INVOLVEMENT OF PRIVATE SECTOR IN PUBLIC URBAN WATER SUPPLY:

A CASE STUDY OF DELHI

Thesis submitted to Jawaharlal Nehru University in fulfilment of the requirements for the award of the degree

DOCTOR OF PHILOSOPHY

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DECLARATION

I, **Bidisha Chattopadhyay**, hereby declare that the thesis entitled "**Involvement of Private Sector in Public Urban Water Supply: A Case Study of Delhi**" submitted by me for the award of the degree of **DOCTOR OF PHILOSOPHY** is my bonafide work and that it has not been submitted so far in part or in full, for any degree or diploma of this university or any other university.

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Glossary

AAP	Aam Aadmi Party
ADB	Asian Development Bank
AfDB	African Development Bank
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ATM	Automatic Teller Machine
BOO	Build-Operate-Own
BOOT	Build-Own-Operate-Transfer
BOT	Build-Operate-Transfer
CGWB	Central Ground Water Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CVM	Contingent Valuation Method
DJB	Delhi Jal Board
DPC	District Planning Committees
DPR	Detailed Project Report
DWS&SDU	Delhi Water Supply and Sewage Disposal Undertaking
EAG	Empowered Action Group
EPC	Engineering Procurement Construction
EWS	Economically Weaker Section
IFI	International Financial Institution
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
JJ	Jhuggi Jhompdi
JMP	Joint Monitoring Programme
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
JUSCO	Jamshedpur Utilities and Services Company
KUIDFC	Karnataka Urban Infrastructure Development and Finance Corporation
KUWASIP	Karnataka Urban Water Sector Improvement Project
LIG	Lower Income Group
MCD	Municipal Corporation of Delhi
MDG	Millennium Development Goals
MGD	Million Gallon per Day
MNWS	Malviya Nagar Water Services
MoU	Memorandum of Understanding
MoUD	Ministry of Urban Development
MPC	Metropolitan Planning Committee
MPCE	Monthly Per Capita Expenditure
MVV	Mehrauli and Vasant Vihar
NCTD	National Capital Territory of Delhi
NPM	New Public Management

NRW	Non-Revenue Water
NSS	National Sample Survey
NSSO	National Sample Survey Office
O&M	Operation and Management
OHT	Overhead Tank
PCA	Principal Component Analysis
PHED	Public Health Engineering Department
PPP	Public Private Partnership
PSP	Private Sector Participation
PWD	Public Works Department
RO	Reverse Osmosis
RWA	Resident Welfare Association
UFW	Unaccounted For Water
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
ULB	Urban Local Body
UN	United Nations
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund
UPE	Urban Political Ecology
WDR	World Development Report
WHO	World Health Organisation
WTP	Willingness to Pay/Water Treatment Plant

CHAPTER I

INTRODUCTION

1.1 CONTEXT

India is a vast country with innumerable rivers, lakes and ponds which have quenched the thirst of the teeming millions over centuries. Water has always been accorded a venerable status equating giving drinking water to a thirsty person to *punya*. Communities were responsible for the water bodies and care was taken to preserve them and keep them clean and pure. Colonisation and the subsequent industrialisation which the former brought to the country marked a change in the attitude towards water. Water was meant to be tamed, to be owned and to be used as per convenience. Industrialisation brought with it, excess drawing of both surface and ground water and pollution of the same water bodies once considered sacred. Responsibility of the rivers and lakes passed on from the community to the State. The control of water through large irrigation projects was for establishing authoritative political patterns **(Wittfogel, 1943).** The British with their disdain for native way of life, built their own elaborate engineering systems to carry water from water bodies to their homes in order to protect themselves and their families. India in its present governance system has continued with the systems passed on by the British. The post-independence era saw the State taking complete control of everything which played a role in the development of the country. Water was an important part of this and several programmes were launched in the first decade after independence. In 1949, Environment Hygiene Committee was constituted and recommended covering 90 percent of India's population by safe drinking water. Water supply was added to the national agenda and big dams like Bhakra Nangal and Hirakud were planned in the First Plan Period (1951-56). Even today, several of the large cities are dependent on water from the big dams, despite protests from the civil society due to the negative impact of big dams on the ecology and the local population.

The 1970s was a watershed decade for environmentalism when the world woke up and took notice of the grave environmental issues. Access to clean water, sanitation and conditions which ensure the dignity and wellbeing were recognised as a fundamental right in the Stockholm Conference, 1972. The train of thought continued through the next decade, thus 1981-1990 was declared the International Drinking Water Supply and Sanitation decade. The focus in global discourse shifted from large Government infrastructure to community participation and community financing **(O'Rourke, 1992).** In India, National Drinking Water Mission was launched during this decade and the first

National Water Policy was framed. Globally, Millennium Development Goals (MDG) were the first attempt to set deliverable targets and the period was set as 1990-2015. The MDG target was halving the proportion of the global population without sustainable access to safe drinking water and basic sanitation by 2015 **(UN, n.d).** Around this time, the Dublin Statement on Water and Sustainable Development (1992) recognised water scarcity resulting out of multiple, conflicting use of water and emphasised on the economic value of water and advocated recognising water as an economic good. This period was also a time when several developing/eastern bloc countries were liberalising their economies. The role of International Financial Institutions (IFI) was increasingly becoming important in the economic revival of these countries. The IFIs were driving the structural reforms through conditional lending. The state's role was also changing from an active one to a facilitator and regulatory one. There was emphasis on financial self-sufficiency of the public utilities and reams of paper were devoted to full cost recovery and cutting down of subsidies. This also contributed to a shift in debate from inequality and injustice to depoliticised technological fixes. In India, this change was reflected in the infrastructure sector as well but instead of a full divestiture, public private partnership was given preference, especially in the water sector. The urban water sector was not to be left behind and the mid-1990s saw several attempts at involving the private players into the water infrastructure sector. Giant Multinational Water Corporations were introduced in the urban water scene in India. Although the initial attempts failed, but the process had been initiated. Launching of Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in 2005, one of the largest comprehensive reform linked funding programmes in India, played a key role in bringing in private players in the water infrastructure sector by promoting Public Private Partnership. In 2010, United Nations recognised the human right to water and sanitation as an inseparable part of right to living with dignity.

