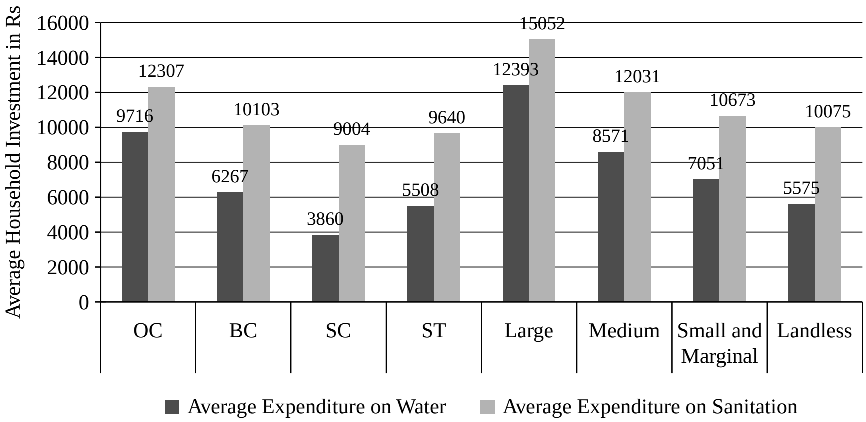


Figure 9.12 Average household investments on water and sanitation by socio-economic groups (Source: WASHCost data)

received. It is clear that the OCs and large farmer households invest and own WASH assets within their house premises (Figure 9.12) and are receiving better services in comparison to the poorer and socially backward classes. In order to understand the amount required for owning the WASH assets the investments made by the households towards WASH assets are assessed. Households spend between Rs. 3,860 ($US 84) and Rs. 12,393 ($US 271) for water; for sanitation the investments are slightly higher, ranging from Rs. 9,004 ($US 197) to Rs.15,052 ($US 329). Since the government is spending less on sanitation, the households have to spend more in order to access improved sanitation facilities. It is seen that the household investments constitute 20 percent of the total costs of water supply and up to 50 percent of the total sanitation costs, when the costing analysis is done using a life-cycle costs framework (Chapters 5 and 7).

Further, it was observed that the investments made by the OCs and large-farmer households are higher compared to the SC/STs or landless households, even among those who are investing on WASH assets. This clearly indicates that household investments are needed to supplement government investments in order to bring services up to a level that is acceptable to each household. It is also observed that the poor households also spend substantially on water and sanitation infrastructure. In fact, the ST households spend more than the SC households on water and sanitation, which is in tune with per capita household expenditure (Figure 9.13). In proportionate terms, household expenditure on WASH services accounts for 2–4 percent of the total expenditure across the socio-economic groups (Figure 9.13). The ST households spend the lowest proportion of their income on water and sanitation (2 percent). This is an important and significant deviation compared to earlier studies that observed poor households spending disproportionately higher share of their incomes on

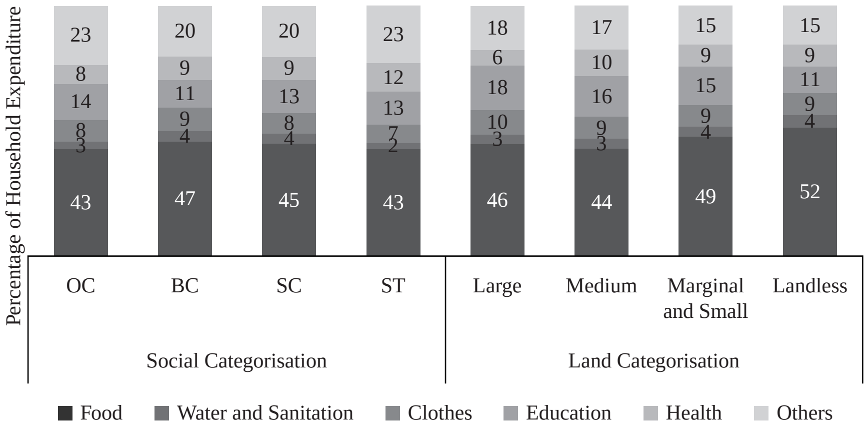


Figure 9.13 Household expenditure for different purposes across socio-economic groups (Source: WASHCost data)

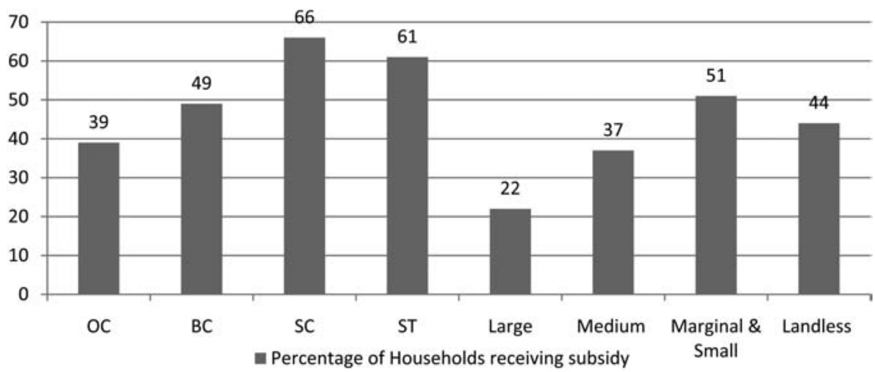


Figure 9.14 Distribution of subsidies across socio-economic groups (Source: WASHCost data)

water services when compared to the rich (Reddy 2001). This was observed even in the case of subsidies provided for the construction of household toilets. A higher proportion of poor and SC/ST households receive the subsidies when compared to the rich (large farmers) and OC households (Figure 9.14). At the same time a substantial proportion of rich are also getting subsidies that are not meant for them.

IV The Venkatapuram Case study

The case study maps and specific findings are presented from one of these villages, Venkatapuram. This is a fairly typical rural village located in Khammam

District with about 420 households spread over clearly segregated colonies. Although there has been outward migration, the population of the village has doubled during the last 20–25 years. Plate 3 shows clearly that the boundaries between caste groups are quite well delineated. It is also clear that the density of housing is higher in the SC and BC colonies as compared to the OC colony. This said, plot sizes are relatively large compared to a typical SC colony, and the road layout is relatively uniform. This is because the SC colony of around 115 houses was built in 1978 after the old SC colony, located to the east of the OC colony, was demolished to make way for a new irrigation canal.

This area of Khammam district has a mean annual rainfall of around 1,000 mm and so is relatively well endowed with water resources. However, during the last twenty-five years, there has been a dramatic increase in groundwater extraction using privately-funded bore wells. This has had the positive impact of increasing the area under irrigation and improving the livelihoods of many landholders, but this has been achieved at the cost of a falling water table and increasing fluoride contamination of groundwater. So, despite being in a district that has relatively high rainfall and receives large volumes of irrigation water from the Krishna river, Venkatapuram is facing increasing water scarcity (i.e. demand and use of water are outstripping sustainable supply).

Venkatapuram's Water Services

During the last thirty years there has been considerable public and private expenditure on WASH services. Plates 3, 4 and 5 provide a snapshot of the water supply infrastructure in 1980, 2004 and 2010. The main features in these maps and water-supply timeline are summarised below.

By 1980:

- Three hand pumps have been constructed in the village (note only one is shown on the map). These were sited on the basis of technical (not social or caste) criteria.
- Open hand-dug wells are also an important source of public and private water supply. The density of open wells is highest towards the centre of the village (i.e. in the OC colony). A community open well is an important source of supply in the SC colony.
- The canal to the east of the village (built in 1978) is used by many households for bathing and washing clothes.
- Most households use water from the water supply infrastructure for at least one productive or MUS use (e.g. backyard horticulture, dairying, etc.).[3]
- Some livestock are watered from the canal. Others are watered from private wells.
- Institutionally, Venkatapuram is a hamlet falling under the Mudigonda Gram Panchayat (GP).

By 2004:

- Considerable investment has taken place in infrastructure during the previous 24 years. Additional hand pumps have been built and a piped-water supply system fed by an overhead tank (OHT). This piped-water supply system is supplied by two bore wells near the centre of the village.
- Although some open wells are still used, many have been abandoned or filled in. The community well in the SC colony is no longer used. The number of functioning wells continues to be skewed towards the centre of the village.
- Fluoride levels in groundwater have increased but they are still within permissible limits.
- Along with the new water supply infrastructure, household water demand and use has increased. People take more baths, wash clothes at home, and the number and range of MUS activities has increased.

By 2010:

- Population of the village has risen and per capita demand for water has also increased. Households located towards the 'tail end' of the piped water supply network are experiencing major problems with both water pressure and the volume supplied.
- Particularly in the OC colony, many households have improved their water security by investing in private bore wells and submersible pumps. These are used to supplement or back up water supplied via the public water supply systems.
- Fluoride levels in water supplied by the piped water supply system now exceed the National Rural Drinking Water Programme's maximum permissible limit (1.5 mg/l). As a result, a reverse osmosis (RO) plant has been constructed. This produces around 4,000 l/day. Approximately 50 percent of households purchase drinking water at a cost of Rs. 2 per 25 litres. Those that do not purchase RO prefer to collect their drinking water from one of the HPs in the SC colony that is recognised as having a relatively low fluoride level.
- One of the two public water supply bore wells has failed, and, as a result, water is being purchased and pumped from a private agricultural well near the village. This water is pumped into the working bore well, from where it is pumped to the overhead tank. Although difficult to prove, it is likely that the village water-supply bore well failed because of increased groundwater extraction from the private bore wells located near to and within the village.
- Households with their own private bore wells as well as access to the village water supply are relatively profligate in their productive water uses (MUS activities). In contrast, households experiencing water scarcity are

forced to limit their productive water use and/or use recycled wastewater for MUS activities.

- Functioning infrastructure continues to be skewed towards the centre of the village.
- In 2005 Venkatapuram went from being a hamlet under the Mudigonda GP to having its own GP. The consensus from village-level discussions was that the Venkatapuram GP is pro-active in tackling WASH problems in all parts of the village.

Plate 7 shows the variation in mean daily summer per capita water use across Venkatapuram in 2010. This map highlights the fact that water use in the OC colony tends to be higher than in the other colonies. However, the map also shows that there is considerable variation in household water use within all the colonies. For example, in the OC colony the per capita water use of some households is around 40 lpcd, whereas others use well over 100 lpcd. In many cases high water use can be explained by number of livestock (i.e. high water users have large compounds in which they keep and water livestock). Plate 7 also indicates that around 10 percent of households are accessing less than 40 lpcd (i.e. the volumetric norm).

As noted in Venkatapuram's water timeline, groundwater quality has deteriorated during the last thirty years. Plate 8 shows fluoride concentrations in the main sources of the village's water supply as measured in November 2011. This map highlights the considerable variability in fluoride concentrations across the village. Of the eleven water sources surveyed, seven had fluoride concentration within acceptable limits (i.e. less than 1 mg/l), two were marginal (in the range 1–1.5 mg/l) and two exceeded the maximum permissible limit (1.5 mg/l). The biggest concern is that water delivered by the piped-water supply is not fit to drink (i.e. the fluoride level exceeds the permissible limit).

Plates 9 and 10 summarise the views or perceptions of users regarding the adequacy of Venkatapuram's water supply systems during summer and non-summer respectively. The main findings from the summer perceptions included:

- The volume of water supplied by 5 out of 7 of the working hand pumps in the northern colonies was insufficient to meet the demands of all potential users and uses.
- The volume of water supplied by the piped water supply network was insufficient to meet the demands of all potential users and users at the tail ends of the network (i.e. at points furthest away from the overhead tank).
- Overall the piped water supply network was a relatively better source of supply than hand pumps.

In contrast, the main findings from the non-summer survey included:

- The adequacy situation was much improved; however in the northern colonies there was still an adequacy problem at the tail ends of the piped water supply network.
- Hand pumps were regarded as a better source of water than the piped water supply network (i.e. user choice switches between summer and non-summer from the piped water supply network to the hand pumps).

Venkatapuram's Sanitation Services

Venkatapuram is a NGP village (awarded in 2008), and, as such, the majority of its households own or share toilets (Plate 11). The percentage of households having toilets is highest in the OC colony (86 percent) and lowest in the SC colony (73 percent). The percentage of the population using toilets rather than defecating in the open is above 90 percent in all the colonies. However, the situation is complicated by the fact that many compounds are shared by an extended family (i.e. often more than one nuclear family lives in each compound). From field surveys, it appears that most compounds have at least one toilet, and some sharing takes place, but open defecation is still common in cases where the toilet(s) was/were constructed and paid for by one nuclear family (e.g. if it was built and paid for by one of several brothers sharing a compound).

Focus group discussions revealed that, in the lead up to the conferring of Venkatpuram's NGP award, social pressure was applied by the sarpanch and GP on villagers to both construct and use toilets. A committee of five men and five women was assigned the responsibility of curbing open defecation. This committee paid men Rs 80 (US$ 1.75) per day and women Rs 50 (US$ 1.1) per day to make regular rounds of the village. Anyone caught defecating in the open would be escorted to their house and locked inside their toilet. The view of the sarpanch was that only by following this procedure strictly and continuously for a period of eight months, was it possible to achieve a 100 percent open-defecation free status.

Such coercive tactics were found to be fairly common in the NGP villages surveyed. The need for such radical tactics suggests that sanitation and hygiene awareness campaigns failed to reach and/or significantly affect the behaviour of all social groups. In the case of Venkatapuram, this prompted GP members to apply additional pressure, particularly on poorer social groups, during the lead up to the NGP award. Whilst this is difficult to justify it seems to have been effective, at least in the short term. The big problem with coercion based on humiliation and fear is that it does not lead to behaviour change, and, as a result, slipping back to old practices is likely once a NGP award is made and social pressure either ceases or is much reduced. This said, some commentators have suggested that we need to stop pretending that decentralised development is necessarily the ultra-democratic panacea it is often made out to be. Humiliation and fear are effective tools, especially when spearheaded by the village itself. If this helps achieve the common good of improved sanitation, maybe it is justified (Chatterjee 2011).

Gradients of Power, Wealth and WASH Services

In spatial analysis, a buffer is a zone around a map feature (e.g. a point or a polygon). Buffering can be used to create concentric polygons of the same radius and/or width (Figure 9.15). These were used in the Venkatapuram spatial analysis to obtain averages of variables relating to distance from the centre of the village (taken as being the new GP office in the OC colony).

Buffering analysis of income and land ownership shows clearly how these two indicators of wealth and status decline with distance from the centre of Venkatapuram (Figure 9.15). Whilst these gradients are very marked, it is important to note that within these zones there is a high level of variability. For example, in the 0–150-m zone most households have a relatively high income, but there are also some households with very low incomes. However, regardless of level of income, households in the central area tend to live in large compounds and to be involved in a diverse range of income-generating activities. In addition to land compounds within the built area, these relatively better-off households also own agricultural land outside the built area. The net result is that there is also a gradient of livelihood diversification and resilience outwards from the centre of the village. Finally, there is a tendency for GP members to live in the central area of the village, so to some extent political power is also skewed spatially towards the centre of the village.

One-off investment in water supply also declines steeply away from the centre of the village (Figure 9.16). Much of this investment has gone into construction of private bore wells. These bore wells lead to significant

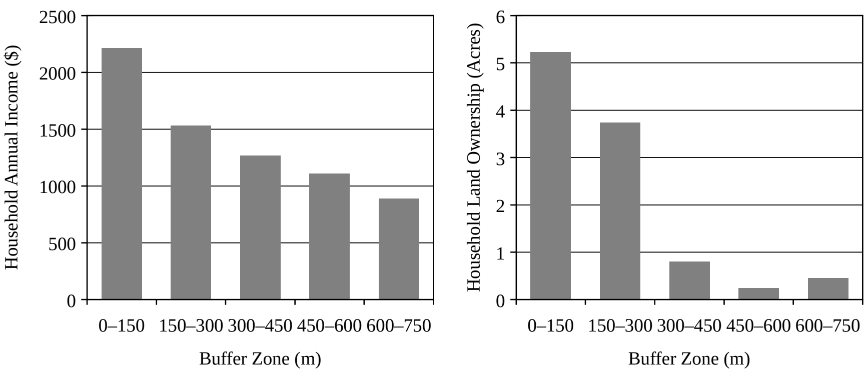


Figure 9.15 Gradients of household income and land ownership

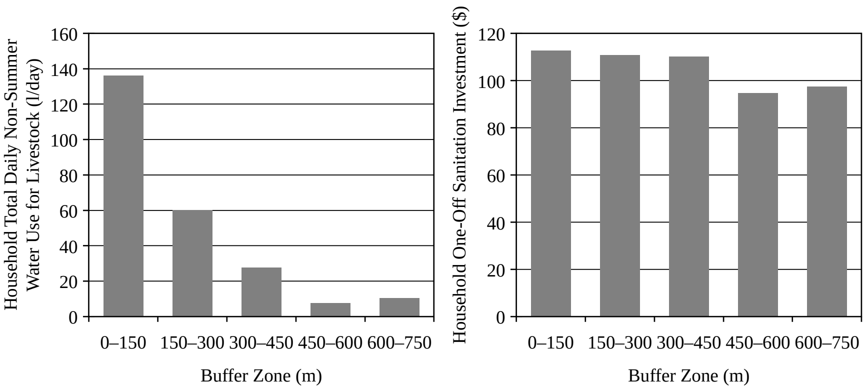


Figure 9.16 Gradients of household one-off investment in water supply and sanitation

improvements in the volume, ease of access and security of water supply for these households. Clearly, these more central households regard this investment as worthwhile, even though their public water supply is relatively more reliable than that received by households at the tail end of the public water supply system. Arguably, tail-enders would benefit more from private bore wells, but they are less willing or able to make such large investments.

Whilst the large numbers of private bore wells in Venkatapuram bring benefits to individual households, this is at a cost to the village as a whole, because these wells are contributing to a falling water table and deteriorating groundwater quality (e.g. the failure of one of the bore wells that was a source of the piped water supply, increasing fluoride levels). Clearly it would be better if household water supply investment were directed to activities that would accrue benefits such as improved water security but have less obvious externalities. For example, investment in rainwater harvesting into cisterns would improve household water security with no, or very limited, negative impact on groundwater levels or groundwater quality.

Discussion

For many years, decentralisation, community management and community participation have been promoted as practical means of ensuring equitable access to WASH services.[4] However, the stand-out finding of the case study reported here is the inequitable access to WASH services within Venkatapuram village. This is despite the fact that in recent years Venkatapuram has had a go-ahead GP with a sarpanch from the SC community. Or put another way, despite effective (and at first sight successful) decentralisation, community management and community participation in Venkatapuram, WASH service levels continue to be skewed spatially and towards relatively better off and more powerful social groups.

Why, then, are Venkatapuram's WASH services so inequitable and skewed, given that relatively high-level of decentralisation, community management and community participation?

Decentralisation consists of a transfer of public functions from higher tiers to lower tiers of governance (Jütting *et al.* 2005). It can include:

- Administrative: transfer of civil servants and public functions to the local level.
- Fiscal: devolution of fiscal resources and revenue-generating powers.
- Political: devolution of decision-making powers.
- Multifaceted: a mix of the above.

In theory, decentralisation has the potential to improve local-level ownership and accountability for decisions linked to sustainable and equitable delivery of WASH services. For these and other reasons (e.g. to improve efficiency and effectiveness), state governments throughout India have been implementing WASH programmes that will ultimately be managed by the villages they are meant to serve (Jha 2010). However, decentralisation can, and often does, provide opportunities for elites to capture disproportionate benefits. Hence there is a definite risk that decentralisation will increase inequities rather than reduce them (Jütting *et al.* 2005, Sato and Imai 2010). It is also clear that decentralised institutions responsible for WASH governance tend to reflect the political and social realities at the local level. Similarly, if and when they exist, village water and sanitation committees (VWSCs) tend to reproduce or even reinforce existing biases in society.

In theory, decentralisation should have a positive impact on WASH services to poor and marginal groups. On that basis decentralisation should:

- make the voices of the poor better heard;
- improve their access to and the quality of public services;
- provide an opportunity for establishing democratic institutions in which the poor can actively participate, decide and lobby for their interests;
- provide an opportunity for the poor to monitor and hold local officials and politicians to account.

However, recent research in India suggests that giving power to local tiers of government is not sufficient to increase the participation of marginalised groups. The central state has to ensure that existing social inequalities are taken into account and are not reinforced once the decentralisation process has started (Jütting *et al.* 2005).

Driven by a decentralisation agenda and a paucity of public funds and personnel, and further fuelled by the mandates of (and pressure from) bilateral and multilateral donor agencies, a trend in India during the last two decades has been to put increasing stress on community participation in rural and sometimes urban WASH services delivery. So communities are being asked to either retain or, in cases where this role has been abdicated or forgotten, take on the role of suppliers and managers of WASH schemes with little or no outside support (Jha 2010). On paper at least, water users are expected to form water committees to manage the upkeep of their new communal water facilities and collect money to pay for maintenance. However, the experience of many users is that a new water point is built, it works for a while, then poorly for another year or two, before it finally breaks down. Even if users manage to undertake minor repairs they struggle with major ones. They then have to wait until the facility is replaced through a rehabilitation intervention at some unspecified future date (RWSN 2009).

Whilst community participation and management are needed, other considerations are equally (or possibly more) important when establishing functional management committees (e.g. village-level leadership, managerial and technical know-how and lack of political in-fighting – or, rather, a reasonable level of social cohesion). It is also important to note that even good community management institutions cannot keep infrastructure in working order if their staff have not been properly trained and they are hampered by lack of access to adequate funds, spare parts or skilled technical services.

The assumption of most WASH programmes is that VWSCs are capable of running WASH schemes with minimal external assistance. However, VWSCs often lack interest in taking on this responsibility and/or the technical, economic and managerial capabilities that are required (Jha 2007). This contributes to the fact that the majority of VWSCs collapse or fail to function in any meaningful way (Anon. 2011) and the responsibilities allocated to VSWCs are often taken on by GPs or alternatively by the sarpanch and some of his/her associates. The net result is that VWSCs are often reported as being functional when in fact they do not exist. One explanation of this state of affairs is that reform processes encourage progress through the adoption of standard responses to predetermined problems (e.g. creating local-level user groups is a standard response to inequitable access to services). However, this encourages *isomorphic mimicry*: the repeated adoption of a *form* of institution or governance, despite evidence of the persistent lack of *function* (Pritchett *et al.* 2010). Another explanation is that VWSCs tend to fail soon after formation because there is a mismatch between the capability of the VWSCs and the tasks they are assigned; as a result they fail because of *premature loading* (i.e. before their capability has increased far enough for them to be able to take on their intended roles and responsibilities).

V Recommendations and Conclusions

Access or lack of access to adequate WASH services, is ultimately a function of the effectiveness of policies and institutions. Though government is providing infrastructure up to the village level, it is failing to ensure equitable services across all households. The poorest of the poor are the main group targeted for extending government benefits, but they still receive poor services when compared to their counterparts. Sanitation service delivery is quite poor among the SC/ST households, and IEC programmes designed to raise awareness have not been effective in these communities. Though a higher proportion of socio-economically backward communities is receiving subsidies, these subsidies are not reflected in the service levels. The reason could be that the amount of subsidy is not enough to improve service levels. Further, the spread of subsidies has been limited, as the subsidies intended for poor are also cornered by the socio-economically better off households, like large and OC farmers, due to poor targeting. A substantial proportion of rich are therefore benefiting from subsidies meant for poor, thus adversely affecting the coverage of poor; this is especially true of sanitation: i.e., household toilet construction. Better targeting of these subsidies towards poor households could improve the access to sanitation to a large extent. However, this aspect is critically linked with political economy aspects that are all-pervasive and not limited to the WASH sector.

However, as discussed in the case study, it is also a function of power, wealth, geographical location and the ability or willingness of individual households to invest their own money in, for example, private bore wells or well-constructed toilets. By using standard and advanced mapping techniques, this case study has highlighted that something may be amiss with current WASH policies and institutions and, more specifically, with the ways in which policies of decentralisation, community participation and community management are being promoted and implemented. Despite many years of effort, these policies do not appear to deliver all the expected benefits, even in a case like Venkatapuram (i.e. a village with a go-ahead GP, no major factional problems, etc.).

Assuming that these findings are correct, what can be done to rectify the situation? The following actions are proposed:

- Pro-poor WASH services delivery requires special attention and affirmative action at the implementation level. Allocation of resources towards design and planning at village level is a precondition for addressing social inequities. As the cost analysis (Chapter 5) shows, it is clear that marginal attention is paid to planning and designing the systems. In addition, allocations towards source sustainability and capital maintenance are critical for maintaining the service levels. Simple gradient- and slope-based laying of distribution systems, cost-effective installation of valves at appropriate places and enforced control of illegal connections and booster pumps would improve distribution considerably.
- Subsidy policies directed towards improving access to sanitation for the poor have proved ineffective, and this brings into question the rationale for continuing the subsidies for building household toilets. Instead, the allocations could be directed towards creating demand for sanitation by providing complementary infrastructure, such as sewerage and waste disposal systems, along with awareness and IEC campaigns. For those households that cannot afford, or do not have space for, building individual

toilets, promotion of community toilets with proper maintenance mechanisms can be introduced on the lines of the *sulabh* model.[5]

- Decentralisation should not be seen as an end in itself not least because decentralised management of WASH services delivery does not always ensure that decision-making is participatory and/or democratic. As discussed above, decentralisation can result in local water governance that reflects or even reinforces existing local-level power relations and/or biases. Hence, the challenge is to devolve managerial authority for WASH services delivery in ways that ensure the voices of poor and marginalised groups are heard and minimise the risk of benefits being captured by elites.
- Raising awareness and building the capability of local-level institutions requires long-term effort and handholding, if failure due to *premature loading* is to be avoided. This is especially true for villages that have factional problems and/or lack social cohesion, though less so for villages with a long tradition of successful communal action. Consequently, government should envision a prolonged role for itself, so as to enable communities to better build their capabilities to manage WASH services delivery (Jha 2010, RWSN 2009). Alternatively, the contracting out of VWSC roles and responsibilities to NGOs or the private sector should be considered.
- Particularly in the case of sanitation, greater emphasis needs to be placed on changing entrenched attitudes that hinder adopting improved sanitation and hygiene practices. Some maintain that, in terms of resources, four units of investment in infrastructure (or hardware) should be matched by three units of investment in software (e.g. awareness, skills) (Luijendijk and Lincklaen Arriëns 2007). It is also clear that a significant proportion of this 'software' investment should be devoted to creating and improving the demand for sanitation at the household level (see Chapter 7).
- More attention should be given to the potential negative effects of private expenditure on WASH services levels for the community as a whole. For example, sinking private bore wells and increasing groundwater extraction in built areas can lead to the failure of bore wells that are the sources of public water supply. Similarly, the increasing use of booster pumps and illegal connections affects the hydraulic integrity of piped-water systems with the result that 'tail-enders' receive less water. Clearly some level of regulation (e.g. social policing) is needed.
- Household-level mapping of WASH services levels should be an integral part of planning, managing and monitoring WASH delivery systems. Social auditing based on maps and mapping helps to highlight skewed and inequitable access, and so provides a good starting point for rectifying it. In the past, mapping and use of Geographical Information Systems (GIS) was the domain of specialists. But the increasing availability of GPS-enabled smart phones and new open-source mapping software applications now give the WASH sector a real opportunity to improve the monitoring of WASH services of all households.