In India, the private sector participation (PSP) in the urban water sector has been in the form of PPPs. In some cases, private players have also borne the financial risk by sharing the capital investment. Nagpur is the only city which has a full city PPP project in water distribution. The rest of the cities have PPP projects implemented in pilot areas. In Delhi, the first attempt at private sector participation in water supply was in the commissioning of the Sonia Vihar Water Treatment Plant in 2000 which eventually became operational in 2006. Private sector foray into water supply distribution was made in 2004 at the behest of World Bank. At that time, this was considered as the sole option for improvement and recovery of the flailing Delhi Jal Board (DJB), the organisation responsible for providing water supply to Delhi. The initial attempt was stalled due to city wide civic protests. It was again reintroduced in 2012 and at present three areas (Nangloi WTP catchment area, Vasant Vihar and Mehrauli area, Malviya Nagar UGR catchment area) have been selected for pilot projects. The three pilot projects are being managed by different consortiums. Vasant Vihar and Malviya Nagar comprise the study area for the present research work as the private companies have already taken over the water supply management in these areas. These areas are heterogeneous with respect to settlement typology and have high end colonies along with urban villages and JJ clusters.

1.2 STATEMENT OF THE PROBLEM

Inequality in access to the finite fresh water resources, despite its critical importance, is a global truth. Gender, race, caste, religion and ethnicity, residence, tenure and socio-economic status are also factors for discrimination and exclusion to clean water and sanitation. Most countries agree that a life giving resource like water cannot be market controlled and thus drinking water supply and distribution is done by the State. But the state has also been inept at providing water to all, particularly in the developing countries. The State hydraulic paradigm has under served the poor **(Bakker, 2003).** Provisioning of water by the Government is also intrinsically tied with class. Within urban areas, there is discrepancy between service provisioning in the formal and informal areas. Most of the informal areas are inhabited by low income groups. The poorest often do not have access to safe and affordable water. The narrative in the past decade has focussed on the exclusion of the poor due to the low capacity of the public utilities to expand their network. The emphasis of the narrative has been that as the water utilities are a financial mess themselves, they are unable to meet the needs of the low income groups because of which the poor have to rely on unsafe and/or expensive sources of water. This has been advocated as a strong justification for the reforms to be introduced in the urban water sector.

The public utilities have been criticised because of their dismal financial condition, low levels of efficiency and inability to provide basic services to the residents adhering to norms and standards. The approach had also been supply driven concentrating on augmenting water rather than demand driven. Institutional and financial reforms with emphasis on better water governance have been introduced in the urban water sector with the intention of addressing the many issues plaguing the system. The reforms include unbundling, cost recovery, tariff structure reform etc. In many cases, private sector participation has been an extension of the reform programme. The literature is full of instances, across the globe, where PSP through concession or lease contracts have been detrimental for the poor and have compromised with right to water. PSP in water supply in many other countries has been associated with tariff rise, disconnection due to non-payment and exclusion of informal areas. The present study seeks to understand that whether private sector involvement through public – private partnership in public water supply would result in exclusion of the already vulnerable economically weaker sections of the society and exacerbate the differences through changes in availability and access of water supply

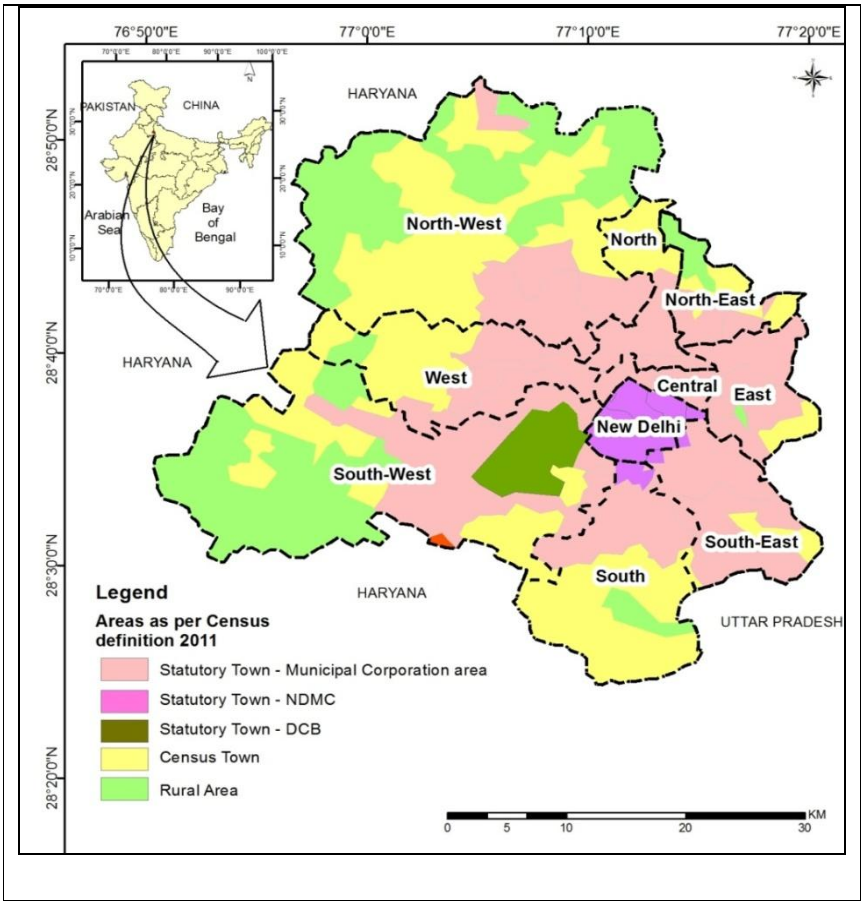
1.3. STUDY AREA AND RATIONALE FOR SELECTION

1.3.1 Rationale for Selection

Pilot projects where water distribution and management has been contracted out to private players have been launched in several cities in India, Delhi being one of them. It has been nearly five years (2012-2017) since the launch of the pilot projects in Delhi and they are half way through of the total contract period. The projects are being implemented in areas which have a mix of various settlement categories with different history, tenure status which influence the variation in access to potable water. Besides, Delhi, as a city, provides a rare opportunity to study the co-existence of the State service provider and the concessionaires within the same city. Many of the factors like water tariff, political set up, agro-climatic conditions remain the same for the city which allows focusing on the internal factors which may have implications on the water governance in different pockets in the city.

1.3.2 Study Area

National Capital Territory of Delhi (NCTD) or Delhi is located in Northern part of India flanked by the state of Haryana in North, West and South and Uttar Pradesh in East. Delhi is located, between the latitudes of 28°-24’-17” and 28°-53’-00” North and longitudes of 76°-50’-24” and 77°-20’-37” East. It was one of the fastest growing mega cities of India in the past decade (2001-2011). In 1991-2001, the city witnessed 47 percent decadal population growth rate, nearly double of the country. It has a unique distinction of being a special state in the country, besides being the seat of the country’s capital. It is also the seat of both the Union and the State Government.



Map 1.1: National Capital Territory of Delhi

Source: Map created from Census of India, 2011

NCTD had nine districts and 27 sub-divisions (2011) as seen in Map 1.1. Two more districts were added in 2012. It comprised three statutory towns, 59 census towns and 165 rural villages in 2001 which has been reclassified in 2011 as 110 census towns and 112 rural villages (Census of India, 2001 and 2011). The statutory towns and census towns together form the urban area as per Census of India, 2011. The Municipal Corporation was trifurcated and has 272 wards.

1.3.2.1 Physical Setting of Delhi and Water Supply

Delhi is situated in a semi-arid area at an altitude of 216 m. It can be mainly divided into three main segments namely the Yamuna flood plain, the ridge and the plain. Yamuna is the main river which flows through the city for nearly 22 kms. There is a forest cover of 11.5 percent. The city witnesses extreme climatic conditions with hot summers with the maximum temperatures soaring to 40-45^{0}c and cold winters with the minimum temperatures dipping to 4-5^{0}c.The annual precipitation is about 711 mm largely restricted to the monsoon months spanning from July to September. Delhi largely relies on surface water from River Yamuna and River Ganga to meet its demand. Ground water supplements the demand.

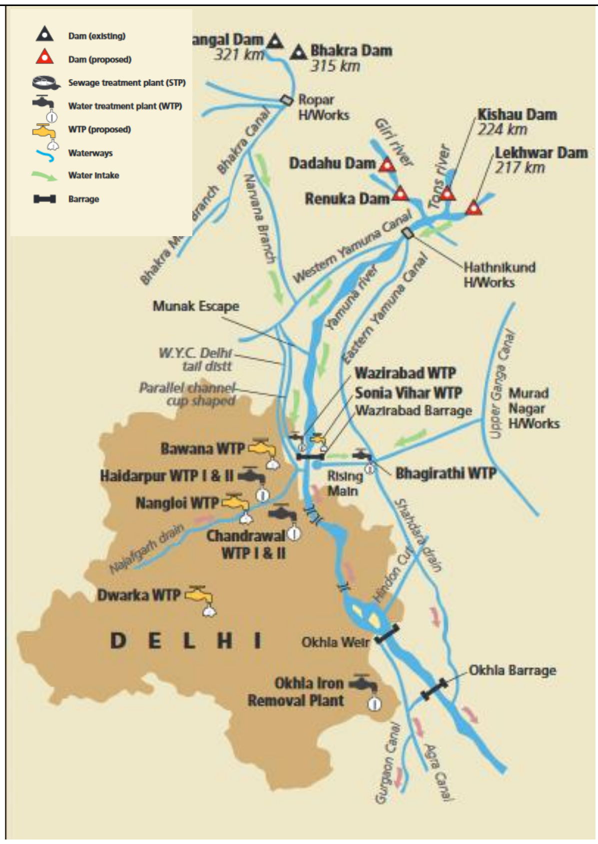
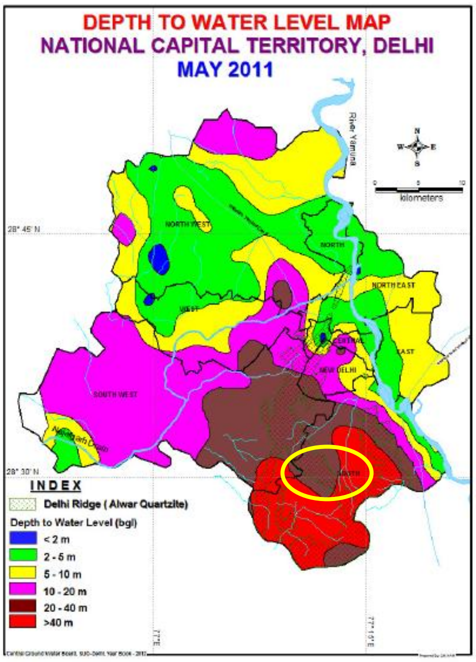


Diagram 1.1: Location of Sources of Surface Water Supply for Delhi

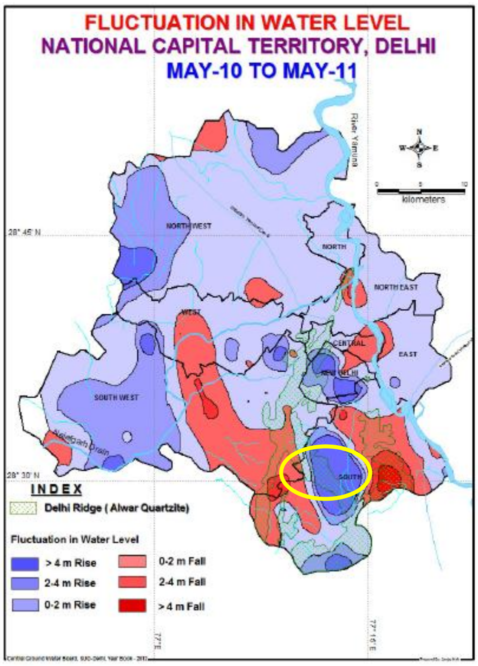
Source: The Water Waste Portrait, Centre for Science and Environment

The sources of surface water are given in Diagram 1.1. The distances from where water is sourced are also given and it is evident that the water footprint of the capital city is humongous. The ground water situation is precarious in some parts of Delhi. Absence or inadequate piped water in many localities force the residents to draw ground water. The ground water depth (metre below ground level) ranged from 0.96 to 66.45 mbgl in May 2011. Map 1.2 presents the depth to ground water (May 2011). Ground water is found at the deepest levels in the Southern part of Delhi while Northern, North-Eastern and North-Western parts have water levels in the range of 2 – 5m.The Yamuna flood plain also falls into this category **(CGWB, 2012).**

Fluctuation, both rise and fall, in water level between May 2010 and May 2011 as seen in Map 1.3, has been the highest in the southern parts of Delhi. Major parts of Delhi have witnessed a rise in ground water levels.