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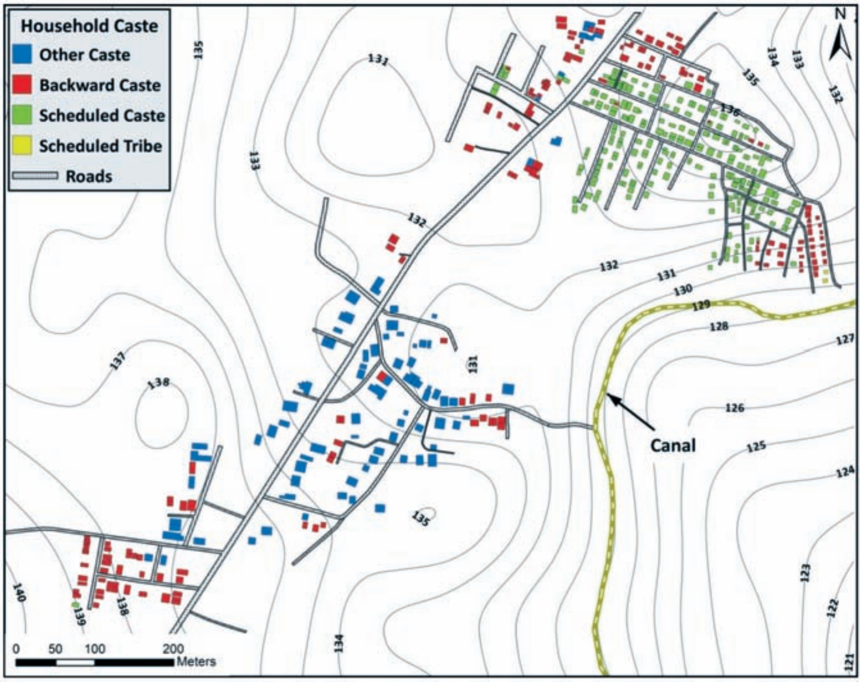

Plate 3 Venkatapuram's societal layout and boundaries

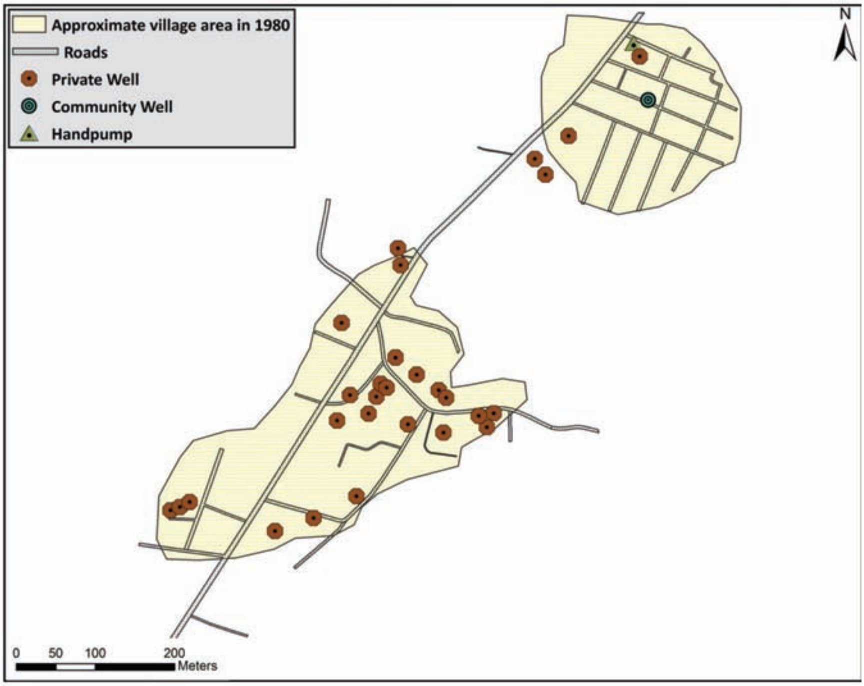

Plate 4 Venkatapuram's water supply infrastructure in 1980

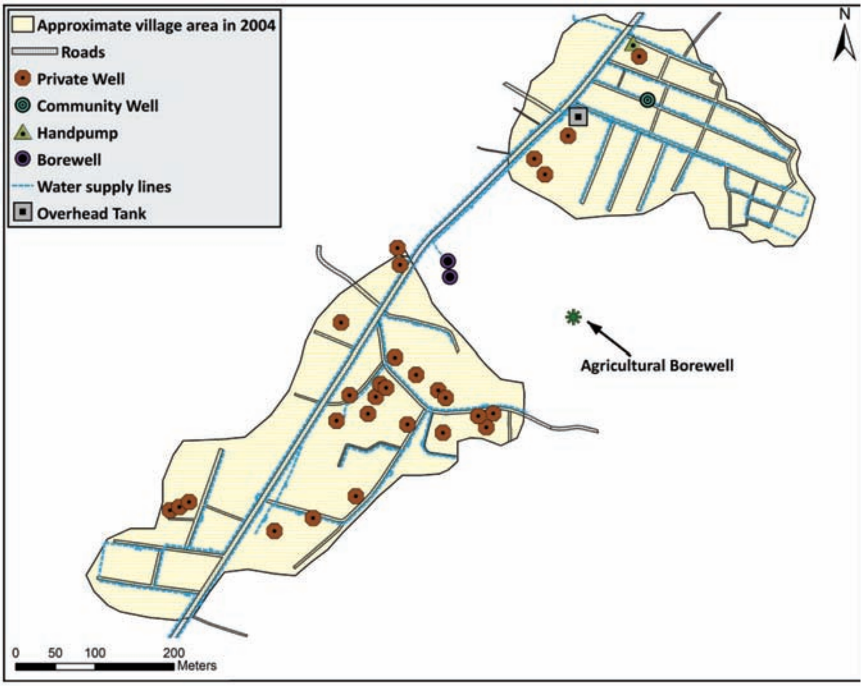

Plate 5 Venkatapuram's water supply infrastructure in 2004

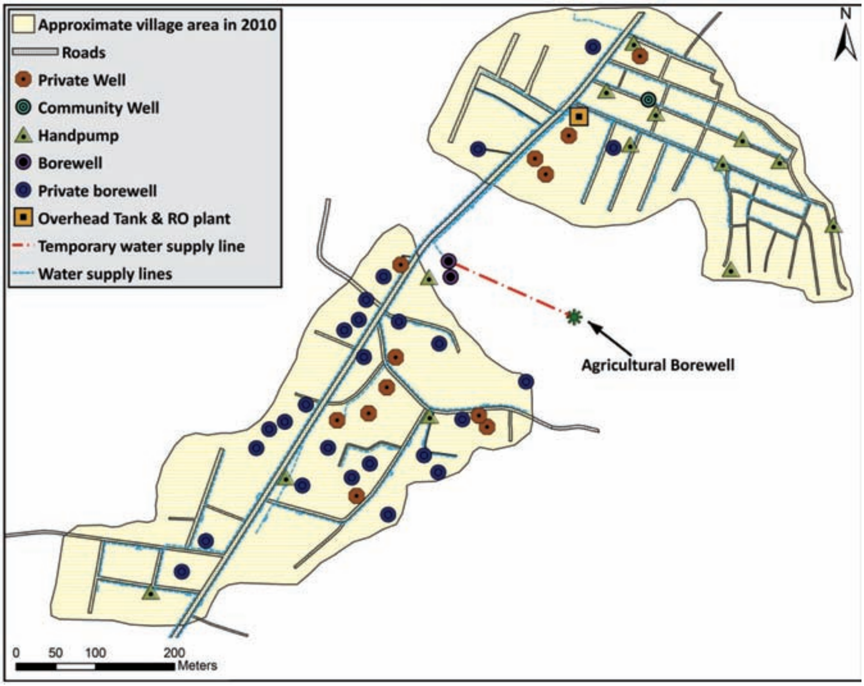

Plate 6 Venkatapuram's water supply infrastructure in 2010

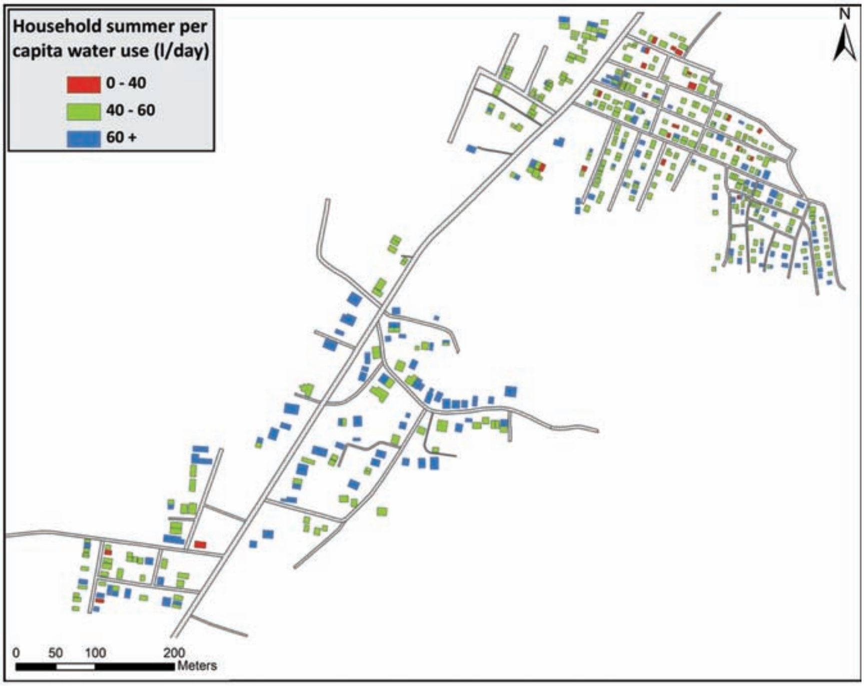

Plate 7 Summer per capita water use (litres/day)

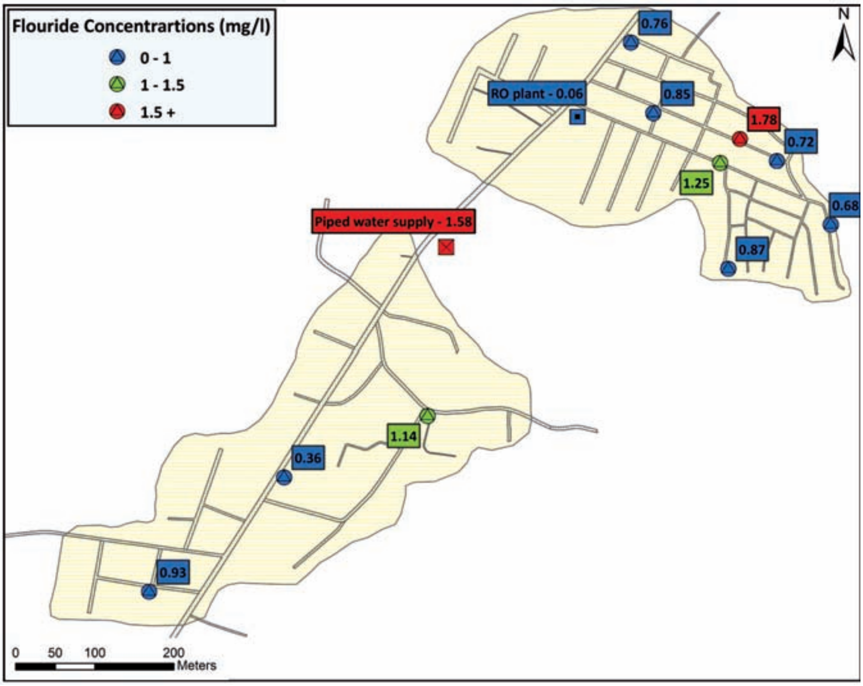

Plate 8 Fluoride levels in Venkatapuram's water-supply sources (mg/l)

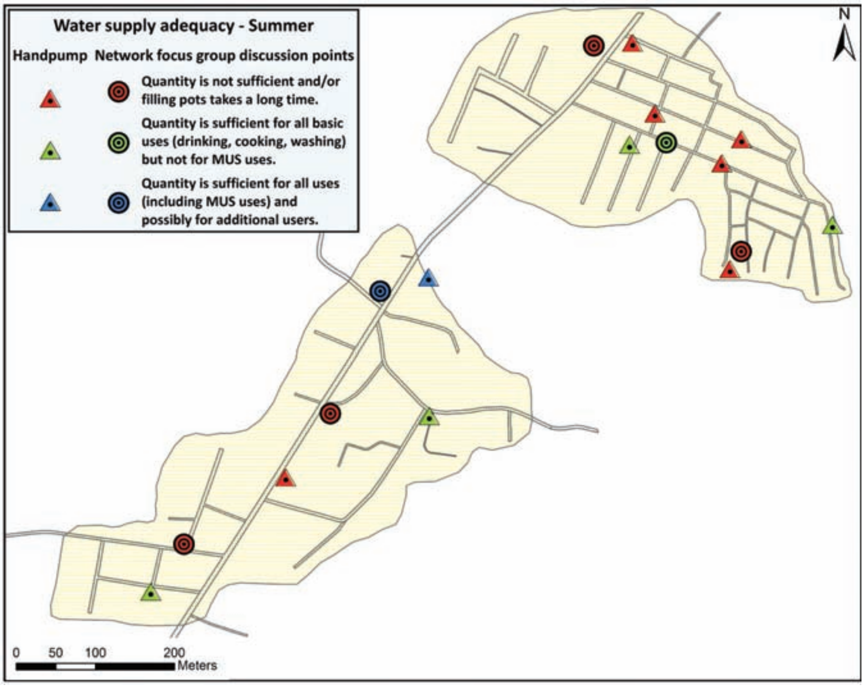

Plate 9 Users' views of water services delivery (summer 2010)

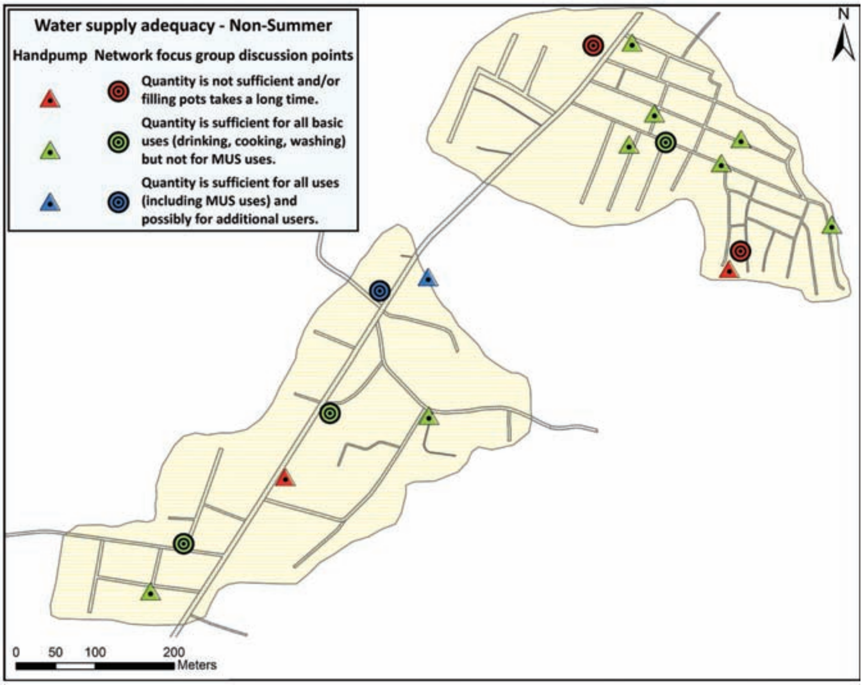

Plate 10 Users' views of water services delivery (non-summer 2010)

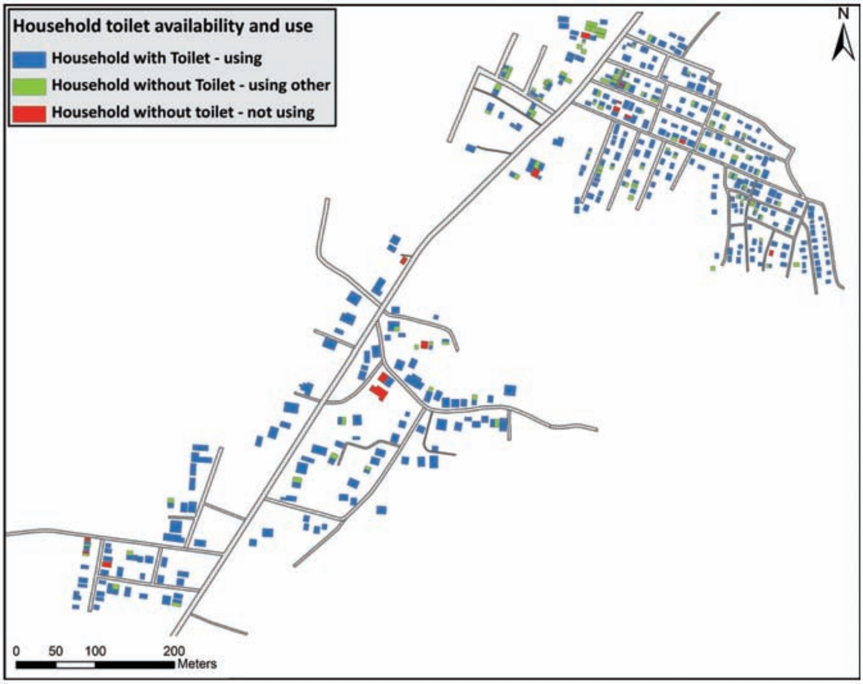

Plate 11 Household toilet availability and use

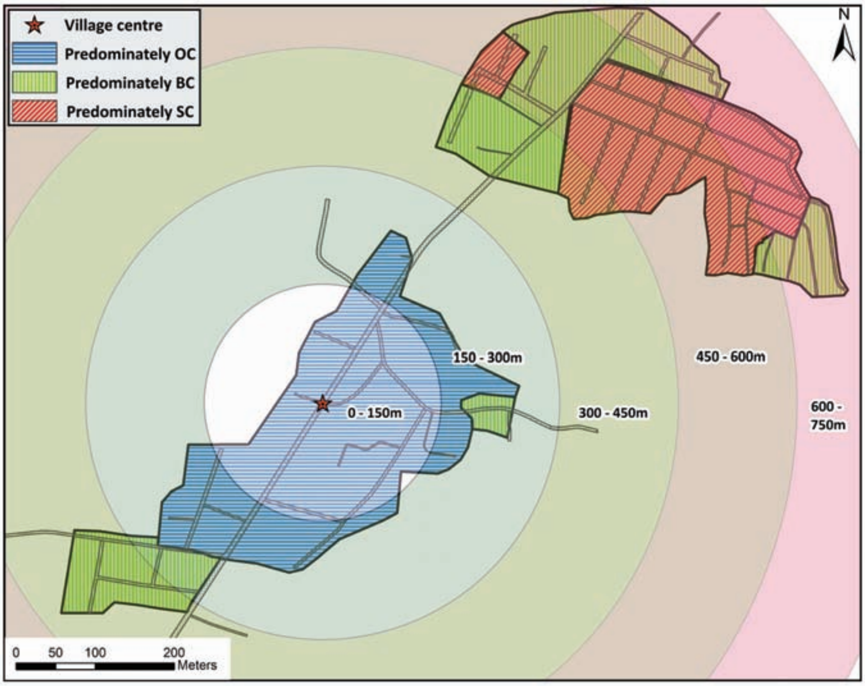

Plate 12 Buffer zones (width of 150m)

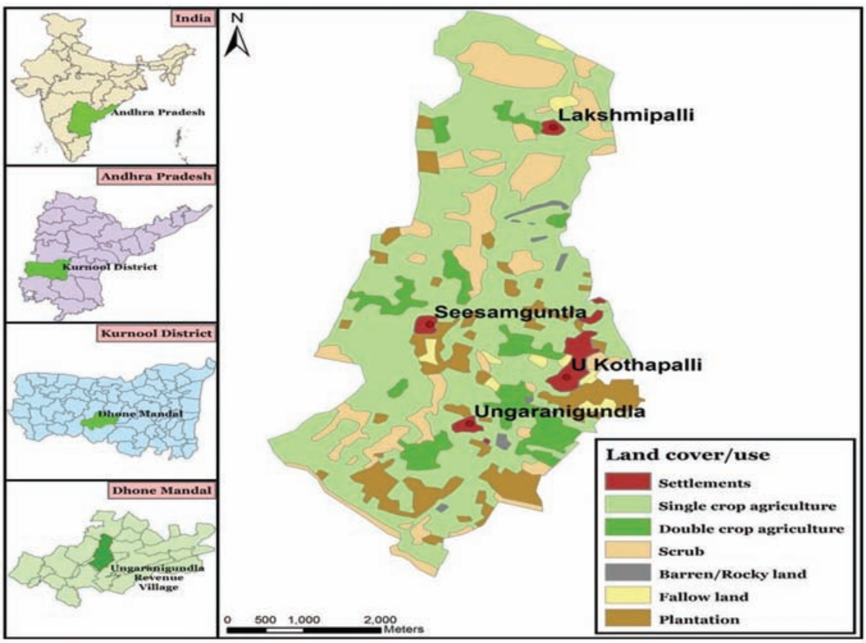

Plate 13 Location and land/use cover in Ungaranigundla revenue village (Batchelor 2012)

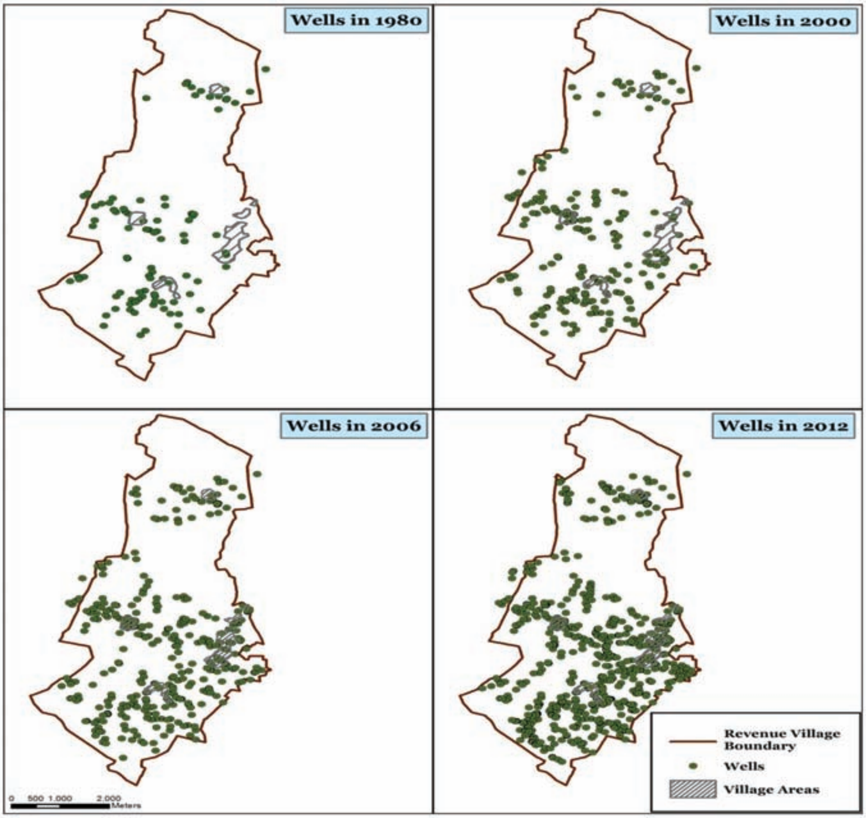

Plate 14 Time series maps showing construction of wells in Ungaranigundla revenue village (Batchelor 2012)

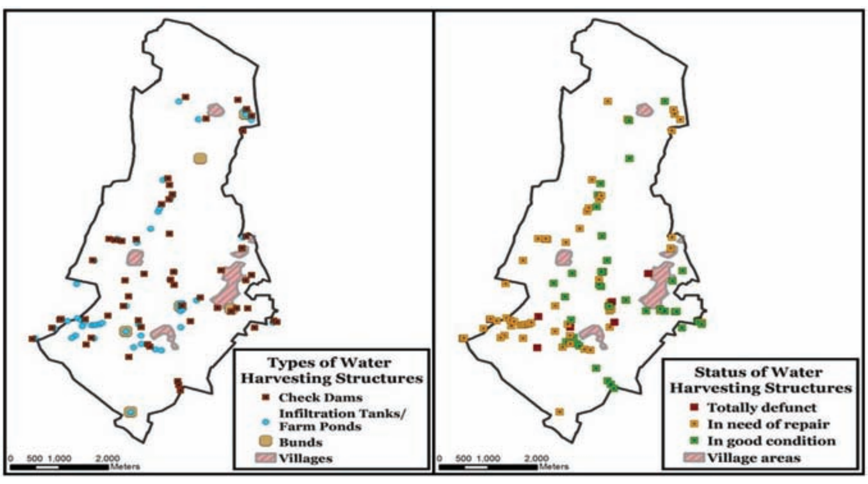

Plate 15 Distribution and status of water harvesting structures in Ungaranigundla revenue village (Batchelor 2012)

Plate 16 Village water purification plant

Plate 17 Women being passive listeners in WASH meeting

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10 How can Water Security be Improved in Water-scarce Areas of Rural India?

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1 Introduction

Improving and maintaining water security is widely recognised as a major challenge to India's continued economic and social development (Wyrwoll 2012). Groundwater, in particular, is a critical resource in India because it accounts for over 65 percent of irrigation water and 85 percent of drinking water supplies (World Bank 2010). However, overexploitation of aquifers, primarily as a source of water for irrigation, is widespread across India even in areas that are well-endowed with water resources. Other major concerns include: lack of effective operation, maintenance and management of water supply infrastructure, and reliance on engineering solutions to water problems of any scale. The net result is that, in many areas and for many users, levels of water security are declining despite heavy public and private investment in water-supply infrastructure. Increasingly, water professionals are of the view that the era of further water development might be over, and from now on, the only way India can improve its water security is by focusing squarely on improving the management of water resources – for which the country has already built the necessary infrastructure (Shah and Lele 2011).

In terms of the policy context, India's draft 2012 National Water Policy (GoI 2012) recognises that: 'Large parts of India have already become water stressed' and 'Rapid growth in demand for water due to population growth, urbanisation and changing lifestyle pose serious challenges to water security'. However, this is the only time that water security is mentioned in the draft 2012 National Water Policy. In contrast, India's framework for action for delivering domestic water services to rural areas (GoI 2010) is based around the following vision: 'To ensure permanent drinking water security in rural India', and it details the steps and actions that should be taken to achieve security of domestic water services delivery. These steps and actions are based on the sensible and pragmatic view that there will always be a risk that delivery systems will fail for source-related, technical or institutional reasons. Hence, to achieve water security:

- at the individual household level, the water supply system should not depend on a single source;

- 'Under all circumstances and at all times, it may be required to have an alternate sub-district, district and/or state level water supply system in the form of a grid supplying metered bulk water to GPs/villages by adopting an appropriate system of pricing.'

The inference that can be drawn is that, at the policy level, water security is regarded as more relevant to the sustainable delivery of water services to domestic users. However, the draft 2012 National Water Policy does refer to food security several times, but without linking it to water security.

Internationally, the concept of water security is far from new (e.g., Winpenny 1997). However in recent years, water security has been gaining more attention as a concept that encapsulates the many competing objectives of water resources management (Mason and Calow 2012). Increasingly, water security is also seen as an important goal, not just for water management, but for broader development. However, despite this increasing attention, there is no agreement on how we define water security (Ait-Kadi and Arriëns 2012). To date, the most widely quoted definition of water security is: 'the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies' (Grey and Sadoff 2007).

In this study, we use the definition proposed by Mason and Calow (2012): 'water security means having sufficient water, in quantity and quality, for the needs of humans (health, livelihoods and productive economic activities) and ecosystems, matched by the capacity to access and use it, resolve trade-offs, and manage water-related risks, including flood, drought and pollution'. The main reason for using this broader, multi-dimensional concept of water security is that it is more relevant to assessments, such as this one, that are interested in changes in both the level and the nature (or different dimensions) of water security over time.

Box 10.1 Dimensions of water security

1. **Water security impacts on water services:** Lack of water security often manifests itself in the water services levels that users experience. As levels of water security increase, the probability increases that water services levels both rise and become more equitable, cost-efficient, and sustainable, even during prolonged periods of drought or after extreme events such as floods or cyclones.
2. **There are often multiple causes of low levels of water security:** These causes can be biophysical (e.g., groundwater overdraft), infrastructural (e.g., poorly maintained water supply infrastructure), institutional (e.g., lack of institutional capacity), socio-economic (e.g., social exclusion or inability to pay for water services), and so on. It is also clear that many causes can lie outside

the water sector (e.g., unreliable power supplies to pump water, government programmes that encourage farmers to intensify agricultural water use).

3. **Water security is often multi-sectoral in nature:** Lack of water security can impact many sectors (e.g., food security, power security, and economic and social development, particularly of the poor and marginal social groups).
4. **Water security impacts environmental flows:** When levels of water security are low, it is probable that less attention is given to restoring or maintaining environmental flows or to protecting aquatic eco-systems.
5. **Water security is best treated as a risk:** In terms of planning and management, water security is best treated as a probabilistic risk to water services delivery that varies in space and time. In general, relatively rich societies are likely to have higher levels of water security than relatively poor societies. This is partly because they are more willing and able to make investments that reduce the risk of water security falling below a level that is politically and socially acceptable.
6. **Competition and conflict leads to low levels of water security:** There is no doubt that competition for water or conflict of any type at any scale increases the risk of a decrease in water security especially for poorer and less powerful water users.

The overall aim of this study is to assess the extent to which the level and nature of water security has changed during the last 10–25 years in villages and hamlets in southern Andhra Pradesh. The study area was selected in part because communities living in this area face water-related challenges that are typical throughout rural semi-arid India, and in part because a detailed water audit was carried out in this region during 2002 (Rammohan Rao *et al.* 2003). An additional aim of this study was to assess the extent to which the recommendations of the earlier study had been implemented and, if not, whether the earlier recommendations were still valid.

2 Methods

Analytical Framework

The multi-dimensional nature of water security has been widely reported in the literature (e.g., ADB 2010, Ait-Kadi and Lincklaen Arriëns 2012, Mason and Calow 2012). A common feature of these reviews includes the recognition that water security is different in nature and scope in terms of, say, food security,[1] and that the relevance of water security extends beyond the water sector. Ait-Kadi and Lincklaen Arriëns (2012) argue that encouraging other sectors to consider water in their policies and planning is the only way to ensure water security. Mason and Calow (2012) propose five key dimensions that, they argue, are encompassed by a broader concept of water security. These dimensions were used as a starting point for developing the framework used in this paper for evaluating changes in the local-level water security in time and space (see Table 10.1). Another important starting point was recent literature that highlights the multi-dimensional nature of water scarcity (e.g., FAO 2012).