Map 1.2: Depth to Water Level, Delhi, May 2011

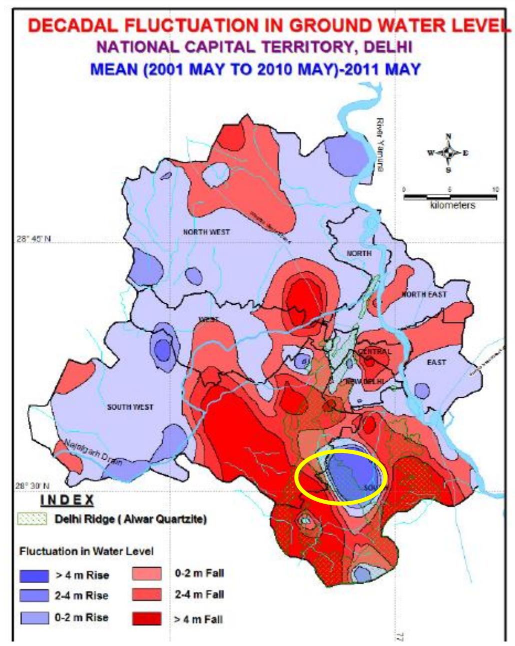


Map 1.3: Fluctuation in Water Level, Delhi, May 2010 -2011

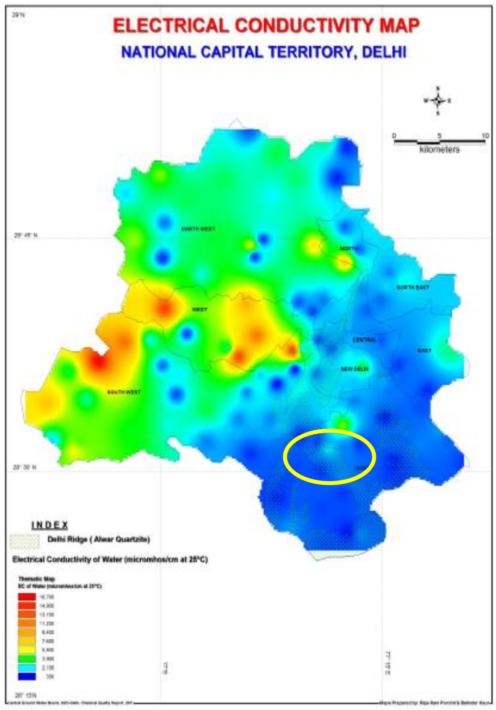
Source: Ground Water Year Book, NCT of Delhi, 2012

The decadal fluctuation (2001-2010) of ground water level, as seen in Map 1.4 presents a stark picture with the Southern part of Delhi experiencing fall in water levels ranging from 0.02 to 14.07 metres. On the other hand, ground water levels have risen in large parts of Delhi in the range of 0.05 to 31.32 metres **(CGWB, 2012).**

Electrical conductivity is a measure of mineralisation of ground water. Parts of West Delhi show high levels of electrical conductivity. Areas of Najafgarh, Kanjhawala block, Bhalsawa, Burari, Dhirpur and Jagatpur show high levels of electrical conductivity. On the contrary, Southern and South Eastern areas show much lower levels as seen in Map 1.5.



Map 1.4: Decadal Fluctuation in Ground Water Level , Delhi, May 2001 to May 2010



Map 1.5: Salinity of Ground Water, Delhi- 2011

Source: Ground Water Year Book, NCT of Delhi, 2012

The selected specific study area for the research has been highlighted by the yellow circle. It is evident that these areas have the deepest aquifers along with the highest seasonal and decadal water fluctuations. Salinity is also on the higher side.

Water Supply and Sanitation Services in Delhi is the responsibility of Delhi Jal Board, constituted under Delhi Water Board Act 1998. It is responsible for production and distribution of drinking water in Delhi. The Board is also responsible for collection, treatment and disposal of waste water/sewage in the capital (Refer Chapter 4 for details).

1.3.2.2 Urban Growth and Expansion in Delhi: An Overview

a) Population Growth

Delhi has been one of the fastest growing metropolitan cities in the country. Population of megacities of India is given in table 1.1.

Table 1.1: Population of Megacities in India: 2001 and 2011

S.No	City	Population (2001) Million	Population (2011) Million	Decadal Growth Rate (Percent) (2001-2011)	AAGR (Percent) (2001-2011)
1	Greater Mumbai UA	16.4	18.4	12.05	0.012
2	Delhi UA	12.7	16.3	26.69	0.025
3	Kolkata UA	13.2	14.1	6.87	0.007

Source: Census of India, 2001 and 2011

Among the megacities, Delhi urban agglomeration has grown the fastest in the past decade. Population growth in National Capital Territory of Delhi from 1981 to 2011 as per place of residence is shown in table 1.2.

Table 1.2 : Population of NCTD: 1981-2011

Year	NCTD Population (‘000)	Decadal Growth Rate (%)	NCTD Urban Population (‘000)	Decadal Growth Rate (%)	NCTD Rural Population (‘000)	Decadal Growth Rate (%)	Natural Increase (in lakh)	Migration (in lakh)
1981	6220.4	53.0	5768.2	58.16	452.2	8.01	12 (55.8%)	9.5 (44.2%)
1991	9240.6	51.4	8471.6	46.87	949.0	109.8	18.9 (59.2%)	13.05 (40.8%)
2001	13783	47.0	12905.7	52.34	944.7	-0.45	26.6 (60.18%)	17.64 (39.82%)
2011	16753	20.9	16333.9	26.56	419.3	-55.61	24.2 (54.8%)	20.0 (45.2%)

Note: Figures (in bracket) indicate percentage to total net increase.

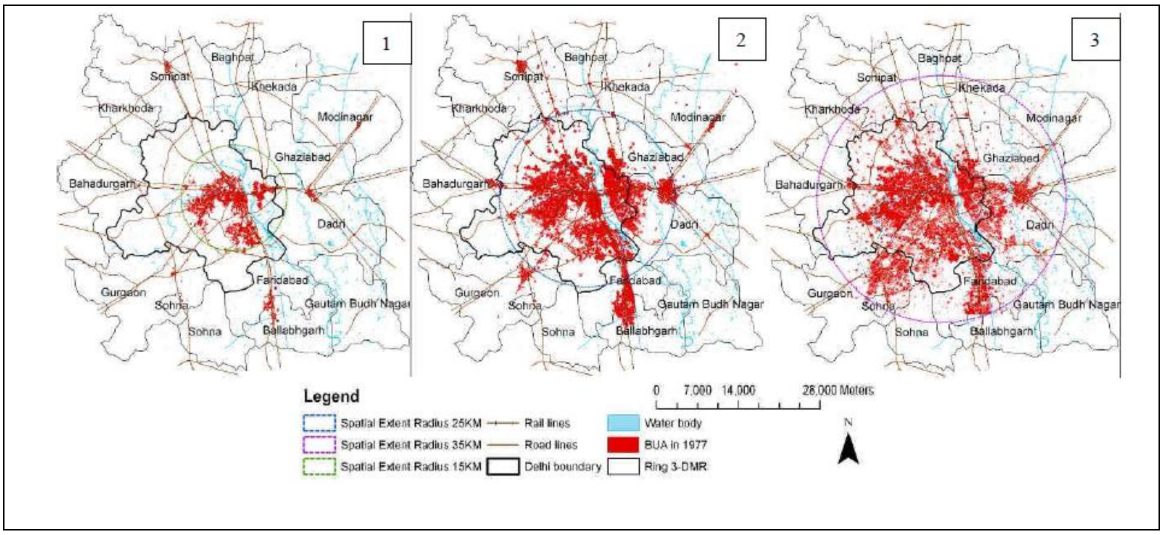
Source: Master Plan of Delhi-2021; Statistical Abstract 2012

Population growth in NCTD shows interesting variation with respect to rural and urban growth. Although the decadal growth rate for whole of NCTD has been showing a steady decline, urban population growth rate showed a fluctuating trend with it declining in the decade 1981-1991, increasing in the next decade and again declining drastically in 2001-2011. Rural population growth rate increased dramatically in the decade 1981-1991 which perhaps can be attributed to mushrooming of unauthorised colonies in rural areas, then declined sharply in the next two decades as these areas got incorporated in the urban areas as per Census definition.

b) Spatial Expansion

All the three megacities, Delhi, Mumbai and Kolkata have witnessed spatial growth in past few decade but Delhi has experienced the highest growth post 1970s. While Mumbai and Kolkata grew three times, Delhi grew nearly five times **(Taubenböck, 2008).**

Spatial expansion of NCTD has been studied from the perspective of actual spatial growth of built-up areas as captured by satellite imageries and as well as from the areas demarcated as urban areas in consecutive Master Plans of Delhi.



Map 1.6: Spatial Expansion of NCTD (Built up Areas): 1977-2011

Source: Jain M et al, Seamless urbanisation and knotted city growth: Delhi Metropolitan Region; Paper submitted in Real Corp, 2011 conference

The growth of built up areas in NCTD in the context of DMA towns is shown in Map 1.6. It is evident that while density of built up has increased east of river Yamuna, the city has spatially expanded to the South-West, West and Southern fronts.

1.3.2.3 A Brief Overview of the Pilot Areas – Private Operation and Management Areas of Public Water Supply

Two project areas with networked water i.e areas under the management of "Malviya Nagar Water Supply (MNWS) Pvt. Ltd" and "Mehrauli and Vasant Vihar Water (MVV) Utility Pvt. Ltd." selected as the study areas are shown in the location map for representational purpose only (Diagram 1.2) along with area under Piramal Sarvajal for non-networked water supply (Savda Ghevra).

Diagram 1.2: Location of the Study Pilot Areas for Networked and Non-Networked Water

a) Networked Water: The Malviya Nagar Water Supply Pvt. Ltd Project Area

The Malviya Nagar project area is spread over 14 sq.km in Southern part of Delhi and comprises a population of 2.7-3 lakh with 32148 (till March 2010) registered consumers **(Detailed Project Report, Malviya Nagar Project, 2011).** The area is supplied water from three sources; Sonia Vihar WTP, Haiderpur WTP and tubewells (260 No.) with larger part of the area getting water from Sonia Vihar WTP.

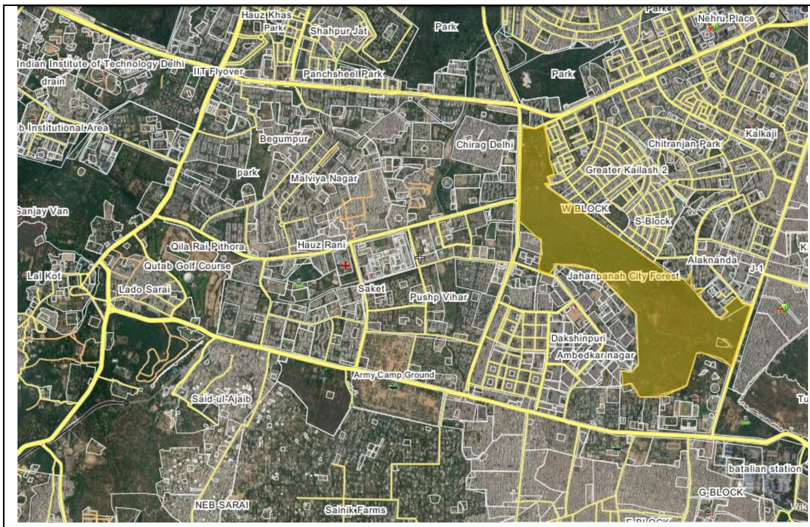


Diagram 1.3: Location of Malviya Nagar Project Area

Source: www.wikimapia.org

The project area is largely a residential area and comprises several settlements of different categories; planned colonies, unauthorised colonies, urban villages and JJ clusters. Table 1.3 presents the settlement category wise break up of population in the project area.