Table 10.1 Observed changes in the dimensions and nature of water security during 2002–12

Dimensions of water security	*Dhone Mandal (2002)*	*Ungaranigundla revenue village (2012)*
Impact of water security on water services	Around 25 percent of the water points in Dhone are not delivering services that meet government norms in terms of volume of water, quality of water, crowding around the water point, or distance to the water. Increasingly, farmers are relying on their own bore wells for irrigation. In 2002, of the wells surveyed in Dhone Mandal, 1 percent were defunct, 7 percent failed routinely during the summer season or during prolonged periods of drought, while 92 percent have never failed.	Around 20 percent of the households in Ungaranigundla revenue village have water services levels that do not meet government norms in terms of volume and quality of water. In terms of access to water for irrigation, farmers have continued to invest heavily in well construction and/or deepening. In 2012, of the wells surveyed in Ungaranigundla revenue village, 24 percent were completely defunct, 19 percent failed every summer, 11 percent failed during drought years, while only 46 percent never failed.
There are often multiple causes for low levels of water security	The main causes for low levels of water security include: high inter- and intra-annual rainfall variability, poor maintenance of infrastructure, and social exclusion of Scheduled Castes from water points used by other castes.	The main causes for low-levels of water security are the same as in 2002, but, additionally, there is well failure caused by falling groundwater levels that are a result of excessive groundwater extraction for irrigation.
Water security is multi-sectoral in nature	Water insecurity is impacting food security, social development, economic development, and educational attainment of, in particular, females from relatively poor backgrounds.	Increased rainfall variability is likely to have an impact on rainfed agricultural production, and so on food security. During the last ten years failed investments in well construction have become a major cause of hardship for many landowning households.

(Continued)

Table 10.1 (Continued)

Dimensions of water security	*Dhone Mandal (2002)*	*Ungaranigundla revenue village (2012)*
Water security impacts on environmental flows	Whilst watershed development activities have improved/intensified rainfed and irrigated farming, they have also contributed to reduced inflows to tanks and other water bodies. The net result is the loss of important aquatic eco-systems that rely on tanks and water bodies retaining water throughout the year.	As a result of falling groundwater levels, springs and seepage zones have dried up, and base flows have all but disappeared except in the wettest years. Paradoxically, poor maintenance of water harvesting structures has meant that downstream impacts of intensive water harvesting have not worsened during the last ten years.
Water security is best treated as a risk that is variable in space and time	Indications are that inter-annual variability of rainfall may be increasing and, as a result, the risk of reduced water security may be increasing. It is probable that intensive water harvesting and well construction are increasing agricultural water security, but possibly at the expense of village water security in rainfall years. Relatively poorer social groups have the highest risk of low levels of water security.	Further indications that wet years may be wetter and dry years may be drier. Falling groundwater levels means that villages as a whole are more at risk/vulnerable to prolonged drought. However, households with access to reliable agricultural bore wells are much less at risk. Construction of water harvesting structures has become less effective as a means of improving water security.
Competition and conflict leads to low levels of water security	The main source of competition for water is between agricultural and village water users. Competition between private agricultural bore-well owners exists, but only in parts of Dhone where there is a high density of bore-well construction. There has been no attempt to manage inter-sectoral or inter-village competition for water.	Competition between agricultural and village water users has intensified, as has the competition between agricultural water users. The emphasis of government programmes is still on augmenting supply rather than managing inter- or intra-village competition for water.

Description of Study Area

The study area, Ungaranigundla revenue village, is located in Dhone Mandal,[2] Kurnool District, Andhra Pradesh (see Plate 13). The climate prevailing in this mandal is semi-arid to arid. As a result, agricultural production in rainfed areas is not easy, in part because monsoon rains are often unevenly distributed and droughts are common. Dhone is the driest mandal in Kurnool District; far from the eastern coast, this part of Andhra Pradesh does not receive the full benefits of the north-east monsoon (October to December) and, being cut off from the west coast by the Western Ghats, the south-west monsoon is prevented from fully reaching this district – the south-west monsoon and north-east monsoon rainfall contribute around 60 percent and 30 percent of the total annual rainfall respectively (Hill 2001). In agro-climatic terms, this area does not have distinct *kharif* and *rabi* seasons[3] because, rainfall permitting, cropping takes place continuously throughout these periods (except in the deep black soils). Dhone has a geology that comprises both crystalline and sedimentary rocks. In general, the areas underlain by granites are undulating with numerous rock outcrops, while those on sedimentary rocks are hilly with steeper terrain. The soils in Dhone are predominantly red sandy loams (alfisols) with a depth in the range 0.3–1.0 m. The remaining area is covered by black clayey soils (vertisols).

Ungaranigundla revenue village was selected for the study in part because of the earlier 2002 water audit and in part because the administrative boundary of this revenue village matches reasonably well with hydrological boundaries. This revenue village has a total area of approximately 25 sq km and consists of four villages and 1,087 total households; Plate 13 shows the land cover and the location of the four villages. The dominant land use is single-crop agriculture, which accounts for 60 percent of the total area, and crop cultivation is predominantly rainfed. Double-crop irrigated agriculture accounts for 8 percent of the total area. However, the irrigated area and the intensity of cropping (number of crops grown on the same land per year) fluctuate year by year depending on water availability. Other significant land uses within the revenue village include scrub forest/land, plantations (mainly mango trees) settlements accounting for, respectively, 16 percent, 11 percent and 3 percent of the total area.

Data Collection

The focus of data collection during 2012 was on updating information collected during the 2002 water audit (Rammohan Rao *et al.* 2003). This included updating the rainfall analysis, re-assessing the status of ground and surface water resources, remapping the location and functionality of water-related infrastructure, and re-assessing the service levels and demands of water users. Using an approach that involved the active participation of the Gram Panchayat[4] and community members, surveys were made of all the wells and water-harvesting structures in the village. The geographical location of the wells and structures was recorded using hand-held GPS sets.

3 Results

Dhone Rainfall

A widely held view is that annual average rainfall has been declining in the dry areas of southern Andhra Pradesh. However, statistical analysis of a hundred years' data from thirteen stations of Anantapur District[5] revealed that, if anything, the average annual rainfall has been increasing, albeit by around 25 mm since the mid-1970s (Hill 2001). This analysis also indicated that during the recent decades of 1981–1991 and 1991–2001, nine of eleven stations were experiencing increasing rainfall variability. Further, analysis of recent annual rainfall data showed that the annual rainfall totals and variability appear to have increased during recent decades (see Figure 10.1). Whilst this analysis is based on only one station, the indications are that the dry years may be becoming drier and wet years wetter.

Groundwater Extraction

The 2002 water audit reported that there had been a dramatic increase in the construction of wells in Dhone Mandal during the preceding 15 years primarily for groundwater-based irrigation (Rammohan Rao *et al.* 2003). However, by 2002–03, a large number of open wells became defunct or were failing routinely, and the prognosis was that there would be a marked shift from open well to bore well construction. The prognosis was also that competition for water between farmers would intensify. Plate 14 summarises the findings of the well survey carried out in the Ungaranigundla revenue village in 2012. This shows that, as predicted, farmers continued to invest heavily in well construction during the last decade. Figure 10.2 also shows that

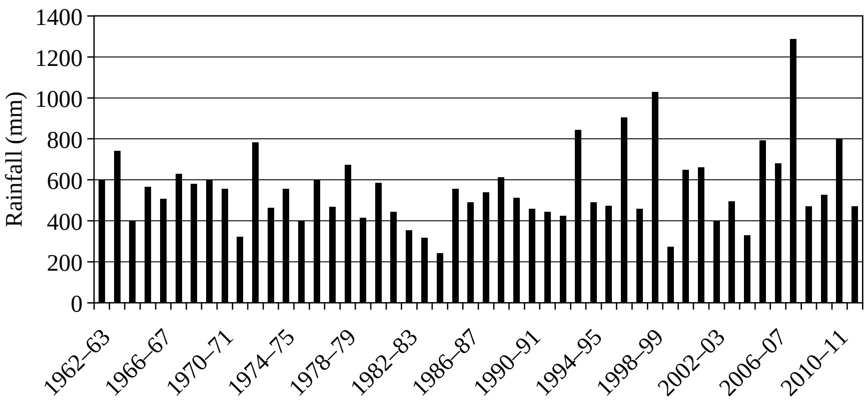

Figure 10.1 Dhone – Rainfall per water year for the 50-year period 1962–2012 Average 1962–87: 516 mm (Standard Deviation = 133) Average 1988–2012: 603 mm (Standard Deviation = 234)

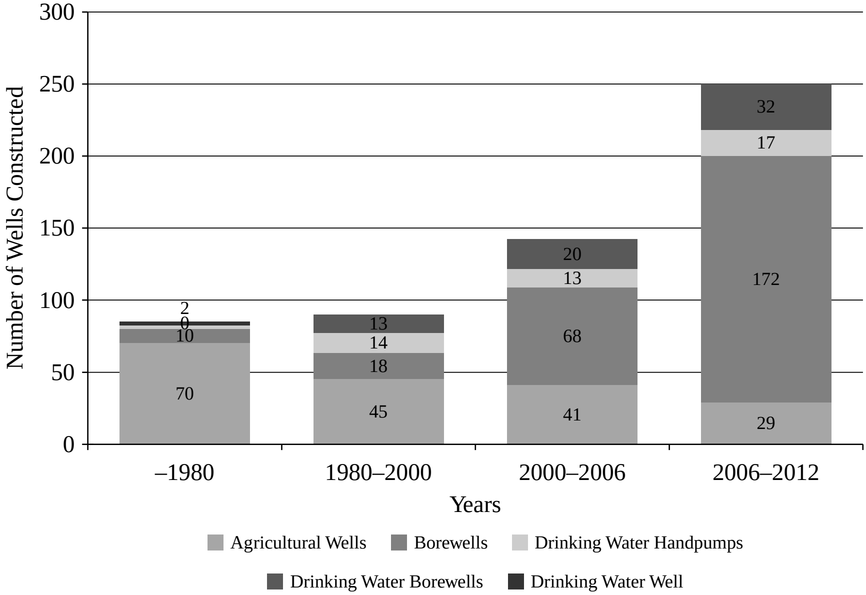

Figure 10.2 Well construction and type in Ungaranigundla revenue village (Batchelor, 2012)

the type of wells being constructed has changed over time. Up to 1980, 85 percent of the wells constructed were agricultural open wells, while only 12 percent were agricultural bore wells. Between 2000 and 2006 the percentage of agricultural open wells constructed had fallen to 29 percent, while that of agricultural bore wells constructed had increased to 46 percent. Finally, by 2006–2012 the proportion of wells agricultural open wells constructed had dropped to just 12 percent, while the figure for agricultural bore wells had risen even further to 85 percent.

Another interesting trend shown in Figure 10.2 is the increasing construction of drinking water bore wells. During the periods 1980–2000, 2000–06, and 2006–12, as many as 11, 20, and 32 bore wells were constructed respectively. In terms of the number of wells constructed per year, the rate has increased from approximately one new well every two years to five new wells every year. This is an indication of the increase in the annual capital investment in public water supply over the last thirty years or so, mainly to replace failed or failing bore wells. In the case of Ungaranigundla village, water is now supplied by three bore wells, each over 100 metres deep, 2 km south of the village. However, one of these three new bore wells failed recently, and as a result check dams have been built in the nearby drainage channel in an attempt to increase local groundwater recharge.

Further, not only has the type and number of wells changed significantly over time, the depth of the wells has increased also. Figure 10.3 shows the

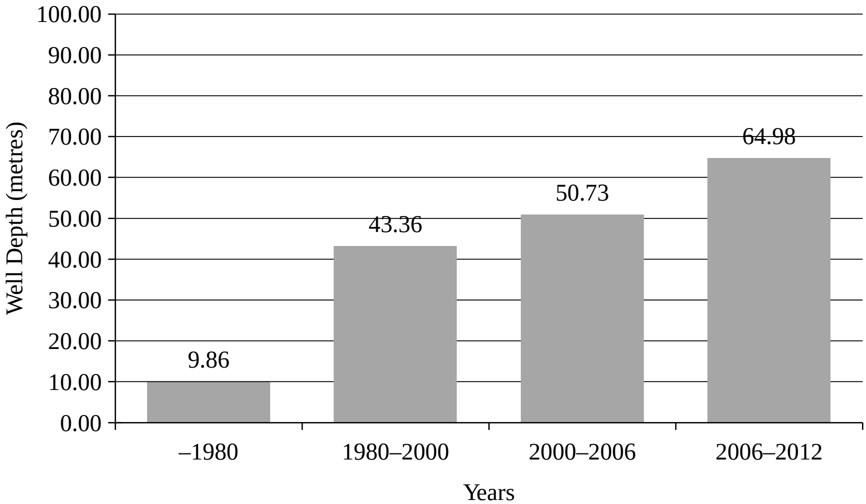

Figure 10.3 Average depth of wells constructed in Ungaranigundla revenue village (Batchelor, 2012)

average depth of wells constructed for four time periods up to 2012. Those constructed until 1980 had an average depth of only 9.9 metres; between 1980 and 2000 the average depth increased by 340 percent to 43.4 metres; and by 2006–12, the average depth was 66 metres. Implications of this finding include higher costs of well construction (drilling costs are usually linked to the depth drilled) and higher recurrent costs (since more energy is needed to lift water from deep bore wells).

The 2002 water audit reported that less than 1 percent of the wells surveyed in Dhone were defunct; 7 percent failed routinely during the summer season or during prolonged periods of drought, while 92 percent never failed. On the other hand, the 2012 survey reported that 24 percent of the wells surveyed in Ungaranigundla revenue village were completely defunct, 19 percent failed every summer, 11 percent failed during periods of drought, while only 46 percent never failed. This indicates that both the absolute number and the percentage of problematic wells increased significantly during the last decade.

Water Harvesting Structures (WHS)

The 2002 water audit reported that water harvesting structures (or gully control structures) were more prevalent in the red soil areas of Dhone. It also noted that there were 18 tanks in Dhone, but inflows to these tanks had reduced as a result of the combination of water harvesting, groundwater extraction and agricultural intensification (including changes in land use) in the catchment areas of the tanks. For example, it was estimated that the annual inflow into the

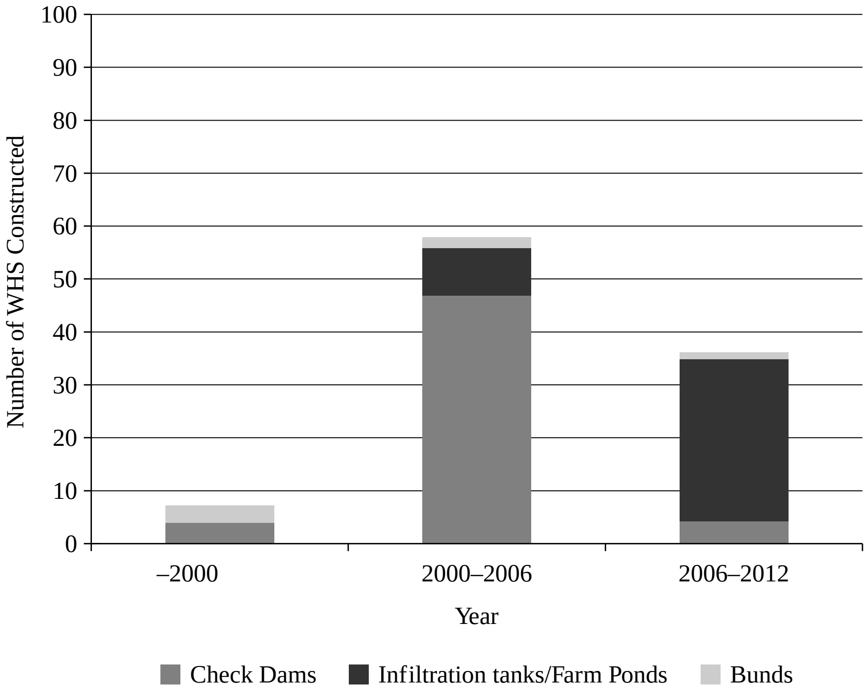

Figure 10.4 WHS construction in Ungaranigundla revenue village (Batchelor, 2012)

Yapadinne Tank had reduced by around 40 percent as a result of WHS and increased groundwater extraction for irrigation in the tank's catchment area. The 2012 WHS assessment in Ungaranigundla revenue village indicated that WHS structures have continued to be an important component of watershed development programmes in this area (see Figure 10.4). Interestingly, the majority of the check dams were constructed during the period 2000–06, while most of the infiltration tanks were built after 2006. This indicates that there have been some subtle changes in the policies and practices of the Government of Andhra Pradesh (GoAP) Department of Rural Development (i.e., a shift from constructing storages along drainage lines to creating storages in interfluvial areas).

Plate 15 shows the distribution of WHS in Ungaranigundla revenue village in 2012. These include 55 check dams, 42 infiltrations tanks/farm ponds and 6 bunds, spread extensively across the revenue village and particularly along drainage lines; in total, approximately US$ 550,000 has been spent building WHS there. Despite this significant investment, more than half of the WHS in this revenue village are either defunct or in need of repair (see Plate 15). This illustrates that most government programmes focus on capital expenditure and leave recurrent expenditure (e.g., O&M costs) to village Gram Panchayats, which are either unable or unwilling to take on this responsibility. It should also be noted that, despite the high-level of investment in water harvesting during recent years, the depth of wells and the probability of well failure have increased. This reaffirms the fact that well-planned WHS construction can, and often does, deliver significant benefits – although intensive WHS construction alone cannot be relied upon to restore the wide-scale imbalance between water supply and demand.

Water Services

The 2002 water audit found that around 25 percent of the village's supply water points in Dhone Mandal were problematic, inasmuch as they failed to meet government norms in one respect or another (e.g., volume of water supplied, quality of water supplied, crowding around water points, distance to water point, etc.). The 2012 assessment of water services in Ungaranigundla revenue village showed that around 20 percent of the households had water services that fell below government norms, and these households were often located in the poorer areas of the villages. So, although the metrics and scale of measurement are different, it is apparent that between 2002 and 2012 there has been little change in the percentage of users not receiving services according to government norms (i.e., 20–25 percent).

4 Discussion and Conclusions

Although physical water scarcity (defined as an imbalance between water supply and demand) often contributes to low levels of water security, physical water scarcity is just one of the many possible causes (Winpenny 1997, Mason and Calow, 2012, Ait-Kadi and Lincklaen Arriëns 2012). WaterAid (2012) argues that, for most of the 800 million people worldwide who lack access to safe water, the primary problem is rarely one of physical water scarcity; the causes are more likely to be linked to, for example:

- insufficient political will to improve water supply services and management of water resources;
- insufficient investment in water supply services and management of water resources – particularly insufficient recurrent expenditure on operation and maintenance, capacity building, and institutional support mechanisms;
- exclusion of certain groups because of inability to pay, political affiliation, disability, race, caste, gender, age, or social status.

An overall conclusion of the 2002 water audit in Dhone Mandal was that demand for water was outstripping the supply and that the scope for supply augmentation was limited (Rammohan Rao *et al.* 2003). However, the 2002 water audit also showed that water scarcity and low levels of water security for many households and social groups was linked to factors such as social exclusion, caste, poverty and even failed private investments in bore well construction. The 2002 water audit also showed that watershed development activities (e.g., intensive water harvesting) funded by the GoAP and international agencies could improve the water security of some social groups or some villages, but at the expense of reduced water security for other social groups or downstream villages (Batchelor *et al.* 2003).

The 2002 water audit also predicted that farmers would continue to invest heavily in well construction, groundwater extraction would continue to increase relative to recharge, and groundwater levels would fall regardless of the expenditure on water harvesting structures. The 2012 follow-up study in Ungaranigundla revenue village (one revenue village within Dhone Mandal) confirmed that this prediction was correct. The 2012 study also shows that water security for many water users has declined despite high levels of government expenditure on water supply infrastructure and watershed development activities. Another important finding is that the water security of many relatively rich and/or lucky households in Ungaranigundla revenue village have increased as a result of successful investments in self-supply of water for domestic, irrigation and other productive uses. Better security of relatively rich households is not a surprising finding, but the role of luck is often overlooked. It was observed that the dividing line between winners and losers during periods of competitive well-deepening was determined as much by luck as, for example, willingness and ability to invest in well construction or deepening. This is because the hydro-geological characteristics of the basement regolith underlying Dhone and Ungaranigundla revenue village are highly variable. Some farmers have been lucky enough to strike water-bearing fissures in the regolith when drilling or deepening a bore well, whilst the others were not so lucky.

Table 10.1 summarises the changes in the levels and nature of water security in Dhone Mandal and Ungaranigundla revenue village during the decade 2002–12. These can be further summarised as follows:

- Village water supply services have not changed significantly. They remain unacceptably low, with approximately 20–25 percent of the households having domestic services that do not meet government norms. The two studies showed that social exclusion and geographical location in villages or hamlets are major determinants of the domestic water services of households and social groups.
- Groundwater levels have declined rapidly during the last ten years. As a result, physical water scarcity is a problem affecting both the village and irrigation water-users.
- As a result of falling groundwater levels, groundwater can no longer be relied upon as a source of water during prolonged periods of drought.
- Variability in annual rainfall appears to be increasing. This is affecting the viability of the rainfed farming systems, and it may also be leading to an

increased frequency of damaging floods that affect both landowning and non-landowning households.

- Although the names may have changed, the content of government programmes such as the IWMP, NRDWP and NREGA has changed little during the last ten years. They continue to fund the construction of water harvesting, even though the value for money of these investments has declined. Only limited funds are available for managing demand for water or for maintaining the existing water supply or harvesting.
- The risk that the lack of water security will have a damaging impact on livelihoods, development and the environment has increased significantly during the last ten years as a result of groundwater decline. Plans for linking multi-village water supply systems may reduce this risk, though significant doubts exist over the ability of this system to provide a reliable safe source of water.

The 2002 water audit prompted vigorous discussion amongst key stakeholders, including the implementers of the DFID-support livelihood programme that funded both the water audits in Dhone Mandal during the period 1998–2007.[6] Table 10.2 summarises the extent to which the 2002 water audit prompted change in policies and practices in Dhone Mandal.

Table 10.2 shows that the 2002 water audit recommendations have had a limited impact on the GoAP policies and an even more limited impact on the government and DFID-supported programmes that have been implemented in Dhone during the last ten years. Whilst the fundamental need for regulating and managing the demand for water is recognised increasingly by many water professionals, political and public opinion – as well as the view of the media, NGOs and most government staff working in the sector – firmly remain that the solution to water security problems lies in more engineering (e.g., recharge structures and inter-basin transfer schemes). This, coupled with fact that

Table 10.2 The 2002 water audit recommendations and evidence of their implementation in Dhone Mandal

2002 Recommendations	*2012 Evidence of Implementation*
Programmes for watershed development should promote a wider range of activities and interventions aimed at improving water use productivity and/or equitable access to water resources.	Water use productivity and equitable access to water are still major issues. Emphasis is still on a relatively small number of water development and source protection activities and interventions.
Trade-offs and externalities associated with activities or interventions related to watershed development should be identified, assessed, and, if relevant, mitigated.	Potential trade-offs and externalities have been ignored in Dhone despite increased evidence and recognition of their importance (e.g., Reddy *et al.* 2011).

2002 Recommendations	*2012 Evidence of Implementation*
Rather than use a 'one size fits all' approach to planning and budgeting, activities and interventions for watershed development should be matched to the physical, social and institutional settings as well as local-level priorities.	There has been no change in the manner in which the activities and interventions are selected. The assumption continues to be that these interventions and activities work well for every context.
Village-level planning of watershed development and source protection should take place within a wider district-level planning framework, so that issues, such as upstream–downstream equity, security of village water supplies, pollution control, and protection of environmental flows are taken into account.	The unit of watershed development planning has increased from 500 ha to 1,000–5,000 ha. In theory this should provide more scope to handle a broader range of issues, but this has not been the case in Dhone.
Programmes for Watershed development should shift their emphasis from augmenting water supply to managing demand for water.	The emphasis continues to be on local supply augmentation (e.g., IWMP, NRDWP, NREGAs) and/or bulk transfer of water from distant sources.
Monitoring and Evaluation and systems should be GIS-based and must take into account the users' views of the water services they receive (i.e., 'official' statistics should be compared routinely with the outputs from social auditing).	The 2010 NRDWP programme framework for action includes use of mapping and social auditing, but these methods are not being used in Dhone.

public-sector construction projects provide opportunities for exercising power and accruing benefits, means that it is surprising that less politically challenging interventions such as augmenting supply and increasing efficiency of water use are favoured (COMMAN 2005).

The negative perceptions contribute significantly to the resistance to any shifts from engineering supply-side solutions towards an increasing emphasis on managing the demand and consumptive use of, in particular, the agricultural sector. For many, these perceptions are founded on the belief that managing demand necessitates setting tariffs and charging for water. However, the aim of demand management is simply to ensure that a given supply of water is distributed in closer accord with its 'optimal' use pattern, however this might be conceived or negotiated (FAO 2012). In water scarce areas, 'optimal' use patterns will inevitably require tough political decisions and result in winners and losers (i.e., the pattern may be optimal for the majority, but bad news for individual water users). However, in areas such as Dhone this has to be a better option than the current free-for-all that is causing an inexorable decline in water security, particularly for the poor and marginal social groups.

So what can be done to make demand management more palatable? One option is to move the focus of attention away from economic instruments to a wider mix of regulatory instruments and, more importantly, to creating incentives to users who consume and/or pollute less water. Another argument for shifting away from economic instruments is the fact that demand management through pricing of water (or the power to pump water) is more effective in managing domestic supply but much less good at managing agricultural water supply and consumptive use (Molle and Turral, 2004). The simple fact is that returns from groundwater irrigation often outweigh the disincentives resulting from changes in power pricing; moreover, in the absence of power quotas such changes have a limited impact on the overall volume extracted (Moench 1995, Kumar and Singh 2001). In addition, it is difficult to tailor pricing policies to meet groundwater extraction needs in specific areas (COMMAN 2005).

The view of Shah *et al.* (2007) is that attempting to impose regulatory reforms such as pricing and new forms of organisation in largely informal water economies (as found in India) is ill-advised, not because they are not needed but because they will fail. Rather than attempting to impose new institutional arrangements and water management practices (e.g., water pricing), the focus should be on promoting and facilitating innovation at the local level. Meanwhile at the macro-level the focus should be on managing change and building institutional capacity (Merrey and Cook 2012), on the basis that, over time as the economy develops, the formal water sector will expand, and the informal water sector will contract.

Molle and Turral (2004) argue that direct controls adapted to the local context appear to be the easiest and most efficient means of reducing consumptive agricultural water use. Direct controls have two overwhelming advantages over economic instruments:

- first they ensure a degree of transparency and equity in the face of scarcity; and
- second, they are directly effective in bringing use in line with the available resources.

This adjustment by users to direct controls is made easier if the supply of water (or power to pump water) is gradually, rather than abruptly, decreased and if the reduced supply is both predictable and dependable. Given also that the empirical evidence shows water use is invariably curtailed through supply management and establishment of quotas, rather than by price mechanisms (Molle 2011), it seems that, despite the challenges, direct controls could and should be a prominent part of the mix of regulatory instruments in water-scarce areas of India. However, for this to be politically and socially acceptable, they should be used alongside the following:

- encouraged self-management (e.g., groundwater sanctuaries or conservation zones);
- compensation schemes;

- systems of intelligent rationing of power for pumping groundwater, as described by Shah *et al.* (2007) and Shah (2011); and
- improved planning and targeting of groundwater recharge.

Increased emphasis on demand management using a range of coping strategies (e.g., FAO 2012) is fundamental to improving water security in Dhone and other water-scarce areas of India. However, it is recommended that more attention is given also to information management. One of the conclusions of the 2002 water audit was that 'policies and practices are needed that are based on accurate information that seek long-term solutions'. A major finding of the 2012 survey is that the GoAP continues to fund many watershed development activities in Dhone and elsewhere in the belief that they will, amongst other benefits, improve the levels of water security. By using water accounting/auditing, the study reported here has shown that the levels of water security for most water users is declining in Dhone despite heavy government investment during recent decades on watershed development and rural water supplies. Hence there is a solid argument for water accounting/auditing to be mainstreamed into information management systems and used as the basis for support for ongoing or future water-management programmes (FAO 2012). Not only does water accounting/auditing provide a solid basis for evidence-informed decision-making, if used routinely, water accounting can also help identify the possible unintended impacts (or externalities) that can often arise even when the policies or practices are based on meticulous planning processes.

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11 Assessing Progress towards Sustainable Service Delivery in India: Lessons for Rural Water Supply[1]

A.J. James

I Introduction

Over the last decade, several different Service Delivery Models (SDMs) have been tried in the rural drinking water supply sector in India, including that of the *Swajaldhara* programme of the Government of India (GoI), the Water and Sanitation Management Organisation (WASMO) of the Government of Gujarat, and those of the World-Bank-supported schemes in Maharashtra (*Jalswarajya*) and Kerala (*Jalanidhi*). This chapter details these innovative approaches to service delivery at the national policy level, as well as the intermediate and system levels, before discussing key success factors behind the spread and sustainability of innovative SDMs and challenges for future scaling up, including the fact that effective scaling up to 100 percent may well be impossible.

II Service Delivery Models and Governance

Definitions and Modalities

The national model of service delivery is of government-designed and -planned provision, although communities are being involved in schemes under *Swajaldhara*, the national rural water supply programme started in 2002, based on the findings of externally-funded projects, implemented with the support of NGOs.[2]

Swajaldhara SDM (Tamil Nadu)

The Sector Reform Pilot Projects (SRPP) of 1999 implemented by the Government of India in 67 selected districts throughout the country (Mohandas 2003) was the root of this demand-driven and community-based SDM. Community participation, however, does not extend to the planning or monitoring of water supply systems or major repairs – all of which are carried out by government department staff at district level – and is largely limited to making contributions to capital and O&M costs, while the Village Water and Sanitation Committees (VWSCs) are responsible for collecting payments and rudimentary repairs (James 2004). Although implemented throughout the country, the *Swajaldhara* SDM is described here in the context of the State of Tamil Nadu.