Table 1.3: Settlements in Malviya Nagar Project Area

Settlement typology	MCD circle rate classes	Colonies	Population
Planned Colonies	All	All	1,56,956
	B	Geetanjali Enclave, Sarvodaya Enclave, Panchsheel Park, Navjeevan Vihar, Soami Nagar, Sadhana Enclave, Sarvapriya Vihar	22720
	C	Malviya Nagar, Saket, Sheikh Sarai Phase I and II, Shivalik	90388
	D	Pushpa Vihar, Savitri Nagar (Regularised Unauthorised)	43848
Unauthorised Colonies	-	Khirki Extension, Paryavaran Complex , Saiyad ul Ajaib extn	2,14,833
Urban Villages	-	Chiragh Dilli village, Khirki Village, Lado Sarai, Hauz Rani, Neb Sarai, Saiyad ul Ajaib, Kalu Sarai, Begampur, Katwaria Sarai, Adhchini	
JJ Cluster*		Indira Gandhi Camp, Lal Gumbad Camp, Malviya Nagar, Valmiki Camp, Begampur, Harizan Camp, Begumpur, Jugdamba Camp, Block-A, Malviya Nagar, Soami Nagar, Jhuggis	18131
TOTAL	-	-	389920

*Source: Population data from Detailed Project Report, DJB Malviya Nagar Project 2011, *Municipal Corporation of Delhi, 2008*

This particular project was formulated after the construction of Malviya Nagar Underground Reservoir which would be used to feed areas mentioned in table 1.3. Before the implementation of the project, the water supply was intermittent with most areas getting less than 2 hours of water supply in a day. The highest number of borewells were in the urban villages. The ground water in many locations in the area was found to be high in nitrate value during the investigations undertaken for the preparation of Detailed Project Report **(Detailed Project Report, Malviya Nagar Project, 2011).**

b) Networked Water: The Mehrauli and Vasant Vihar Water (MVV) Utility Pvt. Ltd. Project area

This comprises two sub-projects spread over two areas. PPP for water services improvement in Vasant Vihar and adjacent areas and the second sub-section pertains to Mehrauli area. The Mehrauli project has run into hurdles and at the time of survey, the rehabilitation work had not started, thus the sub-project was excluded from the study.

The Vasant Vihar and adjoining areas project largely covers residential areas comprising Shanti Niketan, Anand Niketan, West End, Vasant Enclave, Vasant Vihar. They are largely low density residential areas inhabited by high income group households. The project population was around 68780 in 2011. The area had 6847 water connections **Detailed Project Report, Vasant Vihar and Neighboring Areas, 2011)**

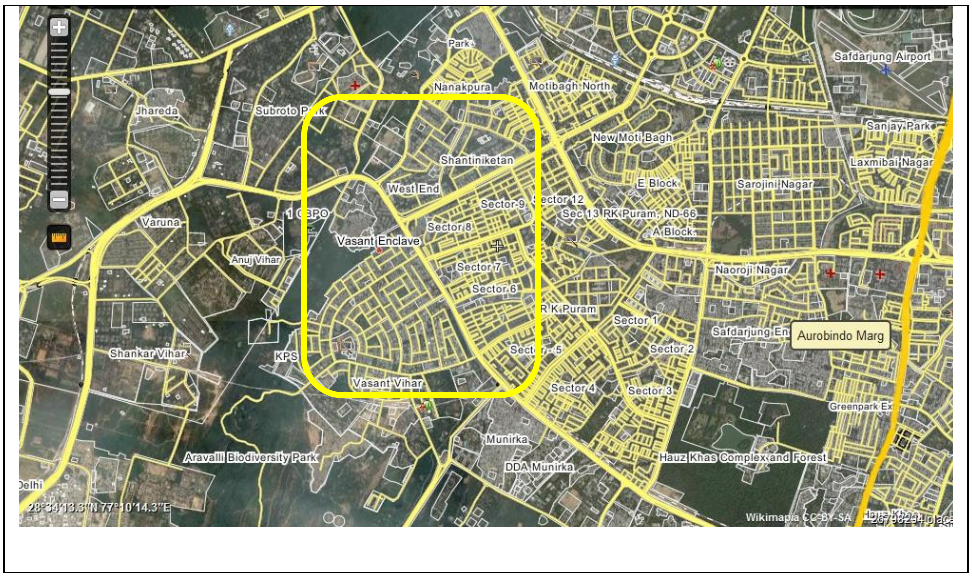


Diagram 1.4: Location of Vasant Vihar Project Area

Source: www.wikimapia.org

The project area, unlike the Malviya Nagar project area, comprises only planned colonies of various categories. Table 1.4 gives a break-up of the population in the colonies in the project area.

Table 1.4: Colonies in Vasant Vihar Project Area

Settlement Typology	MCD Circle Rate Classes	Colonies	Population
Planned Colony	A	Vasant Vihar, West End, Shanti Niketan, Anand Niketan	32325
	B	Vasant Enclave	1230
	D	Vasant Vihar, D Block, Junta Flats	-
Total	-	-	33555

Source: Detailed Project Report, Vasant Vihar; 2011

Water supply was primarily from Palam reservoir, supplemented by Deer Park reservoir and local borewells. The duration of water supply was intermittent with water supply varying from one to three hours per day **(Detailed Project Report, Vasant Vihar and Adjacent areas, 2011).**

c) Non-Networked Water: Savda Ghevra

Savda Ghevra, spread over 250 acres, is a resettlement site built in 2006 to accommodate JJ dwellers from South and Central parts of Delhi. It is located near Tikri border, in North-Western part of Delhi. The plots have been given on a conditional ten year lease. Savda Ghevra resettlement colony is inhabited by 7000 households **(Safe Water Network, 2016)** and is expected to have 20,000 households when fully occupied **(Housing and Land Rights Network, 2014).** Although, electricity has been provided to the area, there is absence of networked water. Water is provided to the settlement by DJB through tankers. Public toilets have been provided in nearly every block, but many were found to be non-operational **(Primary Survey, 2016).**