WASMO SDM (Gujarat)

Until 2002 rural water supply in the State of Gujarat was the sole responsibility of the Gujarat Water Supply and Sewerage Board (GWSSB), and the predominant source was groundwater. In a major step towards reforms in the sector, the Water and Sanitation Management Organisation (WASMO) was created in 2002 with Dutch assistance to promote decentralised, demand-driven and community-owned water supply and sanitation systems. It was created by Community-Based Organisations (CBOs) called the *Pani Samitis* (water committees) to provide safe drinking water in their villages. The *Pani Samitis* currently operate in all the 15,000-plus villages in which WASMO is currently operating. They enjoy full financial autonomy and freedom to select contractors and vendors, participate in designing structures, and implementing the schemes which, after completion, are handed over to the *Pani Samitis* for operation and maintenance. Intensive and regular training of the *Pani Samiti* members and other villagers in project management, as well as financial and auditing processes ensures transparency in operations and water supply that meets the national quality norms.

Jalswarajya SDM (Maharashtra)

In Maharashtra State, the Water Supply and Sanitation Department (WSSD) is responsible for water supply, supported by two technical wings: Maharashtra *Jeevan Pradhikaran* (MJP) and the Groundwater and Survey Development Agency (GSDA). The MJP is the new name for the Maharashtra Water Supply and Sewerage Board (MWSSB) constituted in 1997. It is responsible for constructing and handing over rural water supply infrastructure to the village panchayats in rural areas and the Urban Local Bodies (ULBs) in urban areas. The ULBs and panchayats are in turn responsible for the operation and maintenance of these newly-created assets, as well as major repairs and the renovation of schemes over time using a variety of different funds. The innovative World Bank supported rural water supply, and sanitation SDM (*Jalswarajya*) was implemented from 2003 to 2009 through a 100-member Reforms Support and Project Management Unit (RSMU) in 3000 GPs in 26 of the 33 districts in the state. There are 25-member district-level units, each with a mixed group of technical, administrative, social and financial skills, and a strong support structure comprising a District Facilitation Team to oversee infrastructure provision, a District Appraisal and Monitoring Team to oversee the quality of processes, and a District Finance Monitoring Team to oversee the finances. At the village level, there is a VWSC to contract out the construction of infrastructure and then to operate and manage it, a women's empowerment team to provide income-generating opportunities for women working in water and sanitation activities, and a social audit committee to check and approve the contracts and payments made. The NGOs and para-professionals support these villages.

Jalanidhi SDM (Kerala)

The Kerala Water Authority (KWA) was solely responsible for the design, construction and maintenance of all rural water supply schemes in the state until 1998. As part of the unique People's Planning Campaign since 1996, the Government of Kerala barred the KWA from initiating any more Single-Village Schemes (SVSs) and asked it to hand over all the existing schemes to the Gram Panchayats (GPs). It gave the GPs the power to implement and maintain the schemes and to levy and collect water charges for their operation and maintenance (RDC 2008, 11).[3] The Government of Kerala also approached the World Bank (WB) for funding support to implement a new demand-driven community-based rural water supply and sanitation project, which was accordingly formulated as the Kerala Water Supply and Environmental Sanitation Project (KWSESP or *Jalanidhi*), and implemented from 2000 to 2008 (World Bank 2009). The Government of Kerala then created the Kerala Rural Water Supply and Sanitation Authority (KRWSA) as an autonomous institution under the Department of Water Resources, which acts as the Project Management Unit (PMU). The project became operational in four of the 13 districts in the state, each of which had a District-level PMU (DPMU), although the project did not cover all villages in each district. The PMU itself has multi-disciplinary specialists from both the government and the private sector. The project engaged NGOs to work as support organisations and provided extensive capacity-building and trouble-shooting services; but the real strength of the SDM is the creation and empowerment of the beneficiary groups, and their federations, as well as the responsibility and leadership shown by the GPs in the project areas.[4]

Institutional Responsibilities for Service Provision

Planning

In the *Swajaldhara* SDM, the water supply schemes are planned by the RWS engineers at the sub-district level and approved by the RWS Superintending Engineer (SE) of the district. In the WASMO and *Jalswarajya* SDMs a consultative process is followed with the members of the CBO (e.g., *Pani Samiti,* VWSC or beneficiary group) and the engineers of the supporting PMU. In addition, in the *Jalanidhi* and *Jalswarajya* SDMs the SOs and TSPs respectively provide technical services for planning the rural water along with the community. The KRWSA and RSPMU mainly look at finding technological solutions to issues such as water quality, metering, regulating piped water flows, and source sustainability.

Construction

In the *Swajaldhara* SDM construction is carried out by the contractors selected by the RWS engineers, while in the others the CBOs (*Pani Samitis*, VWSCs, beneficiary groups) hire the contractors. The CBOs are also involved in 'community contracting', where they list the material required, approach vendors (approved by the technical staff of the central Project Support Unit), place orders, and check the consignment that arrives before paying the vendors through a cheque from the CBO.

In the *Jalaswarjya* SDM, this process goes further:

1 the GP is empowered by the state government policy to undertake construction work that is less than Rs. 100,000 in value – and does not have to tender or contract such work even to the RWS engineers; and
2 the village social audit committee, another CBO, scrutinises and approves all contracts issued and payments made by the VWSC, and takes action if discrepancies or corruption are discovered.

In *Jalanidhi*, the beneficiary groups carry out their own construction in all the new schemes, bringing down costs by up to 20 percent of the estimates provided by the KWA (RDC 2008). Thus, in the WASMO, *Jalswarajya* and *Jalanidhi* SDMs, the GP plays a critical role in overseeing the construction, while the CBOs have a more direct supporting role at the village level.

Operation and maintenance

In all the SDMs the community has to bear 100 percent of the O&M costs, a provision integral to the SRPP of 1999. This created some confusion among the CBOs and engineers in cases of 'major repairs' – such as a pump motor burning out, or a pipeline burst – which entail relatively high costs. In the *Swajaldhara* SDM, the *de facto* situation is that the CBOs carry out all minor repairs, and when the repair is major, government engineers are called in. Neither the *Jalswarajya* nor the *Jalanidhi* SDM have faced major repairs yet, since the infrastructure is fairly new. However, in the WASMO SDM, even major repairs are carried out using village funds.

The day-to-day operations (e.g., operating the pumps, collecting user charges, and maintaining accounts) and minor repairs (replacing washers or taps and preventive maintenance) are the responsibility of the CBOs in all SDMs. However, the actual performance depends on the strength and commitment of the CBOs. In Tamil Nadu, among the GPs implementing the *Swajaldhara* schemes, the VWSCs were either inactive or completely non-functional (i.e., they have not met since the VWSC was formed; the meetings happen only on paper).[5] On the other hand, the *Jalswarajya* SDM has also set up a Women's Development Committee (WDC) to provide livelihoods for village women and, in many cases, the women's Self Help Groups (SHGs) have been awarded contracts for the O&M of the village water supply system. This is a unique feature that allows women, the main stakeholders in sustainable water supply, to earn from work that involves maintenance of their water supply service. Furthermore, in the *Jalanidhi* SDM, although there is no formal institution like the WDC, there has been a strong focus on providing livelihood opportunities to women, and several new enterprises have been set up, although not necessarily connected with rural water supply (RDC 2008).

Monitoring

This is supposed to be done by the CBOs, but is a weak link in the project implementation cycle here, as it is globally. Village-level data is largely restricted to financial accounts. However, the active CBOs in the WASMO, *Jalswarajya* and *Jalanidhi* SDMs do a better job at monitoring, largely because improved services have increased community responsibility and interest in monitoring the system. This was also apparent in the TNRWSP, where the RWS engineers, motivated by the change management process, focused on enhancing community awareness of the value of water and the need to monitor leakages and overall system performance (Pragmatix Research & Advisory Services 2007). The financial monitoring system of the *Jalanidhi* Project was judged to be one of the best among all the World Bank RWSS projects and was set up by a dedicated team led by a chartered accountant (RDC 2008).

Post-construction support

As mentioned earlier, maintenance (including post-construction repairs) is formally the responsibility of the community in all the SDMs, but support for major repairs is provided by government RWS engineers, except in WASMO, where the *Pani Samiti* uses its own funds even to hire private contractors for repairs. Training and exposure visits are part of the capacity-building provided to the CBOs under the WASMO, *Jalanidhi* and *Jalswarajya* SDMs, but it is largely missing in the *Swajaldhara* SDMs. The *Jalswarajya* SDM also had two interesting features – sustainability evaluation exercises and community monitoring, which were conducted periodically in order to assess the status of service delivery after construction (World Bank 2010). In all cases the GP has a critical role in addressing social and political issues connected with opposition to payments, unequal supply, repairs, and liaison with government departments whose activities affect the rural water supply provision.

Strategic Planning for Full Life-cycle Service Delivery

In *Swajaldhara*, all roles and responsibilities (including capital investment, operation and maintenance, and monitoring) were worked out at the national level, and thus district-level operations require a thorough understanding of these provisions in order to exploit the leeway provided to adjust to local situations. Unfortunately, in most states *Swajaldhara* has become just another rural water supply scheme, albeit with some 'inconveniences' for RWS engineers, such as forming VWSCs and sharing responsibility for operation and maintenance. There is, therefore, little strategic planning for the full life cycle of service delivery at the intermediate level. Priorities are set by the RWS engineers, and often the guidelines for demand-responsive self-selection are followed only in letter and not in spirit, with local politicians and engineers deciding the selection of the villages and directing the village to apply for the *Swajaldhara* scheme. In many other cases the contractors fill in the forms and even put up the initial 10 percent capital cost contribution – which is supposed to come from the community – in return for 'getting the scheme sanctioned' and a construction contract (James 2004).

In the case of the other SDMs, there are state-level guidelines for strategic planning, but these are less rigid and can be modified relatively more quickly on the basis of field experience. Strong training and information-sharing systems in these SDMs ensure that the staff is aware of the guidelines and how to implement them. They are also aware that local situations may require modifications and encourage local solutions; they discuss these experiences at workshops and meetings in the state unit. Priorities are set by the CBOs in all the three SDMs, based on local conditions and demand.

Thus, in all the three SDMs planning for rural water supply infrastructure investments is done at the local level, while capital investment comes from state government funds. In none of the SDMs, however, is there long-term strategic planning in terms of phased investment for future demand or adaptation to threats from climate change to source sustainability (Batchelor *et al.* 2010).

Project Implementation Approaches

All the three SDMs follow a demand-driven, participatory and community-based approach to rural water supply provision. However, this is applied much better in the *Jalswarajya, Jalanidhi* and WASMO, than in the government's *Swajaldhara*, largely because the staff in the former are better informed about the concept and interpretation of the approach on the ground, and also more experienced in participatory approaches to development in general. In WASMO there were intensive discussions and consultations on the approach, using academics and NGOs, before it was finalised. Similarly, in *Jalswarajya* and *Jalanidhi* the World Bank provided inputs, and the staff of the PMUs, along with other resource persons, go through a lot of the strategic thinking on project implementation approaches, which are further fine-tuned on the basis of field experience.

In the *Swajaldhara* SDM, on the other hand, although there was considerable discussion with external support agencies like the World Bank and DANIDA at the beginning, before the officials at the Rajiv Gandhi National Drinking Water Mission finalised the approach, the state and district-level officials – who had to implement the approach on the ground – understood it inadequately. A study in 2004 on the implementation of *Swajaldhara* in the southern state of Andhra Pradesh concluded: 'It is clear that national and state governments were unprepared for the SRPPs, and it took a long time to put in place even the minimal support structure required for implementation, including conceptual clarity, capacity building inputs and a monitoring system' (James, 2004, 64).

Capacity to Fulfil Functions for Service Provision and Governance

The problem of low capacity to fulfil governance functions of the *Swajaldhara* SDM has been documented (e.g., James 2004, Joshi 2004). The challenge was making technically trained engineers work on socio-economic and institutional issues that are the basis of community management. This is not to say that the central and state governments did not make attempts. Though RWS engineers were sent for training, the selection of engineers to be sent for training and the quality of training programmes tend to be uneven.[6] Despite these attempts, James (2004, 66) found that 'while there were facilitating government orders, training manuals, clarity on institutional structures, establishment of a project support unit, and IEC guidelines, the operational details of the sector reform approach were just not understood well enough by senior and junior level government staff in state and district offices. Thus implementation of these pilot projects continued in the same supply-driven, top-down, community-insensitive mode of traditional rural water supply infrastructure delivery – except that the same government engineers were not doing community mobilisation as well.' A key problem was that the same engineers were being used for the new approach, but without adequate training or capacity-building to undertake these new roles and responsibilities. However, the root of the problem probably lies in the historically low priority given to training and capacity-building, where training is seen as a necessary evil by the trainees – as the quality of the courses and trainers tend to be poor.

The WASMO, *Jalanidhi* and *Jalswarajya* SDMs, however, have much better capacities largely because most of the PMU and DPMU staff was hired from the open market (e.g., 85 percent in WASMO). In addition, the *Jalswarajya* SDM had district capacity-building consortiums comprising engineering colleges and polytechnics (hired to provide technical support to communities) and capacity-building organisations ('to build capacity and mentor and coach both district teams and support organisations' (RSPMU, n.d., 14–15)). They also 'facilitated the interaction between private sector service providers and communities to expose the former to various opportunities and develop partnerships' and built 'the capacity of public service providers to deliver services in a demand-driven manner' (*ibid.*). The *Jalanidhi* SDM also helped build the capacities of the local communities to 'plan, implement and manage local water supply schemes in a sustainable manner' and also to develop local entrepreneurship (RDC 2008, 45) through measures such as skill-building, women's empowerment, and greater involvement of women in local self-governance (i.e., in panchayati raj institutions including GPs, block panchayats, and district panchayats). General skill-building initiatives aim to build 'self-confidence, develop the right attitude and knowledge in managing the affairs of [beneficiary groups] and their water supply schemes' (*id.*), while specific measures aimed at 'enhancing or imparting new skills so that these can be used to improve livelihood security of households' (*id.*). Special need-based capacity-building programmes were developed and carried out by the SOs, who were trained by the KRWSA staff to carry out Training of Trainers (TOT) programmes and, in turn, trained the trainers in community groups. For entrepreneurship training, aspiring entrepreneurs were given general training, facilitated to choose from a list of viable enterprises, and offered capital grants from the project along with the possibility of taking loans from financial institutions.

In Tamil Nadu, as part of the Tamil Nadu Rural Water Supply Pilot Project, a unique change management initiative was carried out in 2004 to motivate and challenge rural water supply engineers to 'do things differently'. The unorthodox appeal to engineers' self respect and sense of duty, through a series of intensive workshops facilitated by UNICEF-supported consultants, had a dramatic effect on their attitudes and behaviour, including improved community interactions, which in turn, impacted the performance of rural water supply service delivery on the ground.

The success of WASMO, however, has led to the provision in the new national guidelines (GoI 2010) to set up Water Supply and Sanitation Organisations (WSSOs) in each state, subsuming the Capacity and Community Development Units (CCDUs) already set up in the wake of *Swajaldhara*, in order to strengthen capacities at all levels of RWS engineers and other stakeholders. Thus, the PMUs of WASMO, *Jalswarajya* and *Jalanidhi* are now set to transform into state-level WSSOs.

III Service Delivery Models at System Level

Institutional Arrangements for Service Provision

The CBOs are the main institutions responsible for community-level service provision under all three SDMs. Under the *Swajaldhara* SDM, the VWSCs have been formed to organise community contributions in cash and kind for construction (10 percent of the total cost), look after the O&M of the constructed infrastructure, and collect user charges to cover 100 percent of the O&M expenditure. In some cases the NGOs were involved, though there was a lack of clarity about roles and responsibilities between the NGOs, VWSCs and government engineers. Furthermore, due to the poor capacity-building of the VWSC members and of the government engineers, and their consequent lack of awareness of how exactly to mobilise the community, performance has been poor on the ground. Another problem in many cases was the lack of integration of the VWSCs with the local government tier at village level – the GP.

The WASMO developed an innovative approach towards institutionalising community management: *Pani Samitis* were formed to carry out the same functions as in the case of the *Swajaldhara*, but were trained and supported by the NGOs as implementation support agencies, while a technical support agency provided technical advice to choose the appropriate design for the infrastructure to be constructed. They were also given the freedom to plan conjunctive use of the available water sources, including traditional sources, and to set their own tariffs for the water supply provided at the household level through taps. Also, while they insisted on a demand-driven approach – interested villages had to apply to have a WASMO scheme (as with the *Swajaldhara* SDM) – they focused on intensive awareness-generation campaigns in villages prior to such self-selection. This ensured that all villagers – including members of the GP – were aware of the benefits and responsibilities before they became part of the programme. After that, a tripartite agreement was signed between the newly-formed *Pani Samiti*, the GP, and WASMO, which ensured clarity of roles and responsibilities, and commitment and motivation to work on the scheme.

The institutional arrangement that all major decisions would be taken or ratified by the GP was a critical one, since it made oversight (through Social Audits, or SAs) and responsibility for the entire scheme a key function of the elected representatives at the village level and hence of the entire village community. In addition, the accounts of the *Pani Samiti* are audited by independent auditors every year, in addition to 'participatory audits' carried out jointly with the villagers. Further, senior WASMO officials also worked quietly and behind the scenes to ensure the support and personal approval of the Chief Minister of the state, which in turn ensured that local politicians and government staff did not interfere with ground-level operations. This was an important 'institutional' facilitation that circumvented the problems encountered with the Swajaldhara in many other states.

The Jalswarajya SDM also worked through VWSCs and GPs, but buttressed these with two more committees at the village level – the Social Audit Committee (SAC) and the Women's Development Committee (WDC) – supported by sub-committees. The former committee was tasked with auditing all expenditure-related activities of the VWSCs, especially contracting and procurement, while the latter ensured livelihood from village-level water and sanitation service delivery for the key stakeholders, the women. There were also Mahila Gram Sabhas (Women-only Gram Sabhas) and, in tribal areas with scattered hamlets, there were hamlet-level committees (*Pada* committees) to look after water supply and sanitation issues in each hamlet. As in the case of the WASMO SDM, NGOs were appointed as social organisers to help with community mobilisation and capacity building, while a Technical Support Agency (TSA) provided technical advice for scheme design. The VWSCs were responsible for construction, which was contracted out either to government or private-sector agencies under the oversight of, first, the VWSC and, after that, the SAC. Further, like the WASMO, the VWSCs were free to set their own tariffs so that they covered the O&M costs of the service.

The *Jalswarajya* SDM had a village-level cadre of para-professionals called *Gram Doots* (literally 'village messengers') intended to 'internalise capacities within the community for sustained and effective management of project activities' (RSPMU n.d., 15). Their responsibilities included supporting village-level activities such as community mobilisation, identifying appropriate technology, supporting record-keeping and accountancy, facilitating health and sanitation activities, and fostering women's empowerment (*ibid.*). The *Gram Doots* are trained by the district capacity-building consortium, support organisations, district facilitation teams, and resource persons. The SDM also provided a village panchayat strengthening fund 'to build the institutional capacity of the VPs so as to enable them to perform the responsibilities more effectively following the activities that are undertaken' (RSPMU, n.d., 15). This fund was used for several activities to strengthen the linkage between the existing CBOs and village panchayats, e.g., providing technical assistance to improve the effectiveness and viability of both old and new water supply schemes, purchasing office and other equipment (e.g., chairs, tables, cupboards, loudspeaker sets, cameras, TVs, computers, video players, books, stationery and generator sets) totalling around Rs. 50,000 (around US$ 1,100) for each village panchayat, printing, paying for an accountant and his staff, para-professionals, support organisations, and for other capacity-building activities of the Village Panchayat (VP) members, CBOs, etc. (*ibid.*, 16).

The *Jalanidhi* SDM had an institution-building component and a community-development and infrastructure-building component, with similar provisions to the *Jalswarajya* SDM. The Gram Panchayat (GP) and Beneficiary Groups (BGs) were the key institutions responsible for the scheme design, planning, implementation and monitoring. There are up to 25 BGs in each panchayat. While the BGs are unregistered CBOs, the project GPs have set up BG federations as registered societies with their own memoranda of association and by-laws, to provide O&M and other support to BGs. Each federation is chaired by the panchayat's president, while the panchayat members are also members of the federation, along with two representatives from each BG in the panchayat (World Bank 2009, 9). Each federation has preregistered group plumbers and electricians with approved daily rates, while each GP has shops providing repair materials, tools, and supplies for rural water supply infrastructure. These federations are funded by initial contributions and regular collections and are now being given statutory powers to provide financial support to the BGs. Thus the federation, backed by the panchayat, is seen as the vehicle to 'ensure the necessary technical, financial, and institutional support to the BGs' (World

Bank 2009, 9). In addition, the GPs recruit individual support staff, rather than recruiting a support organisation. Scheme-level committees for large water supply schemes within a GP area were established, and panchayat project assistants were appointed to liaise between the GP, BGs, and the DPMU (*ibid*).

The *Jalswarajya* and *Jalanidhi* SDMs also addressed household and community sanitation issues along with water supply in their target villages (including school sanitation, solid waste management and provision of sanitary napkins), while the WASMO SDM initially concentrated only on water supply, preferring to deal with sanitation separately and subsequently – unlike the *Swajaldhara* SDM, which did not consider sanitation at all. Sanitation issues of toilet construction were also handled by the VWSCs. Further, the VWSCs of the *Jalswarajya* SDM have been informed about and facilitated to use all available government funding for expanding service delivery. Thus they have been able to leverage funding from various sources, including the National Rural Drinking Water Programme (NRDWP), the Twelfth Finance Commission (TFC), and the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS); in addition, they were also able to apply for the prize-based Sant Gadge Baba Swachchata Abhiyan (SGBSA) of the Government of Maharashtra.[7] In both *Jalswarajya* and WASMO SDMs, the VWSCs address even major repairs through the money saved in their bank accounts, funded from user charges collected from the village community and other funds from government sources. The *Jalanidhi* SDM has not yet faced major repairs, as was pointed out in the World Bank's report.[8]

Mechanisms and Approaches for Community Participation

In the *Swajaldhara* SDM, customer participation was assumed to happen through the formation of the VWSCs and the facilitation by the NGOs or government engineers. This, however, was limited to community contributions towards construction cost and collection of user charges to defray all expenses for O&M. The planning of rural water supply infrastructure was supposed to be done exclusively by government engineers, with no role envisaged for the village community or the CBOs. In the WASMO SDM, however, community participation was central to the efforts to set up sustainable rural water supply systems. These efforts began during the awareness-generation phase, even before the *Pani Samiti* was formed, with the WASMO staff of the community mobilisation unit using all manner of media (personalised letters to village leaders, posters, brochures, information booklets, radio, television, street theatre, etc.) as well as interpersonal communication (one-on-one meetings, group meetings, habitation and social group-level meetings, separate meetings with women and women's groups, meetings with school teachers and school children) to inform the village community about different aspects of the WASMO approach. During the Gram Sabha meetings the WASMO staff explained the approach and sought out people with what they called the 'X' factor – 'the people who have a desire to give their time, energy and resources to make their community a great place to live'.[9] If the community expressed willingness to participate, they formed a *Pani Samiti* in the Gram Sabha and subsequently signed the tripartite agreement with WASMO along with the GP. After that, intense awareness-generation continued, and training courses begin for the *Pani Samiti*, as WASMO worked with the village, helping them prepare a Village Action Plan (VAP) and beginning the contracting and construction. Once the scheme is constructed, ownership is formally handed over to the GP in a ceremony called *Atmarpan*. Post-construction activities include the setting and collection of tariffs, and carrying out routine operation and maintenance.

The *Jalswarajya* SDM has a similar set of detailed steps to foster awareness and participation among the target communities in the design, construction, operation and maintenance of rural water supply infrastructure. An interesting innovation in this SDM is the use of peer-to-peer learning through *Gram Doots* and by setting up progressive GP resource centres for other GPs in the area. Like the WASMO and *Jalswarajya* SDMs, the *Jalanidhi* SDM also had four phases – pre-planning, planning, implementation, and post-implementation – but the activities are slightly different.[10] The planning phase (one year) begins with the introduction and discussion of the project in the Gram Sabha – which can be stormy, since it usually faces opposition and apprehension from the general public (especially those who benefit from the present unequal distribution of water supply and those who do not want to pay for water) – as well as the support organisation (i.e., the NGO), and goes on to create an enabling environment for project implementation, with hand-holding support from the support organisation or the GP action team under the overall supervision of the GP. In fact the GP plays a critical role in overseeing the creation of community empowerment plans through a transparent and participatory process, and in negotiating and mediating in order to identify and take over land adjacent to potential sources, organise the construction of infrastructure and collect the financial contribution to the project (15 percent of the total costs).

During the implementation phase the community is fully involved and responsible for the procurement, construction, and the contracting of skilled workers, all of which increases community ownership and responsibility over the scheme. This is not just a period of construction, inauguration, and operation of a water supply scheme, but also a period of intense negotiation over sensitive social and political issues, often sparked off by disgruntled or vested interests, and can swiftly snowball out of control. This is where the GP steps in: 'The astute political sense of the GP leadership has to get a premonition of such likely "socio-political time bombs" and defuse them so that the project is salvaged' (RDC 2008, 56). There are also several external stakeholders, including various government departments that operate independently of the GP, including the departments of forests, electricity, public works, telephones, health, education and revenue, apart from the water authority, whose support the GP will need at some point during project implementation.

To address issues that the SO cannot negotiate on its own, the GP negotiates and mediates in order to ensure that the project proceeds to completion.

After about two to three years, the water supply schemes are commissioned, and the supply begins (post-implementation phase), but the GP can expect to face a new set of issues and needs, including the drying up of wells during summer, non-payment of user charges, and trouble-shooting and hand-holding the beneficiary groups. The GP has to analyse each issue in detail, identify root causes, and work out an appropriate solution – including applying for and negotiating additional support from the KRWSA. For instance, the problems of unequal supply and use led the GPs to lobby KRWSA to sanction funds and provide technical support to install household meters. Intervening with households reluctant to pay for water is another instance. Another required activity – post-construction – is the search for means to augment supply (e.g., through groundwater recharge as a result of watershed development activities) in order to ensure source sustainability, although this is not a priority concern at present. Of course, the GPs are also willing to use any public platform to broadcast success stories, thus acting as natural ambassadors of the project in the region.

Financial Arrangements for Water Service Provision

There are two basic payments during the life cycle of the water supply scheme:

1 contributions towards the cost of construction; and
2 monthly payments for operation and maintenance.

In all SDMs, a minimum contribution of 10 percent of the total capital cost and 100 percent of the operation and maintenance costs are collected from the community. Thus, the government contributes a maximum of 90 percent of the capital costs of the created rural water supply infrastructure. Furthermore, contributions are paid into bank accounts of the responsible CBOs (VWSC or *Pani Samiti*) or GPs, and accounts are maintained for all payments towards capital costs and monthly O&M expenses. In reality, however, these did not work according to plan, especially in the *Swajaldhara* SDM.

Capital cost contributions are collected in cash or kind by the CBO and handed over to the support agency, which is the government engineering department in the case of the *Swajaldhara* SDM, and CBOs in the case of the other SDMs. In the case of *Swajaldhara*, however – partly owing to the novelty of the idea of paying for water, and partly due to the political interference discussed earlier – several villages paid the money; but it was not then collected from the villagers. Instead either the contractors or village heads paid the money on behalf of the community. This was for their own interests, as the contractor would be assured of a construction contract as a result, while the village head would make use of the payment in his electioneering, claiming that he had brought the scheme to the village. This was possible because of the low level of awareness among the village community due to the poor awareness-generation efforts of the support agencies (James 2004).

On the other hand, in the WASMO, *Jalswarajya* and *Jalanidhi* SDMs the community members made voluntary contributions because they were convinced of the benefits of the programme after the intensive awareness-generation activities carried out by these agencies. However, these CBOs and GPs have the flexibility to decide who must contribute how much and to cross-subsidise the poorer households in the village. This decision is, however, taken solely at village level, and the PMUs of the WASMO, *Jalswarajya* and *Jalanidhi* SDMs do not interfere in this decision.

The water tariffs in the *Swajaldhara* SDM in Tamil Nadu followed the norms laid down by the Government of Tamil Nadu for household connections, i.e., Rs. 30–50 per household per month; but this was not sufficient to cover the O&M costs of running the scheme (Pragmatix Research & Advisory Services 2007). This was not only because of the poor support received by the VWSCs in taking such decisions, but also because of the novelty of the idea of paying regularly for water and the lack of appreciable improvement in service delivery. In the three other SDMs, however, the tariffs are decided by the village community – based on discussions and analysis by the CBOs and ratification by the GP – and are designed to cover 100 percent of the operation and maintenance costs of their own scheme. In these SDMs, therefore, connection charges and monthly payments varied between the VWSCs, largely because of the differences in the type of infrastructure designed and constructed according to the local conditions. However, perhaps more importantly, these SDMs were able to show improved service delivery, which helped them collect user charges effectively and thus more than offset the costs of operation and maintenance. Furthermore, since the CBOs in these SDMS have been capacitated to leverage other funds from other government programmes, they have fairly large balances in their bank accounts and so are able to pay for even major repairs to their water supply systems.

IV Impact of Service Delivery Models

The *Swajaldhara* SDM has had roughly the same impact on the sustainability of service as the regular service provision through the Accelerated Rural Water Supply Programme (ARWSP), the conventional top-down, supply-driven model followed in the country since 1972–3. This is largely because of the inadequate preparation and capacity building – especially among the engineers as well as the community and the NGOs – that preceded the implementation of the SDM since 2002. There is little community involvement, and the usual model of 'build-neglect-rebuild' characterises this SDM in most parts of the country.[11]

The WASMO SDM is the closest to a large-scale sustainable rural water supply scheme, in the absence of a full-fledged assessment of sustainability in the project area. It has an innovative, effective and locally-relevant institutional mechanism to inform and involve the community throughout the life cycle of the system, a robust support structure and an effective system to set and collect user charges, which has resulted in substantial savings in the accounts of the *Pani Samitis* that can easily cover operation and maintenance expenses. This has so far proved to be effective in around 15,000 rural villages in Gujarat state, and is now aiming to cover all the 18,000-plus villages in the state.

The *Jalswarajya* SDM is also an excellent model for sustainable rural water supply service delivery and has proved itself in the project area of around 2,500 village panchayats. Its significant improvement in sustained service delivery has led to the approach being adopted for the entire state of Maharashtra. Like the WASMO model, it has effectively informed and involved the local communities in these villages across all stages of service delivery, and provided a strong support structure as well as a high level of collection of user charges and other funds for operation and maintenance. A second phase of the *Jalswarajya* is currently in preparation and could be the vehicle to spread the approach more effectively throughout the state.

The *Jalanidhi* SDM, too, is an excellent model and has demonstrated its potential to the 2,500 village communities in 112 GPs across 13 districts in the state. Improvements in service delivery are clearly visible, and user satisfaction levels are reflected in the willingness of the community both to take responsibility and to contribute towards its maintenance and upkeep. For instance, in 90 percent of the schemes, 'operation and maintenance was fully financed and managed by user groups after one year of commissioning' (World Bank 2009, viii). Furthermore, 'water tariffs have been fixed appropriately corresponding to the O&M expenditures and are being levied and collected in all the schemes' (*ibid.*, 9) and 'in the GPs covered by the project, water supply coverage increased from 55 to 81 percent and sanitation coverage from 76 to 86 percent' (*ibid.*, 11). User charge collections have exceeded the targets, and the entire process has become rooted in the local government processes in the project area. A second phase of *Jalanidhi* is currently under preparation, to be implemented with funding from the World Bank, and it has also been scaled up as an approach throughout the state.

Potential for Scaling Up

Although the *Swajaldhara* SDM has already been scaled up, in that it has been implemented as a national programme since 2002, it has not been as effective as originally envisaged by the sector reform. However, its objective is much broader than the other two SDMs, as its coverage area is the entire country – with all its geographical and socio-cultural variations – and not a single state, as with the WASMO, *Jalanidhi* and *Jalswarajya* SDMs. While the WASMO is already a state-level organisation, both the *Jalswarajya* and *Jalanidhi* SDMs are being scaled up to cover the rest of the states of Maharashtra and Kerala respectively, but as in the case of the WASMO SDM, it may be more difficult to implement as it gets closer to the goal of 100 percent coverage with sustainable community-based rural water supply services.

Swajaldhara, which is the oldest of the SDMs and with the largest mandate – the entire country, is also the one designed 'outside' the states (and almost exclusively by the central government) for use in the states. However, inadequate capacity building and acceptance within the implementing agency – the state rural water supply engineering department – is a major reason for its poor performance in the field. There are also poor support mechanisms at state and district levels to help rural communities take over and manage their water supply systems.

The WASMO is a strong SDM that has already demonstrated its potential for scaling up, having already reached 15,000 of the 18,000 villages in Gujarat State in a period of eight years or so. It has all the essential elements for a sustainable and locally-relevant SDM for rural water supply, being based on a clear understanding of local strengths and sentiments. The fact that the CBOs work closely with and through the GP embeds it strongly within the democratic institutions of local self-government. There are possible improvements, including technical support for addressing weather variability due to climate change (although this is likely to be a bigger problem for villages situated further from the canals carrying Narmada water through the state), ecological sanitation to conserve water further, and stronger hygiene promotion, especially among adults. However, it is likely to have problems in reaching 100 percent, since the last few villages are likely to be the ones with the greatest problems of effective service delivery, either due to technical or other reasons (e.g., settlements of nomadic communities).

Jalswarajya is also a strong SDM that has successfully implemented an integrated water supply, sanitation and hygiene programme in a relatively large project area, with strong and innovative support structures at the district and village levels for community awareness, participation and management. As in the case of the WASMO, the approach has been well thought out to be locally relevant and effective. It also draws on the strength of the GPs to sustain community participation. Possible improvements are also along the same lines as WASMO, addressing weather variability induced by climate change, ecological sanitation and hygiene. Perhaps the next phase will be the opportunity to address these issues as well as expanding the approach to the entire state.

Jalanidhi is an excellent SDM that has implemented an integrated water supply, sanitation and hygiene programme in a relatively large project area. The approach of strengthening the GP incentives and capacities to design, implement and manage rural water supply – as with the WASMO and *Jalswarajya* – is sustainable, since it is rooted in the statutory self-government institutions and is translating into action the 73rd Amendment to the Indian Constitution. However, its focus on motivating and capacitating BGs and their federations is similar to that of WASMO, and is also a somewhat less complicated structure than the several committees of *Jalswarajya*.

V Conclusions: Success Factors and Challenges

All the SDMs are responses to the local context, and as long as they are working effectively, and are owned and operated by the community and their representatives, they will be sustained. The key factors underlying the success of the three SDMs are:

- high motivation levels of senior bureaucrats and politicians in showcasing each project to be a success;
- support provided by external funding agencies;
- the willingness of the technocracy to extend its operations into community-based service delivery; and
- the willingness of the communities and their representatives, in addition to the CBOs, to take on responsibility for the full O&M of their water supply systems.

Despite this, challenges remain, and there is a long way to go before any of them cover the entire country effectively. However, a lot of useful lessons are available for the other states to improve their SDMs through their new Water and Sanitation Support Organisations (WSSOs):

- ***Political support is vital***, especially to insulate the reform processes from vested political interests. In Gujarat, the Chief Minister of the state ensured that local politicians did not try to manipulate the scheme for personal political gains. Similar results ensued from the support of ministers and senior bureaucrats in both Kerala and Maharashtra.
- ***Support institutions for community management are vital***, given the huge task of building capacities and facilitating them to take over their rural water supply schemes effectively. Large PMUs and district-level units in all the three innovative SDMs (except *Swajaldhara*) provided strong support for the effective functioning of the CBOs (VWSCs and *Pani Samitis*). The legislation, through which these CBOs were declared to be official sub-committees of the statutory GP, was particularly helpful.
- ***Institutional role clarity is essential*** between government agencies (e.g., for bulk supplies and village-level distribution), community institutions, and private players. In Maharashtra, for instance, the government policy of making GPs responsible for all civil works below the value of Rs. 1 million, helped clarify the role of the GP *vis-à-vis* the rural water supply engineers. The Government Order (GO) in Kerala transferring all single-village schemes from the KWA to the GP played a similar role.
- ***Community management requires space, time, and support*** to be given to the communities. All three SDMs took at least six to eight years to achieve successful transfer of management to the CBOs, during which local capacities were built, financial resources were accumulated at the local level, and the CBOs gained experience (and thus confidence) in

managing their own drinking water resources. Since then it has become virtually impossible for vested political interests to try and 'reclaim' authority over drinking water provision, at least in the areas in which these SDMs are functional.

- ***Change management for greater democratisation of decision-making*** can be a powerful motivational tool – stronger than financial incentives or institutional restructuring, e.g. in Tamil Nadu. While the other SDMs opted to create independent structures (e.g., PMUs) outside the regular institutional structure of government provision, only the change-management initiative in Tamil Nadu sought to engage directly with government engineers. This is a useful and essential element for bringing on board a powerful – and potentially useful – ally in the entire process of decentralisation and democratisation of decision-making in rural water supply provision. The Tamil Nadu experiment showed clearly what committed and motivated government engineers could do to support community management.
- ***Communities are willing to pay for improved service quality***, but some flexibility in payment norms (e.g., reduced percentage of initial capital contributions, subsequent collection, and payments by instalments) may elicit better response. While this was indirectly shown in the high collections of community contributions in the WASMO, *Jalswarajya* and *Jalanidhi*, the Tamil Nadu example of change management demonstrated the role of improved service levels in eliciting community contributions (Nayar and James 2010). This turns conventional wisdom on its head: community collections *per se* do not improve service delivery, but collections improve when service delivery improves.
- ***Information and experience sharing is necessary*** – it is not currently being adequately practised – especially through 'horizontal sharing' among the villagers and PRIs. A key strength of the WASMO was to build a service 'brand' which other villages aspired to. News of the success spread more than anything by word-of-mouth among villagers and PRIs, to inspire other villages to come forward and take up the initiative. Although only WASMO has the numbers for this effort (15,000 villages), even the *Jalswarajya* and *Jalanidhi* succeeded in creating demand in other villages for a similar initiative; they are now poised for a second phase, in both cases.
- ***Focused and sustained capacity building of PRIs and CBOs is vital*** not only to enable communities to implement other government schemes more easily, but also to strengthen them to counter local political interests. The WASMO, *Jalswarajya* and *Jalanidhi* SDMs have shown the importance of building the awareness and capacities of local politicians to support and take forward the process of community management. This engagement, however, had to counter several arguments and counter-moves by vested interests, which called for an agile response from the PMUs; this could happen only if the engagement was sustained. Such quick responses also helped the fledgling CBOs build their arguments and capacities to counter such threats on their own subsequently (RDC 2008).

- ***Scaling up from limited-area projects faces new challenges*** and requires different thinking from working within a relatively autonomous project mode. This is an important lesson for scaling up, and one not easily appreciated in the usual policy thrust towards rapid implementation and quick results through a predesigned programme. Expansion requires engagement with the larger body politic of water supply, including the regular development administration, water supply engineers, and local politicians. So far, only WASMO appears to have overcome these challenges, although there has been some build-up of opposition to its continued expansion. Both *Jalswarajya* and *Jalanidhi* SDMs are going into a second phase, but have a relatively long way to go before they can reach the scale of WASMO's implementation. These challenges are likely to become more serious as they reach scales that threaten a range of vested political and other interests in the rural water supply sector. There are, however, no quick and easy solutions, and creative planning will be needed to overcome these challenges.

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12 Transparency, Accountability and Participation (TAP): Understanding Governance in Rural WASH Sector

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I Background

It is argued that excessive focus on technology/capital investments in provision of WASH services is not necessarily leading to sustainable and equitable services (Reddy *et al.* 2009). There is also growing evidence (WASHCost (India) Project case studies) on the ground as well as in literature on the influence of good governance practices on WASH service levels. UNESCAP argues that earlier strategies,

> . . . are not sufficient to ensure that all people have access to the services they need and are entitled to. The reason is that they do not address the underlying cause of the problem: the political barrier, the poverty of power. This barrier prevents the poor from influencing decision making, from claiming access to basic services and from holding the government and the service provider accountable for the service provided. It thereby excludes them from sharing the benefits of development.
>
> (UNESCAP/UNDP/ADB 2007)

Hence, the role of good governance is imperative for access to better services, particularly for the poor. Further, it is argued that 'inclusiveness and equity; participation; transparency; efficiency and effectiveness; responsiveness; subsidiarity; adherence to rule of law; accountability and sustainability' could indicate the quality of governance. Decentralisation principles and practices in India also broadly reflect similar sentiments about good governance. The Government of India consciously promoted participatory and decentralised governance in the WASH sector (Box 12.1) (GoI, 2010). Panchayati Raj Institutions (PRIs)[1] are made central to all developmental initiatives, including WASH, as part of its decentralisation of power (through 73rd and 74th amendments of the Indian Constitution). Decentralisation is also expected to be cost-effective in implementing development programmes. This could be possible with the active participation of elected members, local organisations and people (GoI 2001).

However, the experiences of decentralisation/devolution of power through the PRIs have not been uniform in the country (Siva Subramaniam 2003). Each state has evolved these practices according to its own vision, and there have been several gaps between principles and practice. Some states, like Andhra Pradesh, have introduced several parallel institutions (Community-Based Organisations or CBOs) in an attempt to dilute the powers of PRIs (Reddy *et al.* 2009). It is argued that,

> . . . these new experiments have been conceived to reach the stakeholders directly, but in the process they tended to ignore the imperative of institution building in the rural sector of the state. Functions/responsibilities which legitimately belong to the domain of the local government have thus been partly withdrawn from its purview.
>
> (Siva Subramaniam 2003)

There are debates on the role of local self governance institutions (Gram Panchayats) and stakeholder groups in the arena of development processes and programmes. Studies and experiences of decentralisation and devolution in India indicate that,

> . . . although economic and political changes led to some relative decline of the old elite groups of high-caste landlords, these groups continued to dominate village politics, and capture the Panchayati Raj Institutions by means of foul or fair. These institutions rapidly became instruments of elite power rather than popular control
>
> (Drèze and Gazdar 1996)

Box 12.1 Key policy provisions for Transparency, Accountability and Participation in WASH sector in India – guidelines of Rajiv Gandhi National Drinking Water Mission (April 2010)

. . . To provide access to information through online reporting mechanism with information placed in public domain to bring in transparency, accountability, and informed decision making. [page 14]

. . . Community-based monitoring should preferably fulfil the following objectives: It should provide regular and systematic information about community needs, which would guide related planning; It should provide feedback according to the locally developed yardsticks for monitoring as well as key indicators for measuring the consumer's satisfaction. [page 14]

. . . A social audit helps to narrow the gap between the perception of the line department's definition of services provided and the beneficiaries' level of satisfaction of the service provided. Social auditing also enhances the performance of the local self government, particularly for strengthening accountability and transparency in local bodies. [page 44]

Transparency: It is very critical that people are fully informed about the plan, schemes and investments proposed to be made in their areas. In fact, they should have a major role in deciding on the appropriate option. The village committee should display details of funds received and utilised at a prominent place in such a manner that people can see and understand it. This should be updated on a regular basis. [page 67]

A Village Water and Sanitation Committee (VWSC) is to be set up as a standing committee in each Gram Panchayat for planning, monitoring, implementation, and operation and maintenance of their Water Supply Scheme to ensure active participation of the villagers. . . . The membership of a VWSC may consist of about 6 to 12 persons, comprising elected members of the panchayat, women with due representation to the SCs, STs and poorer sections of the village. . . . The composition and functions of the VWSCs can be regulated by a set of by-laws under the State Panchayati Raj Act. [page 20]

Source: GoI 2010

Notwithstanding the above pessimism, several experiments in the rural water supply and sanitation sector could demonstrate a combination of strategies where local self-governance institutions and stakeholder groups played their roles and ensured that WASH services are offered to all on a sustainable basis. These experiences started finding their own space in the policy and programs of WASH sector in India. These references to governance arrangements are clearly visible in the recent policy documents of the Government of India (GoI 2010) and the Government of Andhra Pradesh.

> The Gram Panchayats (GPs) should be empowered with funds, functions and functionaries and capacity building to plan, monitor, implement and manage rural drinking water supply or schemes within their jurisdiction. Meetings of the Gram Sabha as the primary block of decentralised governance should be called in the planning, implementation and management phase of water supply schemes to decide on issues like demand, level of service delivery, type of scheme, contribution by households, concessions to SCs, STs and BPL households, user charges, etc. In order to further decentralise powers and responsibilities and to give greater focus on water and sanitation issues, a Village Water and Sanitation Committee (VWSC) is to be set up in each Gram Panchayat/village/ward for implementation of water supply schemes to ensure the active participation of villagers.
>
> (GoI 2010)

The policy statements are laudable and noble, but an inherent and common agreement among several theorists and practitioners about the complexities in governance and decentralisation of power is reflected in:

> . . . it should be clear that good governance is an ideal which is difficult to achieve in its totality. Very few countries and societies have come close to achieving good governance in its totality. However, to ensure sustainable human development, actions must be taken to work towards this ideal with the aim of making it a reality.
>
> (UNESCAP/UNDP/ADB 2007)

The water crisis is often said to be a crisis of governance. The Government of India policy emphasises promoting transparency, accountability and participation of local communities in WASH governance. Several instruments, arrangements and mechanisms are incorporated in the policy for this purpose. These include access to information, monitoring, social audit, institutional set up, etc. (Box 12.1). However, there arise questions such as:

What do these policies mean in reality?
What are the key elements of WASH governance?
How is it operationalised at the village level?
What is the influence of governance on cost/investment-related decisions?
Is there a relationship between governance and service levels? If yes, what factors influence this relationship?
What are the good practices in WASH governance and WASH service delivery?

This chapter attempts to find answers to such questions by assessing the influence of governance on WASH service levels in rural Andhra Pradesh, India. It seeks to assess WASH governance at the village level based on the extensive field survey in 107 villages spreading over nine agro-climatic zones of Andhra Pradesh. Model villages from the sample villages are analysed separately in order to explore the relationships between WASH governance, investment patterns, and service levels in these villages.

II Methodology

The research primarily explores three dimensions of WASH Governance: Transparency, Accountability and Participation (TAP). Given the complex nature of governance and its various dimensions, we define here the key words – Transparency, Accountability and Participation – in the context of WASH governance in India (Box 12.2). These functional definitions and concepts are drawn from the current policy framework of the Government of India (GoI) and the Government of Andhra Pradesh (GoAP).

Box 12.2 WASH governance – Transparency, Accountability and Participation

What do we mean by Participation?

Participation deals with the level to which community members are involved in decision-making while planning and implementing WASH schemes. Functional institutions are necessary for this purpose.

What do we mean by Accountability?

The term accountability within this report means the level of adherence to agreed roles, responsibilities, principles/norms and tasks to be practiced by various actors/institutions (Government, Gram Panchayats, citizens, etc.). An agreed set of principles and practices is necessary for assessing the level of accountability.

What do we mean by Transparency?

Transparency here is the extent to which actors/institutions provide open and clear access to information including details of the tasks performed and decisions taken.

Source: Arnstein (1969). This describes eight stages of citizen participation, among which 'decision-making opportunities' are central; it is also argued that transparency is a necessary condition for participation, but not sufficient. The above functional definitions were evolved from such theoretical frameworks and also from the current policy of the Government of India.

About 420 groups in 107 villages in Andhra Pradesh were interviewed using the 'Quantified Participatory Assessment' (QPA) methodology (James 2003). As part of this, separate Focus Group Discussions (FGDs) were conducted with:

- Gram Panchayats (local self-governance institutions);
- members of women's Self Help Groups (SHGs);
- youth groups; and
- groups of members of disadvantaged sections of society – i.e., Scheduled Castes (SCs) or Scheduled Tribes (STs) – in each village.

A set of 19 indicators related to WASH governance was developed to assess WASH governance (Box 12.3). These indicators were derived from the current policy/guidelines of the Government of India for providing safe drinking water. The same checklist of questions was used for each FGD. The responses from each of these groups were carefully documented and scores were assigned for each indicator on a scale of 0 to 100 points (0 indicates low performance; 100 indicates the best possible or ideal situation related to that particular indicator). These scores reflect the involvement and perceptions of each group pertaining to that particular indicator. The group average for each indicator would give the overall picture of the village.

Box 12.3 Indicators for assessing Transparency, Accountability and Participation in the WASH sector in Andhra Pradesh

The field work, as part of this study, identified 19 indicators of WASH governance. These were classified into five broad groups. Each of these indicators has all three dimensions of governance – Transparency, Accountability and Participation. As an illustration, effective functioning of a Village Water and Sanitation Committee (VWSC) not only facilitates the participation of community in decision-making, etc., but also develops systems for transparency and accountability. Similarly, regular payment of tariff by citizens indicates that they are accountable to a system, which empowers them to demand transparent ways of using the funds.

Institutional Space and Decision-making: related indicators

- Functioning of VWSC
- Functioning of the Gram Sabha on WASH issues
- Participation by women in community-level decision-making on water supply
- Participation by SCs/STs in community-level decision-making on water supply

Involvement in Planning of WASH Services: related indicators

- Participation in the feasibility survey
- Participation in the technical survey
- Knowledge about integrating with existing systems
- Knowledge of extension of system

Capacity-building: related indicators

- Effectiveness of training
- Effectiveness of Information, Education and Communication (IEC) inputs

Operation & Maintenance (O&M) Systems: related indicators

- Operation and maintenance: piped water supply
- Operation and maintenance: Hand Pumps (HPs)

- Water quality at community water points (PSPs and HPs)
- Solid waste situation in the village
- Waste water situation in the village
- Hygiene and sanitation

Financial Management: related indicators

- Water supply and sanitation records
- Tariff or water-user fee collection
- Proactive disclosure of information

As an illustration, if water charges were regularly paid by a majority of the families and the knowledge about the use of this fund was common across all the groups in the village, then that village would get a high score for the user fee collection indicator (about 75 to 100 points). Each group in the village may have its own experiences, knowledge and perception on this issue, and accordingly the responses would differ. While a Gram Panchayat may give a score of 80 as it believes that the payment of tariffs is high and regular, women's groups in the same village may give a score of 30, if they think that the tariff payment is low and irregular.

Facilitators would ask relevant questions to each group (in separate FGDs) and document their responses. The commonality and variations in these responses are indicated by the scores given by each group for each issue/ indicator. When there is high commonality and a high level of common knowledge, the scores by each group would be in the same range. These scores and documented responses are used for assessing the level of transparency, accountability and participation in the WASH sector in that particular village. Similarly, the survey also attempted to understand the perceptions of user communities on service levels (mainly quantity, reliability/predictability, quality and access) from 1,496 water points (hand pumps, wells, public stand posts, and different localities) in the 107 villages, using the QPA methodology. This methodology allows scoring the perceptions of user communities on a scale of 0 to 100 points. The scores in turn indicate the level of service of each water point – the higher the score, the higher the service level, and vice versa (see Appendix for details on standards of service levels) (Moriarty *et al.* 2010). As part of the field survey, a team of trained facilitators (about four to six people) stayed in the sample villages for three to five days to conduct a variety of tasks. These included household surveys, data collection from Gram Panchayats, conducting focus group discussions with user groups of water points for assessing service levels, and separate discussions with four different groups: Gram Panchayat, women SHGs, youth groups and members of SC/ST communities. However, the main emphasis of this chapter is on understanding the WASH governance systems and its influence on service levels.

III Results and Discussion

In general, the WASH sector in rural Andhra Pradesh is marred by low levels of community participation, unaccountable institutions and functionaries and low levels of transparency in a variety of processes. WASH governance is typically weak. In a small number of villages where WASH governance is strong, WASH services are also high. Here the governance systems could translate WASH costs (investments) into high levels of WASH services, irrespective of the volume of investment. Villages that have received the Nirmal Gram Puraskar awards (NGP villages) for their 'zero open defecation' status have marginally better WASH governance arrangements than the non-NGP villages. Nevertheless, the governance processes and systems need significant improvement, even in NGP villages (Figure 12.1). In what follows, we present the analysis and results on different aspects of governance.

Functioning of Institutions

At the village level, the functioning of the Village Water and Sanitation Committees (VWSC) is a litmus test of effective governance. These institutions are expected to provide opportunity for all villagers to participate in the decision-making processes and ensure the transparency and accountability of various functionaries such as Gram Panchayat members, watermen, health workers, etc. However, only 21 percent of the NGP villages were found to have effective VWSCs at the village level that facilitated collective decision-making on WASH issues. This is indicated by higher scores for the institutional space and decision-making indicators. On the other hand, not even a single non-NGP village scored above 50 for this set of indicators. Out of the 420 groups interviewed in the 107 villages, 386 (about 92 percent) said there was no functional VWSC in their village, as they never observed any results/benefits

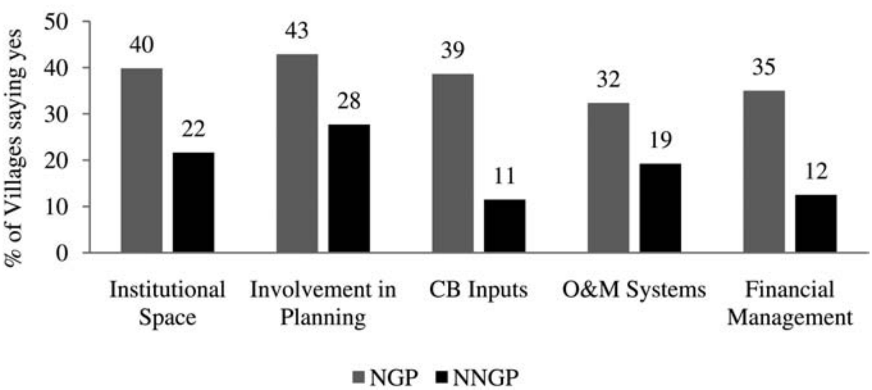

Figure 12.1 Governance in NGP and non-NGP villages in Andhra Pradesh (Source: Based on information collected from the sample habitations)

from such an institution in their village. They also thought that these institutions may be existing 'only on paper'.

Decision-making Process

Decisions pertaining to WASH are often taken outside the Gram Sabha (village general body meeting), which is observed in 59 percent of the sample groups, while 30 percent of the sample groups mentioned that, even when decisions regarding WASH are taken in the Gram Sabha they are rarely implemented. Participation of women in community-level decision-making on WASH issues scored particularly low. Overall, 74 percent of the sample groups (67 percent of the Gram Panchayat groups, 78 percent of the SC/ST groups, 79 percent of the women SHGs and 71 percent of the youth groups) stated that few women participate or contribute towards decisions that are taken in the community gatherings, and 26 percent of the focus groups revealed that women do not even participate in the Gram Sabhas. Although Gram Sabha meetings, in theory, are open to all, women often do not attend. Further, all categories of focus groups said that even if women attended, the environment was not conducive for their participation, since these meetings are dominated by men. In one village the frustrated women's SHGs had even protested that women are not allowed to speak at community gatherings, and, even if they do speak up, no one listens. Several women's groups also said that even officials ignored them: 'They only listen to our problems and go off.' However, this view is not universal; in some villages non-SHG focus groups believed that women have equal decision-making power. In 12 of the sample villages (11 percent), all the groups, including the women's groups, agreed that things have improved: women go to the meetings and participate in the decision-making. Notably, most of the concerns they raise and the contributions they make are related to WASH issues. Indeed 77 percent of the groups in these villages agreed that women occasionally discuss hygiene and sanitation within the SHG groups.

The results were marginally better for the Scheduled Castes and Scheduled Tribes than for women's groups, though almost two-thirds of the SC/ST groups hardly participated or contributed towards the decisions taken at the community gatherings. Overall, 64 percent of the sample groups (54 percent of the GPs, 68 percent of the SCs/STs, 74 percent of the SHGs and 59 percent of the youth groups) made such an observation. They could only voice their opinion on limited issues, and usually, no action is taken. According to some groups, their villages never hold the Gram Sabha/village-level general body meetings, and there was no functional VWSC; so there was no platform for raising their concerns. However, there were 17 villages (16 percent of the sample villages) where all the groups agreed that the SC/ST groups enjoyed equal status and decision-making powers along with other communities. 'There are no caste barriers in this village,' was one heartening response.

Planning Processes

The planning process in the WASH sector has several intricacies: Some key decisions with regard to water and drainage systems are taken up after technical and feasibility surveys. Community members could participate more in these planning processes and contribute significantly to decision-making in terms of choices related to extension of existing systems, etc. It was found that 31 percent of the NGP villages provided better and higher level of opportunities for local communities to contribute to WASH planning, while only 5 percent of the non-NGP villages provided such opportunities.

The people were not aware of the findings of the feasibility survey, and only the Gram Panchayats were privy to this information, as observed by 75 percent of the sample groups. Similarly, 80 percent of the groups mentioned that they were not aware of the findings of the technical survey – again, only the Gram Panchayat has this information, and it was not shared with the communities of the village. The results of technical surveys for new schemes were found to be poorly communicated. Three quarters of the Gram Panchayats also agreed that they did not share the findings with the villagers.

The integration and extension of water systems within villages is required to avoid duplication of services and to ensure that all areas are covered and have access to water. However, 55 percent of the groups said that there was no integration of old and new systems in their villages, and 60 percent of the groups felt that extensions to village water schemes were done in an *ad hoc* manner. In some cases, this has resulted in water taps running dry. This was the view of 67 percent of the GPs, 78 percent of SC/ST groups, 90 percent of SHGs, and 81 percent of the youth groups. Only about 33 percent of the Gram Panchayats themselves tend to think that everything had been done properly, and work was approved at the Gram Sabha, whereas the other groups did not agree with the opinion of the Gram Panchayat. There were only a few examples (five villages out of 107) of good practice where integration and extensions were discussed at the Gram Sabha, and works were carried out according to the agreed and communicated plan. In these five villages all the groups agreed that the quality and service delivery is almost the same across all water points. This is attributed to the systematic efforts to integrate the existing systems with new ones.