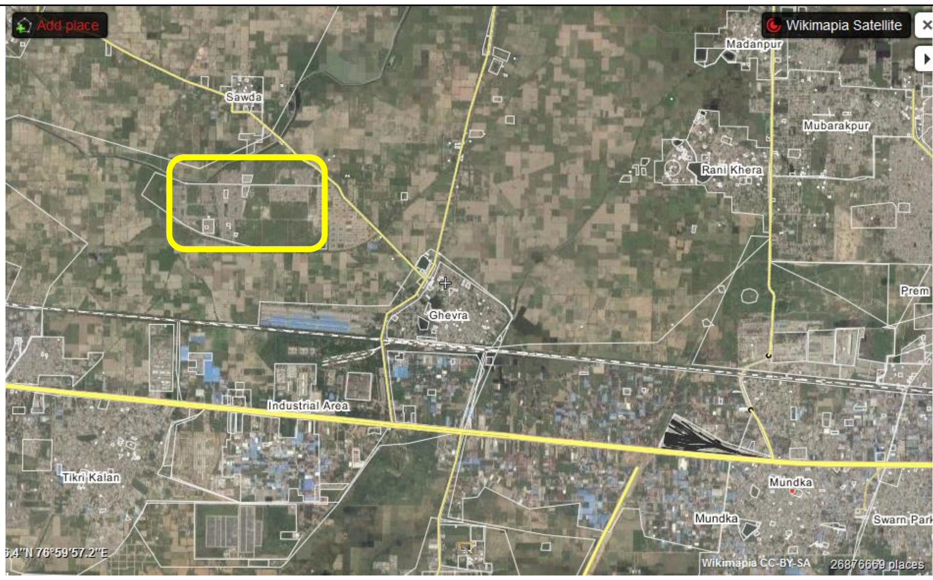


Diagram 1.5: Location of Savda Ghevra Resettlement Colony

Source: www.wikimapia.org

1.4 REVIEW OF LITERATURE

The Literature review comprises three broad categories; the first category briefly describes the popular approaches relevant to urban water, research outcomes under various conceptual heads are discussed in the second category and literature pertaining to research methods employed in this study has been discussed in the third section.

1.4.1. Approaches and Concepts

The present section dwells on the theories and approaches relevant to the contemporary narrative of urban water provisioning and the changing concept of water relevant to the present study.

1.4.1.1 Contemporary Approaches Contextual to Water Service Delivery

Rights based approach identifies the provision of basic amenities as rights and not as needs which are at the discretion of the officials.Post-1997 United Nations has adopted the rights based approach. "A *right* that is not respected leads to a violation, and its redress or reparation can be legally and legitimately claimed"**(UNFPA, n.d).**The UN discourse on right to water is silent on privatisation and is open to any method of service delivery with ultimate aim of universal access **(Wills, 2017).** Some scholars support this approach stating that water right did not originate with the State, it evolved over time and can be used but not owned **(Shiva, 2002 cit. in Singh, 2016).**

A very strong research on service delivery is based on **'**who gets what'. Some scholars are convinced with evidence that the 'underclass is underserved'. A large majority of the poor do not have access to adequate drinking water. The discrimination is such that in the same area, the informal settlements will have more inconsistent, expensive and precarious water supply **(Aguilar et al, 2009).** Scholars have also questioned the validity of national and global statistics showing improving access to safe water among the poor while in reality, the poor mainly rely on public standpipes and kiosks **(Satterthwaite, 2003 cit. in Gerlach, 2008)**. Access to the poor has been found to be denied by administrative procedures **(Almansi, 2003 cit. in Gerlach, 2008).** The State has tried to keep water affordable through subsidies but the existing system of subsidised water has benefitted the rich and the middle class more than the poor **(Kundu, 1991).**

Simultaneously there is another set of scholars who are of the view that the 'underclass hypothesis' does not explain service patterns. Age of the settlement, population density, historical and political factors seem to be more important **(Lineberry 1977; Mladenka, 1980; Jones 1980 cit. in Vogel, 1997).** Any attempt to bring equality in service provisioning, if at all, is viewed as a response for political support rather than a need arising from doing a social good **(Lineberry, 1967 cit. in Hero, 1998).**

Participatory approach towards delivery of basic services has been practised in many Asian countries including India for a considerable period of time. It began in late 1970s and focussed more on gathering accurate and detailed information efficiently for the purpose of appraisal of local situations and priorities mainly proliferating in the rural and health sector. By late 1980s, much of the attention had shifted from rapid to participatory research. **(Mitlin, 1995).** It has also been considered an important part of poverty alleviation programmes. On the contrary, some scholars have pointed out that projects claiming full participation has been driven by the interests of the elites **(Cornwall, 2003 and Ghazala, 2004 cit. in Estache & Fay, 2007).**

Participation, transparency, accountability, equity and efficiency are considered building blocks of good governance. Since 1990s, the focus has shifted from simply provision of basic services to **structural reforms** to be brought in urban services aided by International Financial Institutions like World Bank etc. Improving transparency and accountability in service delivery became the core themes post World Development Report (WDR) 2004 **(World Bank 2004 cit. in Joshi, 2010)**. WDR argued in favour of strengthening the route of direct accountability between users and providers instead of via elected representatives. **Accountability approach** has been implemented through New Public Management (NPM), which emerged in the 1990s, emphasised the use of market mechanisms within the public sector to make managers and providers more responsive and accountable **(Batley, 1999).** On the other hand, simultaneously there were demands for direct participation of citizens in governance **(Fox 2007 cit. in Joshi 2010)**

The **sustainable services approach** addresses sustainability of services through adequate supply of services, equitable access and distribution, efficient pricing/cost recovery, reliability of service, good quality, improved efficiency, minimum environmental burden and energy use and community participation, transparency, accountability **(TERI, 2009).**

Decentralisation of administrative power is perceived as a step towards better management of resources and improved service delivery. Devolution which has been enacted in 73rd and 74th constitutional Amendment is one form of decentralisation. This involves the transfer of authority for decision-making, finance, and management to quasi-autonomous units of local government with corporate status. Decentralisation of services without decentralisation of financing inhibits the benefits of decentralisation **(Bardhan et al, 2006).**

There is another method which was adopted to improve service delivery through **passing on some responsibility of the ULBs to the parastatal agencies**. The trend started in 1960s in India. The state government took onus upon themselves to provide commonly for water, sewerage, transportation through its state board, corporation. Now post implementation of 73^{rd} and 74^{th} CAA, the position of these parastatal agencies is not clear. Metropolitan Planning Committees (MPCs) and District Planning Committees

(DPCs) have been formed to take up developmental activities in the concerned region in place of the parastatals.