Capacity Building

Capacity building inputs such as training programs and information-sharing campaigns are important to empower village citizens in performing their roles in decision-making. About 26 percent of the NGP villages indicated effective capacity-building inputs, mainly in the form of Information, Education and Communication (IEC) campaigns. Only 2 percent of the non-NGP villages were found to have benefited from capacity-building inputs, such as regular awareness-generation events, exposure visits to model villages, inspirational workshops at the district level, etc. The role of capacity-building inputs was abysmally small in 70 percent of the sample villages. While there is an obvious knowledge gap at local level on the issue of the capacity-building agenda, the district-level units/missions also seem to be operating on an *ad hoc* basis on this issue and do not have relevant and village-specific information.

Almost three quarters of the sample groups felt that no training had been carried out. Further, 16 percent of the groups stated that the training they received had not contributed to their skills or capacity. In villages where training did take place, it was often provided by an NGO on hygiene, or was about how to construct Individual Sanitary Latrines (ISLs). The majority of the groups (70 percent) felt that the IEC programs were rarely effective and hardly contributed to sustained behavioural change.

Operation and Maintenance of Systems

Maintenance of environmental sanitation is an important function of the Gram Panchayats and the VWSCs. The villagers are also responsible for following agreed norms for safe disposal of liquid and solid waste in villages. The maintenance of environmental quality requires considerable efforts, such as regular maintenance of infrastructure, payment of tariffs, following norms, etc. Though NGP villages were found to be marginally better than the non-NGP villages, the situation of O&M of WASH facilities presents a dismal picture in rural Andhra Pradesh. Low and unspecified funds at the Gram Panchayat level, low/poor collection of water tariffs at the village level, delayed responses from mandal/district level systems for maintenance of water supply systems/hand pumps seem to be the main reasons behind this low attention to the operation and maintenance of the systems at the village level.

About 87 percent of the groups opined that there are no agreed norms or practices for safe disposal of solid and liquid waste. The majority of the groups (62 percent) mentioned that there are hardly any drains in their village, or the existing drains are badly designed and are either blocked or broken. Most villagers have apparently got used to living in unhygienic surroundings, though 77 percent of the groups indicated that the women occasionally discuss hygiene and sanitation within the SHG groups. What is clear is that these discussions do not make much difference to behavioural change at the personal, household and community levels.

The outbreak of diseases, such as cholera, in some villages, has made people more conscious of the need for hygiene and sanitation. Many groups also mentioned that they gained such awareness by watching television programmes. However, this has not always led to action, and low participation was reported in dealing with solid waste and wastewater, with more than 60 percent of the groups saying that the drains were either missing or blocked.

The availability of information about the quality of water and the results of water testing are important for deciding on alternative options. However, 80 percent of the groups said that only the Gram Panchayat was aware of such results. In one village, the Gram Panchayat said that the results of testing were shared at a Gram Sabha, but none of the other groups was aware of this. Similarly, there were wide gaps in the perception of what happened in other villages as well.

The survey found high levels of dissatisfaction with the maintenance of hand pumps and piped water systems in the villages. All the sample groups mentioned that no one in their village was trained or capable of handling minor repairs of hand pumps. For any repair, someone has to come from the mandal headquarters. They also complained that there is hardly any maintenance support for hand pumps, which leads to their neglect.

Financial Arrangements

The availability of information related to finances, regularity in tariff collection, updated books/records/accounts is essential for ensuring transparency in WASH governance. Both citizens and institutions are responsible for ensuring the financial integrity of WASH systems. The survey, here too, found that the NGP villages are better in comparison to the non-NGP villages. About 22 percent of the NGP villages seem to be following sound systems for financial management, while only 1 percent of the non-NGP villages focuses on the issue.

In the survey, 88 percent of the sample groups were found to be aware about the agreed water tariff; but they said that the money was not collected regularly. Even in some well-organised villages, the tariffs are being collected only from 60–70 percent of households. In the 10 villages that scored high for this indicator, a majority of the respondents are aware of the total amount collected and also know that the money is used for operation and maintenance. Some villages even have differential tariffs, depending on the economic status of the household, and penalties for late payment.

However, almost 90 percent of the sample groups believe that the village record books for water and sanitation are not maintained properly, or that only a few members of the Gram Panchayat are aware of them. Similarly, in 91 percent of the sample villages, the groups believed that there was little effort to disclose information proactively to villagers. Only one or two villages disclosed all information to citizens and introduced effective feedback mechanisms.

IV Governance Matters: A Tale of Four Villages

While the general trend projects a dismal picture of WASH governance, four out of the 107 sample villages were found to have good governance systems that ensured effective WASH service delivery. They are Gangadevipally, Medipally, Boduvalasa and Jankampet, a brief profile of which is presented in Appendix Table A12.1. Three out of them are recipients of Nirmal Gram Puraskar awards. Only in these four villages was the contribution of the local committee towards promoting WASH widely acknowledged by several other groups (Box 12.4).

Each village evolved its own form of local institution, in the form of a village development committee, village water committee, etc. The governance arrangements in these villages offer a new direction and hope for the WASH sector in Andhra Pradesh.

The four villages also faced a severe drinking water crisis (in terms of both quality- and quantity-related issues), which apparently motivated them to seek out alternative systems and make proper arrangements for effective use of water for drinking and domestic purposes. This experience took some time to get rooted in each village (about two to four years). Thus, the effectiveness of governance (and subsequently WASH services) improved over a period of time; there was no instant success. The NGOs helped in establishing systems for planning, collective decision-making and transparent financial management.

Three of the four villages established reverse osmosis plants for supplying safe drinking water at affordable rates. For this, they mobilised funds from the local NGOs/donors. The villagers also shared the cost of establishing the plants, while the Gram Panchayat gave the land for the building. With the support of the local NGOs/donors that supplied equipment, the local institutions maintained the water treatment plants without much difficulty. Good management practices are followed in the case of all WASH and not limited to water treatment plants, whereas most other villages focused only on the water treatment plants, neglecting other WASH facilities.

Box 12.4 Why these villages are different

While most villages remain mute recipients of funds/infrastructure from donors and the state, these four villages went further in improving WASH services. They not only made use of all government schemes/projects but also accessed support from a variety of sources, including self-help. Some of the enabling factors behind the success of these villages are:

- Presence of strong local leaders.
- Leadership in local institutions, such as women's self-help groups and other institutions, that could eventually take up considerable responsibilities in WASH governance.
- Facilitation support received from local voluntary organisations/NGOs.
- Capacity-building inputs to the villages by these local NGOs (in the form of exposure visits/orientation programmes/meetings/awareness camps).
- Willingness of local communities to form institutions and make them functional.
- Willingness of local communities to follow norms.

- Willingness of local communities to contribute (in cash/kind/labour).
- Effective planning that ensured better convergence of existing schemes with new ones; convergence of funds/schemes of different government programmes.

Among the above, the presence of a local leader with a vision to push the local communities towards better governance arrangements is the most prominent enabling factor.

Accessibility to water systems and quantity in these villages is observed to be fairly high, and so was the predictability and reliability of supply. Breakdown was minimal, and timings of water supply are common knowledge. The local committees made serious efforts to overcome limitations, such as frequent power cuts, by evolving appropriate systems and practices for water supply. As the groundwater source is not very reliable during summer seasons, hand pumps scored low for this indicator.

The opportunities for participating in decision-making institutions were found to be fairly high in these villages. The committees formed for WASH governance meet regularly and perform their duties. They have also organised village-level meetings for seeking inputs in planning, sharing information and redressing any complaints. Women and disadvantaged communities are represented in these committees, and these groups mentioned that they were able to contribute to decision-making and planning processes. They also thought that their voices were heard and their opinions were respected by others. Women's SHGs adopt village streets and ensure that they are kept clean of garbage, and the Gram Panchayats/local institutions support these SHGs by appointing staff and sending vehicles for the safe disposal of solid waste (for details, see Appendix Table A12.1 and Box 12.4).

The planning system for WASH facilities was participatory and several stakeholders contributed in this process, including department staff, representatives from the Gram Panchayat, village water sanitation committee, women's SHGs, youth groups, as well as elders in the village. The NGOs helped the villagers conduct systematic analysis of the existing infrastructure and estimate future requirements. Feasibility surveys and technical surveys were conducted before taking decisions in common meetings. Occasionally, training programmes on sanitation and related issues were organised by the local NGOs, although, these largely targeted village leaders. Awareness camps were also organised by the local committees to improve villagers' participation in WASH affairs.

The villages have evolved a system for operation and maintenance of the WASH facilities, and the waterman is an important part of this. Based on the limited training he has received, this person is able to attend to minor repairs

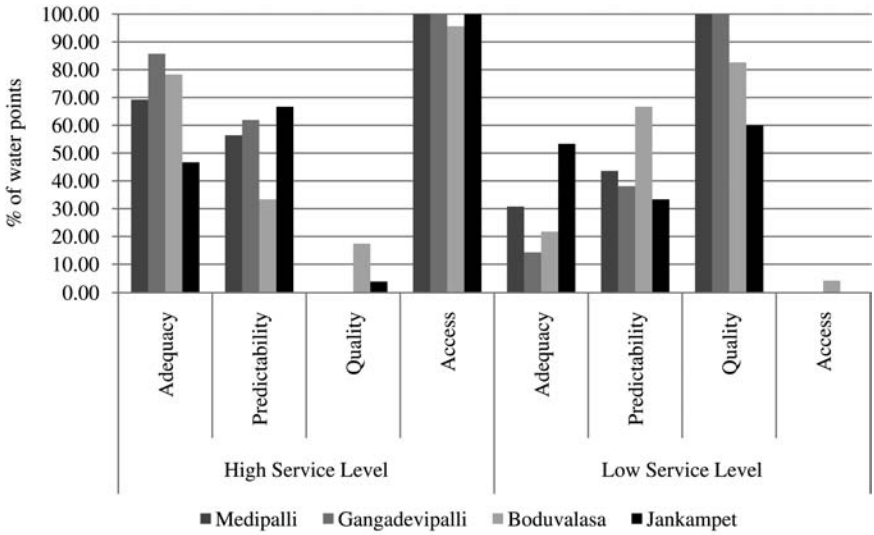

Figure 12.2 Distribution of water points in high and low performance levels (Source: Based on information collected from the sample habitations)

of water supply systems. However, there is a need for further capacity-building inputs for the watermen; as local skills are not readily available, repairs to hand pumps are delayed. The staff of the Gram Panchayat and the local committees is responsible for managing environmental sanitation and safe disposal of liquid and solid waste in the villages. Using rickshaws/vehicles for collecting solid waste, common garbage bins/pits, segregation of plastics and other wastes, and developing composts are some of the practices involved.

Elaborate financial arrangements are made in these villages, which are built on principles of transparency. The collection of tariff and record-keeping are regular. Village meetings are organised annually to share details and information related to financial aspects of WASH governance. People abide by the norms set by the local committees. Inventories of WASH facilities (lists of families that have household tap connections, toilets, families that pay tariff, etc.) are also maintained by the Gram Panchayat/local committee, which is a rare practice in several villages.

Investments made in the WASH sector in the four villages show significant variations: Both Gangadevipally and Medipally made capital investments for WASH infrastructure (Capital expenditure for infrastructure – CapExHrd) higher than the average of all the NGP villages. Capital expenditure for WASH infrastructure in the other two villages is less than the average. Similarly, outlay on other types of costs/investments also varies. The following inferences can be drawn from the analysis of WASH governance and service levels from these four villages:

- Institutional space (in the form of functional local committees for water and sanitation) has a strong and positive influence on WASH service indicators such as predictability and accessibility (during both summer and non-summer) and quantity (during summer) in case of Public Stand Posts (PSPs). Strong institutions have also influenced other governance indicators, such as financial management, O&M systems, involvement in planning, etc. Better-functioning institutions are also investing large funds in WASH services. This is indicated by higher value of the coefficient of correlation (from 0.7 to 0.9) between these indicators and institutional space.
- Involvement of local communities in WASH planning has a strong and positive influence on the costs/investments undertaken in this sector, as indicated by the very high value of the coefficient of correlation between planning and cost indicators (above 0.95). Further, the planning process also influenced the other governance indicators, such as institutional space, financial management/transparency, etc. – proper planning helped to increase the predictability and accessibility of WASH services.
- Capacity-building inputs can influence WASH service indicators, particularly predictability, accessibility and quantity of WASH services from the PSPs. O&M-related systems were also positively influenced by the capacity-building inputs in these villages. Other governance indicators (institutional performance, planning, etc.) and cost indicators (total costs) were also positive, strengthened by capacity-building inputs.
- The O&M-related indicators/systems have a strong and positive influence on predictability, accessibility and quantity of water supply systems. This is observed in case of both HPs and PSPs.
- Financial management indicators (which include transparent systems of managing funds and records, tariff collection, etc.) have a strong influence on all WASH service indicators except quality.
- Cost indicators, particularly the total cost (US$/head/year), are influenced positively by all indicators of governance. This means that better-performing institutions tend to make higher and more prudent investment choices on WASH facilities, so that the service levels are high. This is reflected in the high level of predictability and accessibility of WASH services.
- Even strong institutions could not make much difference in the quality of water from the HPs and PSPs with contaminated drinking water sources. This quality issue was addressed by establishing community-managed water purifying plants.

V Conclusions

Analysis of the data on various indicators of governance across 107 villages indicates overall poor governance of the WASH sector at village level. Of the 107 villages, only four could transform the investments into higher-level WASH services. In these four villages there appears to be a strong relation between investments, service levels and governance arrangements, while no such link is observed in the remaining villages. In Andhra Pradesh the maze of investments that produce low levels of WASH services could push any policy-maker or development activist to despair. Weak governance systems are the underlying reason behind such low service levels. It is observed that, in the four villages in the state where strong local institutions could make a difference, good governance has ensured delivery of higher levels of WASH services. Transparency in operating systems, accountability of functionaries and citizens at various stages, and the participation of local communities (particularly women and disadvantaged communities) in these villages could be worth emulating. Thus, scaling up good governance practices from this (admittedly small) sample of model villages, which still have their own problems, would be worthwhile.

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Appendix

Table A12.1 Parameters and indicators – understanding correlation among WASH services, WASH governance and WASH costs: Insights from model villages

Zone	*Central Telangana Zone*	*Central Telangana Zone*	*North Coastal Zone*	*North Telangana Zone*
Village	*Gangadevipally*	*Medipally*	*Boduvalasa*	*Jankampet*
A. General Details				
Functionality of VWSC	Yes	Yes	Yes	Yes
NGP/NNGP	NGP	NGP	NGP	NNGP
No. of functional PSPs	6	6	15	13
No. of functional hand pumps	1	7	8	2
B. WASH Services: % of water points providing higher service level during summer				
Quantity	86%	69%	78%	47%
Predictability/reliability	62%	56%	33%	67%
Quality	0%	0%	17%	40%
Access	100%	100%	96%	100%
C. WASH Services: % of water points providing lower service level during summer				
Quantity	14%	31%	22%	53%
Predictability/reliability	38%	44%	67%	33%
Quality	100%	100%	83%	60%
Access	0%	0%	4%	0%
D. WASH Governance Indicators (score out of 100)				
Institutional space for decision making	76	71	47	64
Involvement in planning	65	80	53	64
Capacity building inputs	88	91	49	54
Operation and maintenance systems	33	35	22	26
Financial management	79	78	33	67

Zone	*Central Telangana Zone*	*Central Telangana Zone*	*North Coastal Zone*	*North Telangana Zone*
Village	*Gangadevipally*	*Medipally*	*Boduvalasa*	*Jankampet*
E. WASH Cost Indicators (Rs./head/year)				
Normative costs (costs supposed to be required as per norms of the department)	210	453	257	265
Actual costs (costs actually incurred in the village)	1,096	1,715	447	529
Household-level expenditure	747	522	669	1,093
Total Costs	1,843	2,237	1,116	1,622

Appendix 12.1 Norms and Standards of Service Levels for Drinking Water in India

The norms in India have recently become less exact in terms of figures. There has been a shift towards broadening the norms and guidelines and allowing flexibility to communities in planning water supply schemes based on their needs and to suit to local requirements. It is recommended (GoI 2010) that desirable service levels should be decided in consultation with the local community.

Access: Coverage of population is to be calculated on the following criterion: Percentage of people in the habitation receiving basic minimum quantity of potable water within a distance of 500 m from the household taps or from either a public or a community source.

Crowding: Less than 250 persons per hand pump/stand post. No social exclusion.

Quantity: 40 litres per capita per day; and 70 litres per capita per day (with high livestock density).

Quality: Water is defined as safe if it is free from biological contamination (guinea worm, cholera, typhoid, etc.) and within permissible limits of chemical contamination (excess fluoride, brackishness, iron, arsenic, nitrates, etc.) as per IS-10500 of the Bureau of Indian Standards.

Reliability: The concept of security to access, rather than reliability, is used. Security is based on the premises that, even in times of stress, the households should have access to at least some water. To ensure this and acknowledge that all systems do break down sometimes, security is defined as having access to at least two separate systems. There should be supply of water at least once a day.

Understanding Service Levels

For each of the above service level indicators, a higher level of access indicates the best possible situation in a given situation. As an illustration, if a water point gets 90 points for access during QPA (high level of service), it indicates that that water point is easily accessible without social barriers and there is no crowding. The distance between the house and water point should also be short. On the other hand, another water point may get a low score for access (say 23 points out of 100, indicating low level of service) as it may be far away from residence; has several dependent users (higher level of crowding) and has several social restrictions (on access).

13 Decentralised Governance and Sustainable Service Delivery: The Case of Nenmeni Rural Water Supply Scheme, Kerala, India

P. K. Kurian, V. Kurian Baby and Terry Thomas

I Background

Since the declaration of the International Drinking Water Supply and Sanitation Decade (IDWSSD) (WHO/UNICEF 2010) provision of water supply and sanitation services in rural areas all over the world has become a focus of attention. Significant evolution in the thinking on the subject has taken place in India since 1999, the year in which representatives of the Government of India (GoI) and several states met at Cochin and made what became popularly known as the 'Cochin declaration'. During the following decade 'community demand-responsive development approaches' to rural water supply and sanitation service provision were tested and demonstrated for their viability, indicating a marked shift from previous centralised, supply-driven, engineering-focused approaches. The Millennium Development Goals (MDGs) added further vigour to the collective global effort on WASH service delivery with well-designed targets and global indicators (Lockwood and Smits 2011).

Parallel to this, the Indian states were witnessing political and economic decentralisation efforts of varying degrees of success following the historic 73rd and 74th amendments to the Constitution. This made the local government a critical party to the management of water supply services. The establishment of the Rajiv Gandhi National Drinking Water Mission (RGNDWM) gave further a fillip to the rural water supply and sanitation services; furthermore, the Government of India began to show greater political commitment to the water and sanitation sector, especially in rural areas. Henceforth the previous supply-driven focus began to give way to issues relating to institutional reforms, O&M, cost recovery, community participation, water resource management, water quality and delivery mechanisms. There was a growing realisation by the Government of India that the needs of the poor and marginalised deserved better and more focused attention. In the sanitation sector there was a shift in emphasis from merely building latrines as physical structures towards effecting behavioural change in sanitation (Jha 2010).

Consequently, the Accelerated Rural Water Supply Programme (ARWSP), under the Rural Development Ministry of Government of India, was revamped and was rechristened the Sector Reforms Programme (SRP) (for details, see Chapter 2). The GoI instituted a Memorandum of Understanding (MoU), to be signed between the Union and State Governments, dealing with central assistance for drinking water supply and sanitation. Under this MoU, the state governments were required to clearly articulate a state-wide programme of reforms in the RWSS (GoI 2010) sector to access Central Government funding, following the water and sanitation sector reform principles.

The GoI sought to incentivise the MoU process by:

- committing that by 2006 all RWSS funding would be channelled through *Swajaldhara* (the scaled-up successor of the sector reform programme) and the TSC programmes; and
- making the MoU a pre-condition for accessing loans for the RWSS sector as well as for accessing external assistance.

The role of the government at all levels shifted from that of supplier-provider to that of facilitator, focusing more on policy-making, regulation, training and monitoring over a wide spectrum of development, including water supply and sanitation (Taylor 2009). Under this new approach, the national and regional governments would create a congenial atmosphere for development and provide for an enhanced role for the local governments and Community-Based Organisations (CBOs).

The Government of India adopted the 'Sector Reforms Programme' (SRP) and subsequently the '*Swajaldhara*' in the rural water sector, incorporating principles and practices focusing on demand-responsive approaches. These approaches include changing the role of the government to that of a facilitator, cost sharing, and 100 percent cost recovery in Operations and Maintenance (O&M) since 1999. Several States including Uttarakhand, Kerala, Karnataka, Maharashtra, Andhra Pradesh, and Punjab (Reddy *et al.* 2011) have now adopted the new approach to rural water supply. Participatory methodologies are increasingly applied in the process. The NGOs became partners in this new approach, and international donor institutions like the World Bank (WB) and the Asian Development Bank (ADB) provided funds to support the new style of projects.

This chapter presents a case study on the Nenmeni rehabilitation scheme, one of the 16 large water supply schemes in *Jalanidhi I* in Kerala. Reconfiguring a supply-driven and subsidised water supply scheme managed by the government to a demand-driven and community-managed scheme with partial capital costs and full O&M recovery is a difficult exercise in social, political and institutional terms, quite apart from changes to the technical aspects of the scheme. This case study provides insights for scaling up such initiatives, since successful and sustainable rehabilitation models are few in India.

The main objectives of the case study are:

- to document the rehabilitation process;
- to capture the changes brought about in rehabilitation; and
- to discuss the effect of rehabilitation in the policy context.

II Kerala's WASH Sector

When we look at Kerala's rural WASH scenario, 'self-provisioning' is a major approach to ensuring water security, characterised by the rural-urban continuum coupled with dispersed settlements. Historically, both households and micro-communities actively owned and participated in this self-provisioning of water in Kerala. This resulted in the generation of local technologies and 'local water science'. A classic example can be found in Kuttanadu, the low-lying wetland in Kerala where there are plenty of water sources but potable water is scarce. Nonetheless the local community devised several innovative ways to procure potable water through a process of continuous innovation. Similar experiments had taken place throughout the coastal lowlands and other regions. However, 'technology- and energy-heavy' overexploitation trends resulted in overkill of resources and traditional water systems, pushing the local water science into oblivion.

Kerala's climate makes it a rain-rich state. However, the ecological changes that have occurred there, whether natural or man-made, have made the state 'water-poor'. This water scarcity has four dimensions (Kurian *et al.* 2011):

- spatial (water scarcity experienced by people living in hilly and water-scarce locations);
- social (socially backward and uninfluential communities generally live in water scarce and hilly regions with the fewest social opportunities);
- economic (economically backward and low-income groups cannot afford water services);
- political (the politically uninfluential are by definition powerless to affect the decision-making process).

The 'self-provisioning' approach began to decline as families moved inwards into isolated and difficult terrains, where water was not easily available, and the governments assumed the responsibility, promising free provision. A natural political response to this situation was to require the PRIs to provide water to settlements. Simultaneously, it became the constitutional mandate of the Gram Panchayats (GPs) to cater for the drinking-water demands of their populations. For instance, in Olavanna and Vallikunnu GPs of Kerala, and also in other GPs, a collaborative effort between the communities and panchayats helped provisioning initiatives. Projects such as the *Jeevadhara, Swajaldhara* and *Jalanidhi*, demand-responsive and participatory community-driven drinking water programmes funded by the World Bank, the Dutch government and the

Government of India respectively, have been building on the earlier models and scaling it up.

Donor agencies have played a key role in bringing about reforms in the rural water supply sector, attaching such reforms to the project aid package. The Government of India also persuaded States to adopt Community-Driven Development (CDD) approaches and accept reforms, using funding as leverage (Pushpangadan and Murugan 1997). The State of Kerala has had a powerful monolithic public sector water provider, the 'Kerala Water Authority' (KWA). When large externally-funded projects like the *Jalanidhi* were implemented, they were ring-fenced by special institutional architecture, rules of governance and procedures. As a result, though the projects were successful on the ground and are functioning with admirable success, they have not been able to critically influence sector policies and institutionalise the reform agenda. There is almost a universal acceptance of the CDD model at ground level, among the user population and the local governments (Kurian 2008), but the Government of Kerala (GoK) is still reluctant to address the reform agenda at sector level. Along with the recently concluded negotiation for *Jalanidhi II*, one condition put forth was that the GoK should accept and introduce the *Jalanidhi* model into all rural water supply schemes irrespective of the implementing agency. However, after a few months, the Government Order (GO) making the *Jalanidhi* model compulsory was diluted and relaxed; this was as good as withdrawing the earlier order.

The introduction of new-generation CDD schemes brought new insights and experiences into the sector. The NGOs and GPs were enabled to become sector partners, thus widening the knowledge and experience base in the rural water sector. One drawback is still that the experience remains in the sector is not converted into documented knowledge and disseminated among users. Gaps in human and organisational capacity exist, and there is no arrangement now in the sector for any continuing, structured post-construction support once the schemes are commissioned. Another key opportunity is the application of Information and Communication Technology (ICT) in post-construction support and monitoring sector performance.

Kerala State has a long tradition of distributive and consumption politics. It does not have production and conservation politics that are badly needed in the water sector. When *Jalanidhi* got wider acceptance among the people, the GoK, in response to the demands of the GPs, reduced the electricity charges for water supply schemes. Set on a par with the lowest domestic tariff rates, they became an incentive for pumping more water. However, there are proven cases where this has adversely affected source sustainability in several panchayats as a result of excessive pumping from bore wells. State-level policies have to be consistent and integrated in terms of conservation and distribution, and to complement each other. Another glaring disparity was the rural-urban divide in the subsidy regime (Jha 2010). At the urban level, the government-owned public utility undertakes operation and maintenance, and consumers are not billed or charged for the repair and maintenance. However, in the rural sector the entire burden of operation and maintenance is left to the consumer community, with no involvement or facilitation support after the commissioning of the schemes (Nisha 2005).

In the rural areas there is very little knowledge creation and documentation. As more schemes are implemented that include participatory approaches and the involvement of PRIs and communities, there is an increasing need to develop innovative tools, methods and approaches for managing a decentralised water supply sector (Parker and Skytta 2000). This is a challenge that the rural sector has to address in future. The (KWA) is the main sectoral player in the water supply sector, both rural and urban. Its emphasis is generally on large water supply schemes, based on surface water sources. The focus of the distribution is Public Stand Posts (PSPs) with a 'road bias' (located on the roads). Interior and difficult locations are not covered by the KWA in the rural areas, and, where they are covered, the service level is poor and irregular. Non-revenue water, wastage, and unsustainable revenue collection through O&M is high. In 1997, the GoK took a major policy decision to transfer 1,058 single-GP water supply schemes of the KWA to Gram Panchayats with powers to collect user charges. Subsequently, the Kerala Rural Water Supply and Sanitation Agency (KRWSA) was created specifically to implement *Jalanidhi I*, funded by the IDA of the World Bank.

The first major project with demand-responsive approaches was prepared and got approval from the World Bank for a total amount of Rs. 451 crores (US$ 98.6 million). The project included components such as water supply schemes, groundwater recharge, sanitation, strengthening of Gram Panchayats, sanitation and hygiene education, women empowerment, and capacity building. Both the new schemes and the rehabilitation of existing schemes were taken up under the sub-component of the water supply schemes in the *Jalanidhi* Project; the project began in 2000 and closed in 2008, with a total of 3,710 water supply schemes during the period. Of these, 3,696 were small community water supply schemes, and 16 had a coverage of more than 500 households each. Of the 3,710 schemes, 91 were KWA rehabilitation schemes (Pilgrim and Samuel 2008). These were originally planned and implemented by the KWA and subsequently taken over by the GPs implementing the *Jalanidhi* Project, the takeover being mandatory under the agreement between KRWSA and the GPs, and part of the conditions of the loan agreement with the World Bank (Kurian Baby 2003).

Jalanidhi was thus a departure in policy, as it became the first major community-managed rural water supply project to which the beneficiaries contributed 15 percent of the capital cost and owned responsibility for 100 percent of the operation and maintenance cost, after the commissioning of the scheme.

The present case study looks at the transformation undergone by a rural water supply project in the Nenmeni Gram Panchayat (GP) of Wayanad District in Kerala, following a structured trajectory of successful rehabilitation and professionalised management. This experience from Kerala highlights lessons in cost recovery, improved service delivery, community-led professionalism and effective inclusion of the weaker sections of society.

III Genesis of the Nenmeni RWSS in Jalanidhi

The Nenmeni RWSS was commissioned by the KWA in 1993. It has gone through four phases of evolution since its commissioning (Figure 13.1):

Phase I (1993–2005) – commissioning, operation and maintenance by KWA;
Phase II (2005–2007) – GPs take over the scheme and manage O&M;
Phase III (2007–2009) – management of the scheme by the Transition Management Committee (TMC);
Phase IV (2009 onwards) – managed by an apex-level community body.

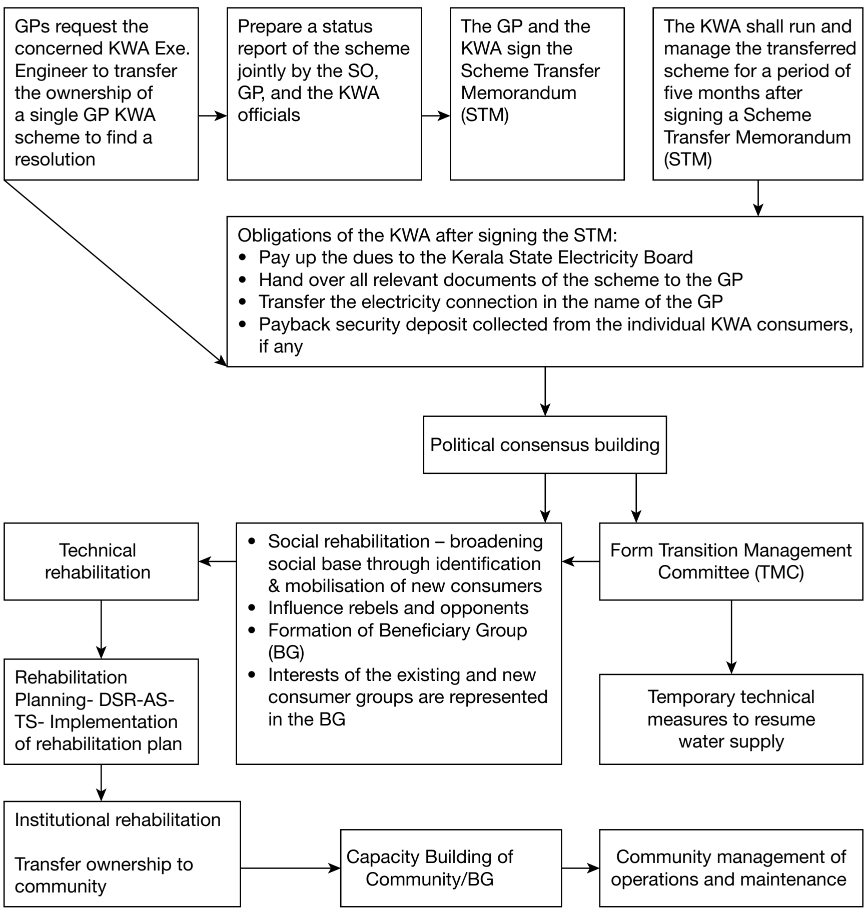

Figure 13.1 KWA rehabilitation process

Phase I (1993–2005): KWA in Charge

KWA has a wing for investigation and planning. It identifies potential rural water supply schemes on its own or under the influence of the PRIs or people's representatives. The KWA is usually short of funds, and, even if schemes are planned, it is not able to undertake work immediately and complete the scheme in a timely manner. This delay affected the Nenmeni scheme: it took 12 years to be commissioned. Two types of services are offered by the KWA: private domestic connections and PSPs. For the former, applicant households have to pay a connection fee to the KWA; such connections are metered and incur water tariff to the KWA according to consumption. For the Nenmeni scheme a total of 389 domestic connections and 250 PSPs existed at the time of the takeover. Extension of the pipeline and establishment of new PSPs usually accompany this phase. In general, during the operational phase the schemes are characterised by poor and unreliable service delivery and unsatisfied consumers.

Phase II (2005–2007): GPs Take Over

The process of rehabilitation usually faces two difficulties: convincing the GP to take over the scheme, and convincing the community and influencing its decision in favour of rehabilitation.

Initially the GPs balked at attempting rehabilitation, on the grounds that the community was not willing to rehabilitate and take on the scheme. No GP is usually willing to take over a large KWA scheme and run it on its own, as it does not have the technical and managerial expertise to do so; secondly, it is a huge financial burden on the GP; and thirdly, consumers get free water through the PSPs, and no local government is keen to face their ire and make them pay for it. When the KRWSA sensed the GPs were shying away from taking over KWA schemes, it overcame this by making the takeover/transfer of ownership of the KWA scheme a condition of participating in *Jalanidhi* Project. The *Jalanidhi* Project was a far bigger incentive, offering an opportunity to establish a large number of schemes and solve drinking water scarcity for several decades. Tempted by this, the GPs submitted to the 'carrot and stick' and expressed willingness to take over the single-GP KWA schemes as well as their entry fee for the *Jalanidhi* Project.

The next step was to convince the community of the need to rehabilitate the KWA schemes and to influence it to participate in the process, politically, socially and financially. The notions of 'the panchayat should provide drinking water' and 'pricing of water' are injected into the community, and political passions are whipped up by elements opposing rehabilitation (KRWSA 2008). Local KWA employees have a role in this anti-rehabilitation campaign; if the scheme is successfully rehabilitated and handed over to the community, they will be transferred to other locations where the KWA scheme is implemented, and they do not want to be displaced from their comfort zone. A lot of hue and cry, agitation, and political campaigning therefore took place as part of this 'engineered public protest'. This phase was managed by assessing the existing condition of the KWA scheme and putting relevant details before the community, setting out the details of the rehabilitation and improvement in the water supply scheme; another successful strategy was to rope in new consumers looking for water supply. Differential financial participation has also been a strategy to make rehabilitation as smooth as possible. The existing consumers were usually allowed a concessional rate of contribution, as they had already incurred expenditure to become consumers under the KWA scheme. Thus we can see that rehabilitation is a process with social, political, technical and financial functions.

The Nenmeni GP was very keen to join the *Jalanidhi* Project. Therefore, it took over the Nenmeni KWA scheme during the initial days of the *Jalanidhi* Project in the GP. Besides, the left front ruling coalition of the Nenmeni GP exhibited a rare political will to take over the scheme. The identical political affiliations of the Social Organisation (SO) Team Leader (TL) and the left front GP board also made for good inter-personal relations, which helped in building the trust. The GP therefore did not cast any doubts on the intentions of the KRWSA/GoK in connection with the takeover move. However, the GP had to face some trouble after the takeover: the quality of the water supplied was poor and turbid, the infiltration gallery was clogged with silt, and the water supply was not regular. The GP appointed a pump operator on daily wages during this period to pump water and maintain the supply; it was careful not to disturb the existing supply scheme, however inefficient it was. The GP had incurred a large financial bill to meet electricity arrears. It negotiated with the GoK and accepted the offer of a one-time settlement to clear the dues owed to KSEB, and as a result the GoK paid the KSEB Rs. 27 lakhs (US$ 59,055).

Even when the scheme was taken over and run by the GP, there was no substantial accountability system, and the quality of the water supplied remained poor. The rehabilitation of the Nenmeni RWSS was undertaken at a cost of Rs. 50 lakhs (US$ 109,361). Physical works of rehabilitation included 25,000 meters of additional distribution network, repair and maintenance of infiltration gallery and intake point, procurement of new pumps, and installation of a silver ionisation mechanism to purify the water. The scheme, which had had 257 PSPs, and 389 domestic connections before the rehabilitation, was expanded by providing new connections, and today the total number of domestic connections stands at 1,596, in addition to the 70 PSPs that the scheme now maintains.

Phase III (2007–2009): TMC Management

A total of 8 beneficiary groups (BGs), with a total membership of some 240 households, desired to join the KWA scheme as beneficiary households. The SO formed a TMC, with representation of these beneficiary groups.

During the rehabilitation of the scheme – done under the leadership of the TMC – the water supply was maintained intact and the GP continued to pay for the energy and wage cost of operations. It took about two years to complete the rehabilitation and provide new domestic connections. At the end of this transition phase there were 727 domestic connections, up from 389 during the KWA management, with the rest of the domestic connections coming from new membership households. Strategically, the pent-up demand for improved service delivery from new potential consumer households acted as a bulwark against existing consumers' resistance to rehabilitation. Capital cost recovery is structured in such a way that the existing consumers are exempted or pay very little, while new consumers are charged more. The process also capitalised the hidden unhappiness of the traditional consumer households over the poor and unreliable services, promising reliability and quality. Thus, the process ensured that the credibility of the service provider was established. The chief technical features of the Nenmeni RWSS are provided in Box 13.1.

Box 13.1 Nenmeni RWSS

- Year of commissioning: 1993
- Source: 6 m diameter well + infiltration gallery
- Pump house: pump house over well
- Pump set: 50 HP × 2 submersible pump sets
- Pumping main: 5,840 m
- Distribution system: 70,227 m
- No. of public stand posts: 70
- Domestic connections: 1,596
- Storage reservoir: RCC-GLSR
- Capacity of GLSR: 380,000 litres
- Pumping shifts: two 8-hour shifts

Phase IV (2009–2012): Expansion and Maturing

The number of domestic connections has reached 1,596, up from 727 at the end of the transition stage. After clearing the sums due to the KSEB, the scheme was transferred to the Scheme Level Executive Committee (SLEC). The case study features discussed in the following section capture the metamorphosis of the scheme since 2009, and examines how the community leadership turned around the scheme to what it is today. Governance and transparency systems, along with improvement in service levels have happened during this phase.

IV Outstanding Features

Substantial Coverage in the GP

The Nenmeni RWSS distributes water in 18 of the 22 wards (habitations) of the Nenmeni GP. The Nenmeni RWSS was rehabilitated towards the end of the *Jalanidhi* Project. There are more than 100 other smaller water supply schemes in the GP that cater to its other wards and hinterland micro-locations (Plate 16). Today, the total coverage of the water supply scheme in the GP is nearly 85 percent.

Social and Institutional Rehabilitation

The Nenmeni RWSS has good institutional, social and human capital systems, and this contributes substantially to making the scheme sustainable and viable. When the rehabilitation of the scheme was taken up, eight new BGs were formed to include the new member households. Representatives from these eight BGs joined together to form the Scheme Level General Body (SLGB) and the Scheme Level Executive Committee (SLEC). However, the SLGB and SLEC did not represent the existing domestic consumers (389) from the KWA. As the rehabilitation work was completed, the political leadership of the GP and the SLEC took a proactive decision to revamp the institutional system of the Nenmeni RWSS: the entire body of household consumers was reorganised into nine area clusters.

The area cluster has a general body. Each cluster elects five representatives to the SLGB. The SLGB elects a nine-member SLEC, with one representation for each area. Further, women members have a majority in all the RWSS forums. The institutional arrangement is illustrated in Figure 13.2.

The GP Council has 22 members. The GP President is an ex-officio member of the SLEC. The SLEC has nine members; it meets every month and during

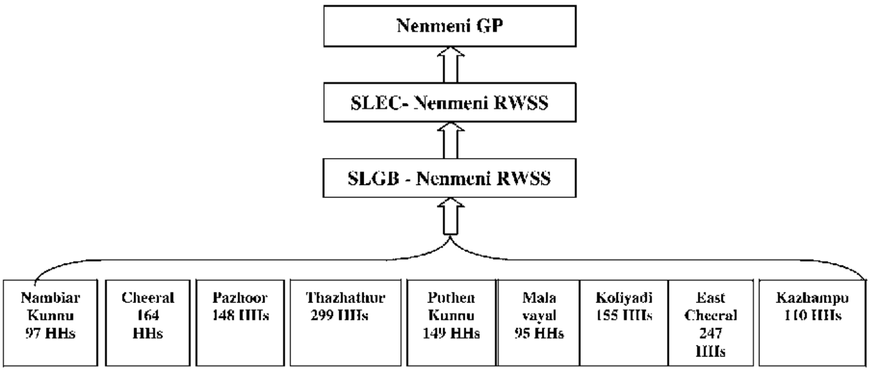

Figure 13.2 Institutional structure of Nenmeni RWSS

other emergency situations. Its administrative head is a paid secretary, who is another ex-officio member. The SLEC has five female and four male representatives. The General Body of the Nenmeni RWSS consists of 45 members, with five representatives (three women and two men) for each area. The SLGB meets every six months.

Relationship with the Gram Panchayat

The Nenmeni RWSS SLEC has maintained cordial working relations with the GP Council, and the President of the Gram Panchayat is an ex-officio member. During the three years since 2009 the GP has provided aid of Rs. 510,000 (US$ 11,155) to the SLEC for extending distribution networks and relocating PSPs. The SLEC functions like an NGO in the GP, offering its expertise, experience and learning to the GP, especially in the WATSAN sector. Recently, one of the micro-community schemes funded and implemented by the GP became defunct, due to management and organisational problems. The GP entrusted SLEC to take over the scheme and operate and manage it on behalf of the GP, with powers to levy and collect O&M charges.

Inclusive Expansion of the Nenmeni RWSS

When the Nenmeni RWSS was rehabilitated and transferred to the community it had 727 domestic connections and 257 PSPs. (The number of PSPs was later reduced to 70 as households that had depended on them opted for higher service level through domestic connections.) At the time of writing there are 1,596 domestic connections. Closing the PSPs maintained under the KWA management was a topic for heated public discussion and debate in the GP. The GP Council came forward to maintain the remaining 70 PSPs that were necessary as communal sources of water for the local communities. The SLEC estimates that, on average, eight households draw water from each PSP, which works out to 560 households ($70 \times 8 = 560$). Thus, the Nenmeni RWSS currently supplies water to 2,156 households, and the GP pays maintenance charges for the PSPs at the rate of Rs. 200 per household per year.

The RWSS supplies water free of charge to the Primary Health Centre (PHC), an old age home, the GP Office, and five houses, which have only elderly people aged above 70 at home. The SLEC has been very sensitive to the social realities and has devised its own inclusion strategies. Elsewhere, once the water supply schemes became operational, the beneficiary committees managing and operating the scheme have been charging very high rates to new and prospective members, but the Nenmeni RWSS still maintains a pro-poor and inclusive policy in admitting new members. New member households of the general category need to pay only Rs. 1,500 in initial entry fees, while BPL households pay Rs.750 , and SC/ST households Rs. 300. The fee structure is illustrated in Figure 13.3.

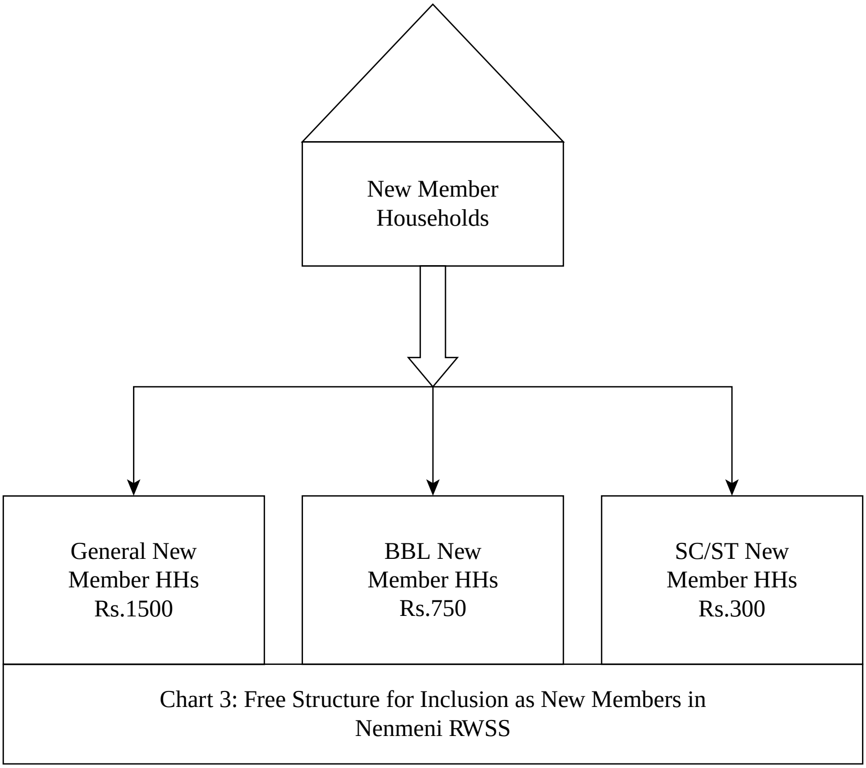

Figure 13.3 Fee structure for inclusion as new members in Nenmeni RWSS

Collecting Water Charges and Financial Management in NRWSS

The process of collecting O&M charges for monthly water consumption begins with the meter reader visiting the member household. He records the meter reading and prepares the demand notice and presents it to the household.

There are different ways the consumer can pay the O&M charges. S/he can make an on-the-spot payment to the meter reader, who will issue a receipt for the money received. Alternatively, payment can be made either at one of four local collection centres (weekly, by pre-arrangement), or else at the computer training centre of the Nenmeni RWSS or at its central office. Figure 13.4 shows a process flow chart, capturing the billing and water tariff collection. The water meter is seen as a behaviour-regulating device and is well accepted by the consumers. Metering of water use has not given rise to any controversies (Table 13.1).

Operation and Maintenance Charges (Tariff Structure)

The NRWSS pays close attention to the consumption of water and scrupulously monitors it. The community has followed the system of telescopic

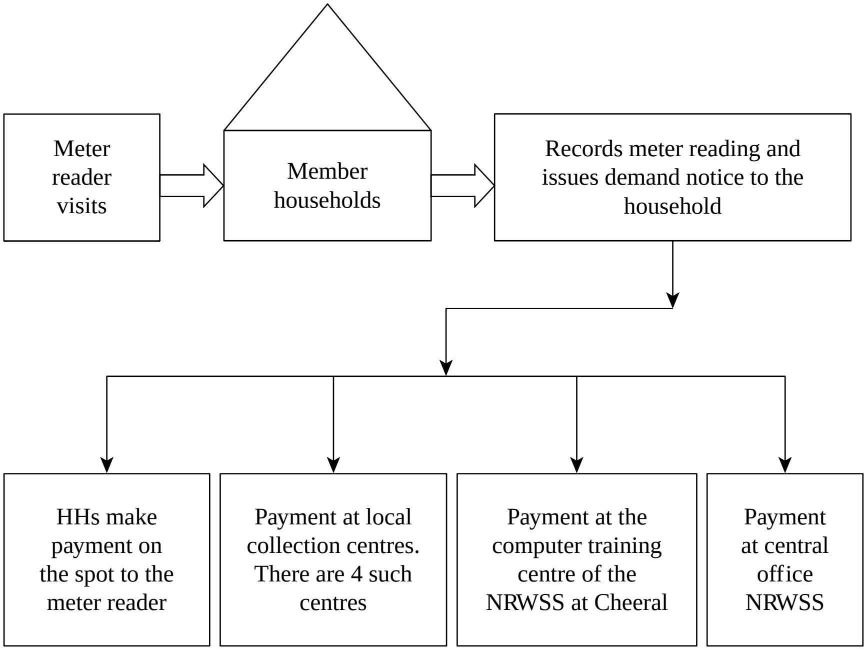

Figure 13.4 Process of water tariff collection

Table 13.1 Income and expenditure under O&M in NRWSS

Year	*Income*	*Expense*	*Balance*
2009	823,740	726,488	97,252
2010	986,831	733,139	253,692
2011	1,020,656	869,381	151,275
Total	**2,831,227**	**2,329,008**	**502,219**

tariff-setting – the rate increases progressively for consumption over 10,000 litres. The minimum O&M charge for a household is Rs.50/month. A detailed water tariff structure is given in Table 13.2. The tariff structure is fixed in such a way as to discourage higher levels of water consumption.

Complaint Redress System

The Nenmeni RWSS has a sound complaint redress system. Complaints are received either directly at the central office or by telephone. All complaints received are recorded and transferred to plumbers engaged by the project. After the complaint has been addressed, and suitable action taken to rectify it, they

Table 13.2 Water tariff structure in Nenmeni Rural Water Supply Scheme

Consumption level/month	*Base charge*	*Additional charge*	*Remarks*
0–10,000 litres	Rs.50	Nil	Rs.50 if the consumption is 10,000 litres
10,001–15,000 litres		Rs.8/each additional KL	Rs.90 if the consumption is 15,000 litres
15,001–20,000 litres		Rs.10/each additional KL	Rs.140 if the consumption is 20,000 litres
20,001–25,000 litres		Rs.15/each additional KL	Rs.215 if the consumption is 25,000 litres
25,000+ litres		Rs.25/each additional KL	Rs.340 if the consumption is 30,000 litres

record the action taken in the work allotment book under their signature. If the complaint is not resolved, it will be carried over to the next day and included afresh in the work allotment register.

Staff

The administration of the scheme is headed by a paid secretary, who is an ex-officio member of the SLEC. Three pump operators, one water meter reader, three plumbers, one valve operator, three accountants and one computer instructor work with the scheme (Figure 13.5).

Diversification of Investments

The Nenmeni RWSS has also made some investments, considering the special needs of its area of operation. It has started a computer instruction centre at Cheeral junction, where students and young people can train on computer applications. It also undertakes jobbing DTP work and has installed a photocopier and a fax machine at the computer centre, so that these services are available to the local people at a reasonable rate. Two 50-hp electric pumps were purchased and installed to enhance the efficiency of distribution. The present office of the NRWSS is situated at Karinkalikunnu, Cheeral. It is a bit far from the village centre, and people find it inconvenient to visit the office, while they come to the village market for various needs. Recognising this as a hindrance to future progress, the SLEC purchased 0.06 hectares of land at Cheeral junction. The SLEC proposes to build a community hall and office space for the NRWSS, and to move the computer training centre to this site.

IV Key Lessons

- Consumer households rate the scheme and its service level highly. The SLEC and its administrative set-up function like an extended

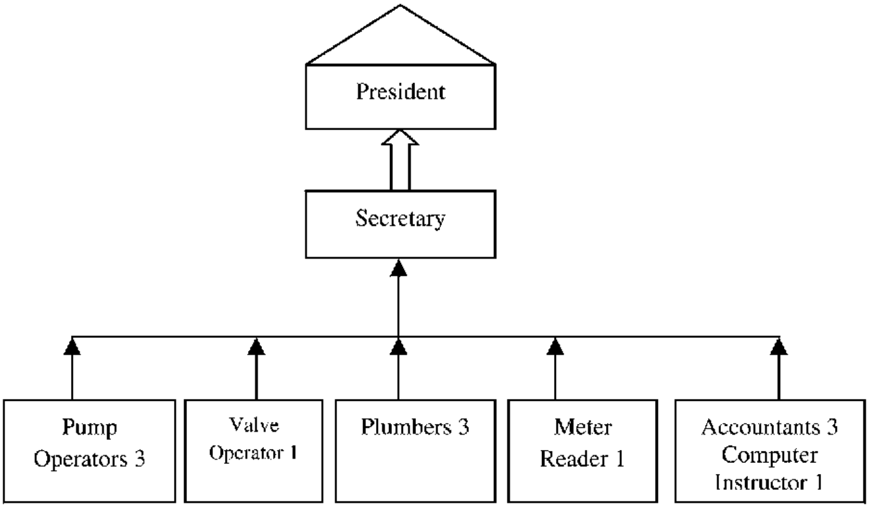

Figure 13.5 Administrative set-up in NRWSS

non-governmental arm of the GP. The NRWSS supports the GP with its specialist skills and expertise in the water sector. The GP takes advice from NRWSS to address problems of other small community-based water supply schemes in the Panchayat.

- The NRWSS is a good case of positive local politics supporting local development initiatives. The NRWSS has so far avoided party-based politics affecting its rank and file, including its elections. An institution that supplies water to around 2,000 households on an everyday basis can potentially become a power centre in a GP in the Kerala context. It can become either a parallel power centre opposing the GP, or an extension of the GP with an NGO façade. The NRWSS has already laid a foundation of professionalism, devoid of partisan politics.
- A methodology for rehabilitation was developed. Rehabilitation of the Nenmeni WSS was attempted by the SO only after making substantial progress with regard to the small water supply schemes. Thus, room for local controversies was kept to the minimum. With construction on the smaller schemes progressing, the confidence of the local community was also enhanced. Hence, the credibility of the rehabilitation scheme improved – the timing of the intervention with regard to the rehabilitation was critical to its success. Another important aspect of the rehabilitation is the continuation of innovation, even after making the scheme functional. This has improved the coverage and efficiency of the scheme.
- The NRWSS has been developing local leadership and skills in 'learning by doing' mode. The scheme has had a stable leadership ever since its

Table 13.3 Effect of rehabilitation of the KWA scheme

Parameters	*Before rehabilitation*	*After rehabilitation*
Water availability	Irregular and inconsistent water availability	Water available on alternate days regularly (350 lpcd).
Timing of water supply	Supply of water was irregular – without fixed timing – making collection of water difficult	Water released at fixed times; hence, collection is easy
Quantity of water supplied	Quantity of available water varied from time to time	A fixed quantity of water is assured (equity in distribution is assured)
Chlorination	Chlorinated, but very often, water tasted of excess chlorine	Silver ionisation of water
Collection point	Mostly Public Stand Posts; limited private domestic connections	A combination of yard taps and essential Public Stand Posts (community stand posts)
Response to breakdown	Slow; rectification of breakdown took considerable time	Quick; efforts are made to supply water without much delay
Payment of water cess	KWA office, which is far from the user community; often time-consuming; exclusive time needed to pay water tariff	Local collection of water charges; collection facility available at selected local centres and central office of the SLEC
Public Stand Posts	No owner for the Public Stand Posts; no respect for a public tap as a common property; water from Public Stand Posts often misused; public taps tampered with and destroyed	Public Stand Posts converted into community stand posts; the GP pays for the water consumption through Public Stand Posts
Resource use	Water was wasted/misused for non-domestic purposes	Water controlled either by metering system or by strict vigilance of the community
Redress of complaints	Slow and unreliable; redress often invited 'extra' expenses	Prompt and reliable; no additional expenditure for consumers
Coverage	Less	Much increased: from 150 to 430 percent

planning stage, and the SLEC is well informed of all developments in the scheme. This stability of leadership has helped to develop a sustainable vision for the scheme.

- The scheme has developed a lot of systems and procedures based on its practical experience and exposure to field realities. This learning-oriented system can be called 'community professionalism.' The complaint redress system, metering, meter reading, collection of water cess, multiple collection centres, and transparency have all resulted from the learning orientation and innovativeness of the NRWSS.

- It has been the experience of *Jalanidhi* throughout the state that, once a scheme is commissioned, the community closes the membership and does not easily admit new members, even if water is available. However, the NRWSS departs from this practice. It has adopted and devised an inclusive approach and easy and workable inclusion techniques. It has made special provisions for BPL and for SC and ST households, with lower subscription rates for new members. Over three years (2009–11) the scheme has generated a positive financial situation, and it has built up a credit balance of Rs. 502,219 (US$ 10,985) after three years of operation.

A community-driven, PRI-centric approach in service delivery is a powerful institutional delivery model (Sato and Imai 2010). However, communities need strong professional, technical and management empowerment for sustainability. At a time when sector players often opt for new projects and neglect existing dysfunctional ones (thus creating a graveyard of investments), the Nenmeni RWSS is a landmark community achievement of successful rehabilitation and expansion of a potentially viable but failed public scheme to improve coverage and service levels. The production cost per kilolitre is only 40 percent of that of the Kerala Water Authority's. The case study redefines the conventional approach to participation. Nenmeni is a typical case of successful takeover, rehabilitation and management of a comprehensive piped water supply scheme by an elected committee of beneficiary households, and the households participate fully by paying 100 percent user charges, including capital maintenance and power, without default. The GP has facilitated the process with governance support. In a modern, rapidly-urbanizing society driven by an economic rationale, beneficiary participation essentially means consumers' choice manifested in effective demand. The management committee assumes the provider role to ensure sustainable service delivery. Sceptics raised serious doubts about decentralisation as a tool for inclusion, arguing that decentralised management of a scheme does not always ensure that its decision-making is actually participatory. Here again, the study shows how effective decentralised local governance can be inclusive by retaining the PSPs intended for the poor, subsidised by the GP. Under the current supply-driven models, on the other hand, subsidies are appropriated by the institutional actors and absorbed in transaction costs.

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14 Sustainable WASH Service Delivery: Policy Options and Imperatives

V. Ratna Reddy, Catarina Fonseca and Charles Batchelor

Inadequate water, Sanitation and Hygiene (WASH) services represent one of the most daunting policy challenges in the Indian development process. WASH happens to be the most neglected sector, despite its economic, health and environmental importance, as noted in terms of losses due to poor WASH services (OECD 2012). Despite policy targets and strategies set up since 1990, and the substantial spending in the sector, the targets are not being achieved or sustained. This could be attributed to the seven co-ordination gaps identified in the OECD countries (Charbit 2011, OECD 2011). In the Indian context, the most important ones include policy, funding, administrative and accountability gaps.

In the case of drinking water, substantial progress has been made in terms of coverage and access. Often such progress is limited to providing the infrastructure, while the actual services in terms of access, quantity, quality and reliability are far behind the plan objectives. At any given point in time drinking water services slip back from full coverage to partial coverage in 30 percent of the villages. In the case of sanitation and hygiene the situation is much worse. Sanitation coverage is poor, and use of sanitation facilities and hygiene practices do not reflect India's economic success. Sanitation has not been a policy priority, though there has been increasing policy concern in recent years. Sanitation and hygiene are always linked to drinking water and never flagged as a policy priority in themselves, though India has separate guidelines for water and sanitation. This is the policy gap, as policy is inadequate in addressing sanitation and hygiene issues.

Despite being an important basic social amenity, the WASH sector has been given a low research priority in India. Apart from the research carried out by the bilateral agencies like the World Bank and UNICEF, very little commissioned or voluntary research is being taken up within India. This reflects the policy priorities at the national and state levels. Most of the research focuses largely on the progress and status of the water and sanitation sectors in the context of Millennium Development Goals (MDGs), though the Water and Sanitation Programme (WSP) of the World Bank brings out in-depth research studies on socio-economic aspects of the WASH sector. However, all these studies based on secondary information provide an aggregate picture of the sector. Often these studies cover one area at a time (Rodriguez *et. al.* 2012) and, lacking a comprehensive analysis, fail to identify the critical systemic gaps and provide any concrete policy direction.

This volume of research papers, generated from the five-year action research project WASHCost India, attempts to provide a detailed analysis of various aspects pertaining to the WASH sector in the three core areas of policy, financing and governance. The action research is based on intensive field studies following a scientific approach to sampling in rural as well as peri-urban areas. It adopted an innovative methodology of life-cycle cost analysis for estimating unit costs, and a service-ladder approach for assessing service levels. Though the core of research is based in Andhra Pradesh, India, the coverage and representation of all the 9 agro-climatic regions of Andhra Pradesh provides the scientific basis for drawing generic conclusions for regions of India that have similar agro-climatic conditions. Besides, a comparative assessment of service delivery models in four other states of India (Chapter 11) and a case study of decentralised service delivery model in Kerala (Chapter 13) provide a broader perspective and wider relevance of the findings and conclusions. This final chapter pulls together the entire analysis, synthesises and draws policy conclusions for the sector. The synthesis is provided for water and sanitation separately.

I Water

Constitutionally water is currently a state responsibility in India. The federal government assumes the responsibility of providing financial support of not less than 50 percent of the budget allocations to the WASH sector (providing grants that should be matched by the state) along with the guidelines for implementing the programmes. The state governments take on the responsibility of implementing the programmes with matching financial provision. The state governments have the freedom to adopt or modify the guidelines, or even design their own implementation modalities.

Over the years India has been adopting different service delivery models through policy guidelines complemented with substantial financial allocations (Chapter 2). The country is close to achieving full coverage in terms of infrastructure provision, which is a significant achievement, although there is general recognition that the security of water services continues to be a major challenge for both rural and urban areas. Water security is considered to mean reliable and secure access to water of acceptable quality over time, even when there are major supply system failures or prolonged droughts. Hence, water security does not only equate to constant quantity and quality of supply but also to the resilience of water services received by users from a public water supply system, self-supply or a combination of the two.

In India, a very pragmatic view has been taken of water security, one that is based on the recognition that even well-managed public water supply systems fail catastrophically from time to time, often for reasons that are difficult to predict. Hence users should have access to more than one public water supply system. Users who are willing and able to pay for private bore wells or roof water-harvesting systems are independently following the same logic; increasingly, they are improving their household water security by investing in water supply systems that are completely independent of the public water supply systems. Households spend as much as 20 percent of the total capital costs on water (Chapter 4). In addition, households invest considerable amounts of time in fetching water, resulting in substantial opportunity costs caused by poor access to water round the year.

The research clearly brought out that rural drinking-water-sector financing in India needs to be addressed upfront with more realistic assessment of unit costs and their composition. This is the 'funding gap', as the present allocations are inadequate to meet the service demands. Similarly, more attention should be given to ensuring that the lifespan of infrastructure and institutions is improved, along with the value for money of services provision (e.g., the annualised cost of achieving a specified level of service). The cost estimates using LCCA methodology across agro-climatic regions and technologies revealed that rural drinking water investment requirements are often underestimated. This is mainly because the cost norms, or the standard schedule of rates used, do not include number of maintenance and support components, as they focus mainly on infrastructure. The result, as revealed by investments over the years, is that water utilities end up spending more than the prescribed norms. While the cost norms are fixed uniformly across the regions or locations, in reality costs vary substantially across and within agro-climatic zones. Inter-village (within the zone) variations are much higher than that of inter-zonal variations. Thus, uniform allocations based on infrastructure across regions may not be the most efficient way of providing sustainable service delivery (Chapter 4).

One of the main reasons for this is that the actual life of the systems is much less than the norms used for fixing the costs. Apart from the agro-climatic conditions, an approach focused on infrastructure (fixed capital costs) neglects allocations towards capital management, source protection, operation and maintenance and support costs, contributing to the poor life span of the systems and a waste of investments. Ensuring appropriate recurrent allocations, along with proper design and governance of the systems, could help to reduce the gap between normative and observed life spans (Chapter 5). Findings show clearly that high costs are not necessarily associated with better service levels. In fact, it is observed that, more than the unit costs *per se*, the main reason for low service levels is the imbalance in the costs' composition and the yearly recurrent costs.

In terms of technology choices, the policy is moving towards multi-village schemes as the rural water supply scheme design of choice in Andhra Pradesh as well as in other states of India. Unit costs also vary across technologies, especially between single- and multi-village schemes (SVS/MVS). The analysis brings out that multi-village schemes (MVS) may not be the best option for sustainable service delivery. Promoting multi-village schemes with surface water sources does not appear to be an optimal option, due to its high costs and low services delivered when compared with other options (technologies) available. It is observed that local communities have only partial control over the management of MVS, as the management is split between contractors (outside the village) and village panchayat (within the village); the village communities are therefore restricted to managing only supplies delivered by the main system. Hand pumps are the least-cost option albeit with poor service levels and often the most reliable. Hence they are a preferred option during a crisis. But, hand pumps are not the part of the mainstream supply technology, due to the effort and drudgery involved in accessing water (Chapter 4).

The variations in unit costs and service levels across the sample villages of Andhra Pradesh are not interlinked. The relation between existing unit costs, focused almost exclusively on capital expenditure, and service levels is quite weak. On the other hand, level of education, demographic and economic factors, technology and governance-related factors appear to be influencing unit costs as well as service levels. However, this does not fully explain the variations, and so changing these factors is not sufficient to improve service levels. Increasing the life of the system is critical for reducing the unit costs. The need is to maintain the systems by means of allocations towards capital maintenance and ensuring required allocations for operation and maintenance so that systems function efficiently despite their age. Maintaining the systems in good condition would not only reduce costs but also improve service levels. Improving literacy and education levels would help to reduce the unit costs along with improving service levels in drinking water at the community level. Existing governance structures appear to be too meagre to have any influence on unit costs. However, they do seem to have a positive impact on service levels, so improving the functioning and effectiveness of governance indicators such as village water and sanitation committees could be a viable policy option in this respect (Chapter 5).

High-altitude and remote locations seem to suffer with poorer service levels. These regions need priority treatment in the provision of drinking water. Economies of scale in terms of population size have significant impacts on unit costs and service levels. While adopting cost norms these factors should be taken into account, rather than adopting uniform unit costs across regions. Besides, smaller villages may need more funds to cover support costs. Shifting from local groundwater sources to far-off surface water sources does not seem to enhance per capita quantity of water, though surface water sources have a positive impact on accessibility. Social diversity (higher number of social groups) within the village seems to affect accessibility adversely, indicating that homogenous communities (with fewer social groups) are likely to manage the WASH services better, especially in terms of access. This has an implication for governance: more efforts are required to manage WASH services in heterogeneous communities, which are on the rise in recent years.

The case of peri-urban water is similar to that of rural areas, as most of the capital costs are spent on infrastructure, and expenditure on other components is either absent or negligible in all the sample locations. The differences between normative and actual or observed capital costs are much higher in the peri-urban areas. The actual unit costs are much higher in peri-urban areas than in rural areas, although the service levels are no better. This is mainly due to the disconnect between the centre and periphery of urban areas in planning and designing water supply systems. As a result, *ad hoc* investments or allocations towards extension and upgrading of the water assets tend to be higher in order to meet the unplanned demand. Households also spend substantially in the peri-urban locations: 25 percent of the total expenditure. Unlike in rural areas the expenditure on public expenditure on operation and maintenance (OpEx) is high at 16 percent. Despite higher spending on OpEx the difference between actual and observed life of the systems is much higher in comparison with rural areas. One of the reasons might be the low capital maintenance costs (CapManEx) in peri-urban areas. Service levels are akin to those in rural areas, as only a third of the households reported basic and above service levels in terms of quantity, and much fewer in the case of accessibility. The situation gets worse during summer months. Demand for water is expected to go up as the density of household tap connections increase in the peri-urban areas (Chapter 8).

Public investments have helped to create infrastructure up to the village level. The existing service levels at the aggregate (village) level are mainly due to the investments in infrastructure development that is conspicuous across rural India. But it fails to ensure equitable services across all households, thus providing water security at the household level, which is the main objective of the guidelines. Public investments coupled with subsidies for the provision of water are mainly aimed at enhancing people's welfare, especially that of the poor. In fact, the poorest of the poor or the socio-economically backward communities are the main target group for extending the public expenditure benefits in the sector, but in reality there is skewed distribution of services within the sample villages in favour of the better-off (Chapter 9).

Evidence indicates that service delivery is biased against Scheduled Tribe households, who are on the lowest rung of the socio-economic ladder, though the bias against Scheduled Caste households is on the decline. This is mainly due to the spatial distribution of these communities, as Scheduled Tribes are mainly concentrated in the hilly and remote regions. Distribution of services are observed to be skewed spatially within a village: service levels decline as one moves from the centre to the periphery of the village. Socio-economically backward communities often reside in colonies on the periphery of the village, and hence receive poor services. Spatial distribution of service levels is better at the centre of the village, as the infrastructure is also concentrated in the centre (Chapter 9). However, this does not seem to hold good at the aggregate level, as service levels are not very different between socio-economic groups, with the exception of Scheduled Tribe communities. This could be due to the special focus programmes aimed at providing water separately for Scheduled Caste colonies within the village.

Spatial bias in the distribution of services is mainly due to poor or intentionally biased planning and design of the distribution networks at the village level. Planning and design hardly get any allocations in the expenditure, and steps are rarely taken to ensure that elites do not capture the benefits of new schemes by ensuring that head works of supply lines are located near to their colonies. Often distribution lines are laid without regard to slopes and gradients. And pressure control valves are not found in appropriate places in many sample villages. Allocations for source sustainability and capital maintenance are critical to maintaining service levels; as a result, poor households living on the periphery of the villages are the first victims of any reduction in service levels (Chapter 9).

Water security planning and governance at the local level are critical for sustainable and pro-poor (equitable) service delivery. Water security planning is highly desirable, but it should use water accounting and mapping techniques, rather than being limited to considering the supply–demand gap. Besides, it is observed that direct controls (e.g. establishing groundwater sanctuaries and intelligent rationing of power supplies) are more effective at demand management than economic regulatory instruments like water pricing. It is argued that governance in terms of demand management using an integrated approach involving a range of coping strategies (FAO 2012) is a necessary condition. In the absence of an integration of supply-side and demand-side aspects, it would be difficult to ensure sustainable services. From the supply side hydro-geology (upstream/downstream), bio-physical aspects, etc. are critical, while water audit/accounting, pricing, governance are critical from the demand side. The failure to integrate these aspects is the 'administrative gap'. Lack of comprehensive policy and planning large investments in water harvesting interventions like watershed development in Andhra Pradesh have failed to improve water security (Chapter 10).

The poor services, slippage and waste of investment in the drinking water sector are often attributed to a lack governance in the sector. Though the importance of governance, especially decentralised governance, is recognised very well at the policy level, governance structures or institutional arrangements have been confined to the paper only. Even some of the institutional arrangements that are in place are found to be neither active nor effective. This is the 'accountability gap' arising out of lack of transparency and accountability. In the absence of proper governance the maze of imprudent investments in the sector can provide only low levels of services. Decentralised governance structures like village water and sanitation committees (VWSC) are more or less defunct across the villages. There is no transparency, accountability and participation in the management of rural drinking water schemes (Chapter 12). Experience from Andhra Pradesh, and also from states like Kerala, has clearly shown that decentralised and effective governance structures could help in improving service levels and sustainability of the systems. The changing socio-economic dynamics at the village level are proving detrimental to the functioning of the participatory institutions (Chapter 13), with participation often marred by increased political rivalry and factionalism at the village level in recent years. The answer could be the promotion of professionalised service delivery models, especially towards the post-construction phase: i.e., professionalised direct support systems, such as those found in Kerala and Gujarat.

The nationally scaled-up central government's *Swajaldhara* programme has not proved effective in providing sustainable services in the rural areas. But there are some state-specific models in Gujarat, Kerala and Maharashtra that are more innovative in their design and implementation. Community-centred approaches with political will and administrative support are central to the success of these models (Chapter 11).

II Sanitation and Hygiene

Sanitation and hygiene are the most neglected sub-sectors within WASH both at the policy level and as research priorities. Sanitation receives marginal financial allocations towards subsidies for building household, community, school toilets, etc. Investments or expenditure on sanitation in rural and peri-urban areas are pretty basic and limited to the construction of toilets. Very little investment is observed in solid and liquid waste management and disposal (Chapter 6), with very few sample villages and peri-urban locations having complete drainage networks and facilities. Similarly, expenditure on hygiene promotion, awareness-building and demand-generation are marginal and not well co-ordinated. If all these investments were to be made the unit costs of sanitation would be much higher than those of drinking water. Apparently there is a 'policy gap' due to inadequate policy attention being given to sanitation.

Households spend as much as 50 percent of total sanitation capital costs. And most of the recurring costs are borne by the households as well. As a result, more than 70 percent of the total sanitation costs are borne by households. And public expenditure is mainly on infrastructure, though awareness building is an important component as far as sanitation is concerned. Households tend to spend more in the peri-urban areas when compared to rural areas, which could be due to the higher demand and ability to pay for sanitation facilities. Unit costs vary widely across villages and peri-urban locations. The coverage is the lowest in the remote and hilly regions of Andhra Pradesh (Chapter 6).

Sanitation service levels received by the majority of the population in the sample villages, including peri-urban areas, are basic and below basic. Though public expenditure on sanitation has helped in creating the much-needed infrastructure, it has not influenced the rate of use of the facilities, which is far below the rate of access. The gap is only marginally lower in the 'open defecation free' award-winning *Nirmal Gram Puraskar* (NGP) villages and peri-urban areas. Despite the best efforts towards achieving open defecation free villages, sustaining such status has become a major challenge. In fact, slippage in sanitation service levels is observed even in the NGP villages (Chapter 7). Public subsidies for household toilets have not created enough demand for *using* sanitation facilities, and, in the absence of a balance between expenditure on infrastructure development and awareness-building, the subsidies or incentive programmes are not found to be effective. Improved demand for sanitation seems to prompt investments, and households investing in sanitation are likely to have higher use. It is observed that literacy, governance and economic development are critical for improving the demand and the use of sanitation facilities (Chapter 6).

The Total Sanitation Campaign (TSC) guidelines emphasise pro-poor service delivery, but this has yet to materialise at the village level. The socially backward groups (Scheduled Caste and Scheduled Tribe households) receive much lower sanitation service levels than the socio-economically better-off castes. Though there is a higher proportion of socio-economically backward communities receiving subsidies, these subsidies are not reflected in the service levels achieved. The reason could be that the amount of subsidy is not enough to improve service levels, including maintenance and pit-emptying. Further, the spread of subsidies has been limited, as the subsidies intended for the poor households are also cornered by the socio-economically better-off like large farmers and other caste (OC) households, due to poor targeting. Better targeting of these subsidies towards poor households could improve their access to sanitation to a large extent. Besides, the information, education and communication (IEC) programmes designed to raise awareness have not been effective in these communities because of their poor design to suit low literacy levels and poor economic well-being (Chapter 6).

Existing governance structures appear to be inadequate and not focused on sanitation, though they seem to have a positive impact on service levels, which is observed in a few villages where these institutions exist (Chapter 12). Only a few of the sampled villages could transform the investments made into higher level of services, due to the strong relationship between investments, service levels and governance arrangements, i.e., minimising the 'accountability gap'. But no such link is observed in the remaining sample villages. Improving the performance of water and sanitation committees could be a feasible policy alternative in this context. Other important governance indicators that could make the difference in the level of the services delivered include transparency and accountability[1] of functionaries in terms of targeting the subsidies towards poor, and participation of local communities, particularly women and disadvantaged communities in the process of planning and implementation.

III Policy Imperatives

The present policy framework for the WASH sector is clearly not effective in providing sustainable and good quality services. The continuation of supply-sided policies are only effective to the extent of creating infrastructure, which is rarely fully functional in the short run and hardly sustainable in the long run. The investments are not effective because they fail to ensure household water security even in the short run. Though the systems supply enough water at the aggregate or village level, the water is not distributed equally across the households. In the case of sanitation, the provision of household toilets does not guarantee their use. Though the policy guidelines provide the necessary outline for improved and sustainable services, operationalising these guidelines at the implementation level remains ambiguous. In this regard the WASHCost action-research in Andhra Pradesh complemented by studies from other states identifies the gaps in the sector and provides policy imperatives for sustainable WASH services.

- In the absence of using a life-cycle cost approach in the WASH sector, a number of important cost components are missed out in terms of national and state budget allocations resulting in negative consequences for sustaining services. The guidelines list most of the important cost components but ring fencing them is a must in order to ensure that funds are not simply spent on infrastructure. The national guidelines miss out one critical cost component: capital maintenance expenditure (CapManEx), which ensures that major system breakdowns are avoided and service levels are maintained.
- Bridging the gap between the actual and normative lifespans of the systems holds the key to cost-effective, sustainable services. Allocations towards capital maintenance (CapManEx) along with regular maintenance (OpEx) and post-construction support structures (ExDS) is the only way to improve the lifespan of the systems. Presently there is no provision for capital maintenance, and system breakdowns are dealt with out of funds from operation and maintenance (OpEx) allocations. This in effect results in poor maintenance in the short run, leading to breakdowns in the medium and long run. Following an asset-management approach in budgetary allocations, similar to public utilities, could be more effective.
- Water security is linked to source sustainability in a broader ecological context, i.e., integrating with hydro-geology and bio-physical aspects. Water security planning at the village level is misplaced and should be taken up at an appropriate scale that can internalise hydrogeology and land use externalities: i.e., at the scale of a hydrological unit or watershed.
- Inequity in water and sanitation services appears to be mainly geographical or spatial, rather than purely economic. Hilly and remote villages house most of the poor and scheduled tribe populations. And within a village, socio-economically backward households live in the areas that are far from the main supply system. At the regional level, appropriate allocations to remote and hilly regions would enhance service levels to the poorest and disadvantaged social groups. At the village level, allocations towards planning and designing the systems is a precondition for ensuring equity in the distribution of funds and services across the different locations.

- Households spend a lot of time and effort fetching water, due to poor service levels such as low pressure, poor quality, breakdowns, etc. Improving access to sustainable water services should assume a higher policy priority than just providing the infrastructure.
- Within the WASH sector the status of sanitation is poor. It has been treated as an add-on component to water and has never been a priority. Given the socio-economic and environmental importance of sanitation and hygiene, it needs to be given special focus in terms of planning and allocations.
- The approach to sanitation needs to change. Sanitation is not a pure public service. At the household level it is a private responsibility, and hence public support should be limited to creating the infrastructure and interventions required for behavioural change. Emphasis is needed on the behavioural aspects of sanitation through well-designed and professionally executed awareness campaigns. Such behavioural changes should be fostered with the provision of effective infrastructure, such as community toilet facilities and systems for safe disposal of solid and liquid waste.
- The present nature of public expenditure in the form of subsidies towards household toilet construction is not effective, as the usage levels of the toilets are very low. Moreover, these subsidies are also appropriated by the economically better-off households. Hence, better targeting of subsidies towards the most needy should be a policy priority. This calls for appropriate and effective governance structures.
- Public incentive programmes like the *Nirmal Gram Puraskar* (NGP) or the clean village awards are found to be effective only in terms of creating infrastructure, and not in terms of usage of the created infrastructure. The main policy concern in sanitation is to reduce the gap between access to facilities and their use. Though this is often explained in terms of lack of demand and cultural practices, it needs to be explored and explained in a systematic manner so that appropriate policies can be framed. A focused approach using professional marketing methods to promote the importance of sanitation and hygiene should be central to WASH policies.
- For those households who cannot afford, or do not have space, to build individual toilets, promotion of community toilets (with proper maintenance mechanisms) can be introduced on the lines of the *sulabh* model.
- Appropriate costing and allocations are not, by themselves, a solution to ensuring sustainable service delivery. Financial allocations are a necessary precondition but not a sufficient one; management and governance of the systems are equally important and deserve policy attention.
- Governance in WASH sector is highly centralised in the hands of the line departments (departments of water and sanitation). Though the WASH sector is part of the constitutional mandate of decentralised governance, its implementation is very limited in most of the states, including Andhra Pradesh. Village water and sanitation committees (VWSC) are created across the state, but in most of the sample villages they either do not exist or (if they do) are ineffective.

- The experiences of decentralised governance structures in Andhra Pradesh and in other states like Kerala, Gujarat and Maharashtra clearly establishes their effectiveness in service delivery. Scaling up such initiatives requires some hard policy decisions at central and state level, such as enforcing and ring-fencing allocations to all the cost components listed in the guidelines.
- There are no set practices for decentralised governance; different states follow different approaches. In most of the states, including Andhra Pradesh, reviving the dormant village water and sanitation committees (VWSC) under the supervision of panchayati raj institutions ought to be taken up as a priority. It is observed that creating and promoting professional institutional arrangements for post-construction support, rather than the usual participatory institutions at village level, would be more effective, due to changing socio-economic dynamics in rural areas that are moving towards individualistic behaviour.
- An example is the Kerala approach of rehabilitating the old systems, rather than constructing new projects and creating a graveyard of investments, which appears to be more sustainable. It is shown that community-driven, PRI-centric approaches to service delivery could provide a powerful institutional model.
- Monitoring service delivery, rather than infrastructure, should be made compulsory within the Rural Water Supply and Sanitation (RWSS)/Urban water supply departments at various levels – village, town, sub-district, district and state levels. Integrating the results of this monitoring with the regular management information system (MIS) should enable all the relevant information – on service delivery levels as well as costs – to be analysed and acted upon.

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Notes

Preface

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1 Introduction

1 PRIs are the constitutional bodies of decentralised institutions. The lowest rung of the administrative structure is the village-level PRI. These village-level institutions need capacities in terms of functions, funds and functionaries.
2 US$1=Rs. 45.72 (2010 exchange rate).
3 The newly formed peri-urban habitations as well as new habitations with less than 100 persons are included in the place of previous definition of coverage, which was based on 40 lpcd, with a safe source for all permanently settled populations of 20 households or 100 persons.
4 Technical lifespan is defined as the maximum life of the system according to the manufacturing norms. Economic life is defined as the length of life where economic benefits are at least equal to costs. Useful life is defined as the period for which the system can provide services.
5 Provided by the Department of Rural Water Supply and Sanitation, Government of Andhra Pradesh.
6 The cost of an individual household toilet is fixed at Rs.2500 in plain areas and Rs.3000 in hilly areas. Of this, the Central Government provides a subsidy of Rs.1500, and the State Government provides Rs.700. The remaining Rs.300 is borne by the household. The state governments can also provide higher subsidy. These figures are now revised.

2 WASH Sector in India: The Policy Context

1 In September 2012 a separate minister for state (sanitation) was appointed for the first time at the Government of India level. This is a step in the direction of according priority to sanitation.

3 Life-Cycle Cost Approach: An Analytical Framework for the WASH Sector

1 Though habitation is the level at which planning is carried out in the WASH sector, we prefer to use the term 'village' in place of 'habitation' for the sake of an international audience.

4 Unit Costs and Service Levels by Region and Technology

1 In WASHCost project parlance at the global level the term 'service delivery model' is adopted to specify multiple service systems at the village level.
2 For details see Fonseca *et al.* (2011) and other WASHCost publications at www.washcost.info.
3 These variations go beyond political economy factors, where a part of higher investments could be attributed to political interference.
4 In some villages, hand pumps are converted for direct pumping by attaching a motor.
5 Operation and maintenance costs are higher in the case of MVS due to the contract system. The operation and maintenance of these systems up to the village is given to private contractors, while the village panchayat is responsible for their operation and maintenance within the village. It is observed that these contractors are often appointed as a result of political pressure, rather than due to their qualified staff. This in turn results in poor maintenance.

5 Explaining Inter-Village Variations in Drinking Water Provision: Factors Influencing Costs and Service Levels in Rural Andhra Pradesh

1 Costs are annualised using the observed life span of the systems. The high variations in the observed life span of systems across the villages further increases the variations in the annualised costs.
2 Social Development Index used in Varughese and Ostrom 2001.
3 We have not included the water quality variable, as it is expected to be determined mainly by the natural factors on which we do not have much information. Besides, the reliability of water quality testing is also an issue.
4 The weighted average of summer (⅓) and non-summer (⅔) quantities have been used to arrive at the total quantity.

6 Rural Sanitation and Hygiene: Economic and Institutional Aspects of Sustainable Services

1 School toilets are constructed by the Education Department.
2 Social Development Index used in Varughese and Ostrom 2001.
3 Fewer observations are available in the case of reliability and environmental protection.
4 These figures are based on rough estimates provided by the Rural Water and Sanitation Department.

7 Nirmal Gram Puraskar and Sanitation Service Levels: The Curse of Slippage

1 A detailed poverty analysis at a broader level is taken up in Chapter 9.

8 Cost of Provision and Managing WASH Services in Peri-Urban Areas

1 Wherever aggregate is used, it means at the state level.
2 Quantity requirements including and excluding livestock are also elicited. Since the livestock population is very limited in peri-urban locations, the quantity perceptions presented here exclude livestock.

9 Skewed and Inequitable Access to Rural Water Supply and Sanitation Services

1 Social composition mainly consists of SC, BC and OC communities. SC (scheduled caste) communities are on the lowest rung of the social ladder and have constitutional provision of reservations in educational institutions and public-sector jobs. BC (backward caste) communities are in the middle of the social ladder and have some reservations in educational institutions and public-sector jobs. The extent of reservation varies from State to State. OC (Other Castes) are on the highest rung of the social ladder. ST stands for Scheduled Tribes, the category used for tribal populations.
2 The Government of India changed the TSC into NBA (Nirmal Bharat Abhiyan), and the incentive pattern has been revised. It is now Rs10,000; the incentive was only Rs 2,700 during the data collection in 2010.
3 In addition to delivering water for domestic uses, multi-utility systems (MUS) meet demand for small-scale productive water uses: e.g. kitchen gardens, backyard horticulture, backyard dairying, tea-stalls, brick-making, etc. For more information please see http://www.fao.org/nr/water/topics_irrig_mus.html.
4 Equitable WASH services delivery does not mean that households should have the same services levels; rather it implies that they should have WASH service levels that exceed accepted norms at all times. In terms of sanitation, equity implies securing an individual's right to use a toilet. Whether he or she chooses to do so is a separate but equally important issue.
5 *Sulabh* is a pay-and-use sanitation facility, which is a successful community toilets model, especially in the urban areas.

10 How can Water Security be Improved in Water-scarce Areas of Rural India?

1 The FAO defines food security as 'all people, at all times, having physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life'.
2 A mandal is a sub-district or block.
3 *Kharif* is the first-season crop (June–October) and *rabi* the second-season crop (November–March).
4 A Gram Panchayat is a village council.
5 Anantapur District borders with Kurnool District.
6 Seeley (2007) provides more information on this programme.

11 Assessing Progress towards Sustainable Service Delivery in India: Lessons for Rural Water Supply

1 The review was undertaken as part of a 13-country study using a common analytical framework of the Triple S project of the IRC International Water and Sanitation Centre, The Hague, in 2011.

2 The section on Service Delivery at Intermediate Level, addresses both state and district-level functioning of the SDMs.
3 Within India, the GPs in Kerala are unusually and uniquely large, with an average population of around 30,000 (World Bank 2009), 15.
4 For more details on this SDM, see World Bank (2009) and RDC (2008).
5 Based on an independent assessment for the Tamil Nadu Rural Water Supply Project (Pragmatix Research & Advisory Services, 2007) and discussions with RWS engineers of the Tamil Nadu Water Supply and Drainage Board (Anbazhagan, 2010).
6 For example, the Centre for Good Governance at the Administrative Training Institute (ATI) in Nainital in Uttarakhand State was a key resource centre for the Department for Drinking Water and Sanitation for several years. The new National Rural Drinking Water Programme, however, has designated many more national institutions for capacity building (see Box 4.3 for a list).
7 The Sant Gadge Baba Swachchata Abhiyan, also known as the Clean Village Scheme (CVS), was started in 2000 by the Government of Maharashtra to foster a sense of collective responsibility for village sanitation. Villages can apply to enter the competition, which evaluates village performance on a range of issues including solid waste, waste water and toilet waste management, besides water supply (including quality issues). A village that wins at the block, district, division and state level stands to win total prize money of around Rs.4 million (around US$ 90,000 at Rs. 44.5 = US$ 1). For details, see Pragmatix Research & Advisory Services and Swayam Shikshan Prayog (2005), Government of Maharashtra (n.d.), and others.
8 '. . . more time would be needed to assess with certainty the long-term capacity of the communities to deal with major repairs' (World Bank 2009, p.15).
9 Water and Sanitation Management Organisation (2010), 49.
10 The description of the four phases is from RDC (2008, 10, 55–7).
11 This is a phrase used in a World Bank assessment in 2005 to describe the state of irrigation infrastructure in the country (World Bank 2005), but it can also be used to describe the situation in rural water supply. In Tamil Nadu, for instance, poor-quality service of the built infrastructure is addressed by introducing a new supplementary scheme (Anbazhagan 2010).

12 Transparency, Accountability and Participation (TAP): Understanding Governance in Rural WASH Sector

1 Local Self Governance Institutions in India

14 Sustainable WASH Service Delivery: Policy Options and Imperatives

1 Though a number of governance indicators have been identified and used across the countries, we have focused on the transparency, accountability and participation. Other important indicators include: i) legitimacy, ii) inclusiveness, iii) fairness, iv) integration, v) capacity and vi) adaptability (for a review see OECD, 2012).

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Page numbers in **bold** refer to tables, those in *italic* refer to figures.