Market based approach of service delivery include privatization and contracting out of Government services, competitive tendering of services to not-for-profit and for profit agencies, increasing use of for-profit providers and the private sector to provide services, use of user pay and cost recovery principles, the application of business metrics and the imposition of corporate management models and approaches that have their origins in the for- profit business context. Four major strategies are usually considered part of the market based approach: a) full privatisation b) PPP c) contracting out and d) corporatisation **(Elmer & Leigland, 2014).** It is based on the assumption that privatisation of services will increase efficiency and save Government money.

1.4.1.2 The Water Debate: A Public or an Economic Good

Water as an economic good found credence during the Dublin conference on water and the Environment, 1992 though the concept had come up during Earth Summit in Rio De Janeiro, 1992. Water as an economic good became one of the four Dublin principles; "Water has an economic value and should be recognised as an economic good, taking into account affordability and equity criteria". The supporters of water as an economic good advocate that pricing water, based on market principles enables improvement in equity, sustainability and efficiency. The international donor agencies support and promote this school of thought. The World Bank have funded more than three hundred private water projects in developing countries and promoted corporate investments **(Barlow et al 2002 cit. in Hughes, 2010**). The supporters of this particular school of thought believe that allocation of water should be based on the amount people are willing to pay **(Perry, 1997). Rogers et al (2002)** has used case studies to show that water resource is used indiscriminately when the rates are low. **Bond (2003)** through the example of Kampala Statement drafted by World Bank with the Water Utilities Partnership explains that although need of the poor and women has been made into a strong case in this document but the actual content is heavily skewed towards privatisation and that the willingness of poor to pay for services suited to their needs is strongly expressed.

The idea of water as an economic good has given rise to the concepts of commodification of water, commercialisation of services and privatisation of management. Commodification, commercialisation and privatisation are often used interchangeably, but it is important to understand the difference in the three concepts to do justice to the comprehension of the subject. Commodification of water refers to the transformation of water into a marketable or a tradable good that has both use value and exchange value **(Walsh, 2011).** Commodification entails pricing of municipal water aimed at cost recovery, corporatisation of water utilities, creation of full scale markets **(Bond, 2003; Walsh, 2011).** It also includes reducing cross subsidisation, fostering conditions for water privatisation **(Bond, 2003).** Commodity values have been explained as including the following: increasing economic value, transfer to higher value use, interstate commerce in water, full or marginal cost pricing, expanding water markets and individual decision making by **Brown and Ingram in 1987 (Mutz et al 2002).** Commercialisation involves changes in resource management practices like introducing commercial principles such as efficiency, methods and objectives such as profit maximisation **(Bakker, 2006).** It mainly refers to the commercialisation of water services. Commercialisation also transforms water into a commodity which is to be sold at market rate on the basis of willingness to pay rather than ability to pay **(Bakker, 2003 cit. in Beckedorf, 2010).** Commodifaction and commercialisation of public water has been reported to have the same effects as that of privatisation **(Bond, 2003)**

The views of the opponents of water as an economic good are based on ethical and moral grounds. They consider access to water as a human right. They advocate that water is a social good and a basic need which should be available to everyone irrespective of their paying capacity. Technological sophistication might have become high but the social, political, economic and historical aspects which determine access to water are yet to be understood fully **(Swyngedouw, 2002)** Access to water was recognised as a human right as late as 2010 by the UN Human Rights Council. Some scholars are also of the view that subsidy of water for irrigation purposes has the ability to lower food costs **(Chamber, 1988 cit. in Perry, 1997**).There have been large scale resistance to unbundling of land and water rights in Australia and Arizona **(Walsh, 2011).**

There is a group of scholars who consider water to be an economic good albeit a special economic good and thus they believe that general economic theories do not apply to it

(Savenije, 2002). The reasons cited for this vary from the importance of water for survival of living beings, scarcity of water in certain regions of the world, fugitive nature of water and bulky nature of water. Water is also a complex system, interference in any stage of the system can cause havoc downstream. Water is non-substitutable **(Savenije, 2002).** Reasonable pricing structures which can recover costs but at the same time not deprive the poor of access to water should be given more importance than market pricing **(Zaag, 2006).**

Naturally, the debate of water as an economic good or a public good has had its repercussions on business as well with more areas coming under either private water utilities or management being contracted to private companies. The Human Rights Council endorsed the guiding principles on Business and human rights in June 2011. The corporate responsibility to respect all human rights is called the "minimum standard", but this is not legally binding **(Gaughran, 2012).**

1.4.1.3 Market Environmentalism

In the Western world, the great Depression and the World War II led to the growth in the belief that the State needs to be actively involved in ownership of production and delivery of services. Largely, it was accepted that sectors like telecommunications and postal services, electric and gas utilities, airways and rail should be with the State **(Megginson, 2000).** In the developing countries, Government ownership was seen as necessary to promote growth **(Rondinelli et al, 1996 cit. in Megginson, 2000).** Much of the twentieth century, most countries adopted the State hydraulic model where water management was characterised by supply based solutions, planning for growth, a focus on social equity and universal provision, state ownership, large scale state led hydraulic development resulting in inundation of ecological and cultural sites **(Bakker, 2005).** This was followed by a period of State withdrawal from infrastructure and services provisioning citing reasons such as fiscal crisis. This coincided with increasing environmental awareness regarding depletion of resources and health. The state hydraulic model faced a multifold challenge: ecological, cultural, ideological and socio-economic. **(Bakker, 2005**). The rise of market environmentalism grew out of the perceived failures of the State Hydraulic Model and the simultaneous expansion of neo-liberalism. Market environmentalism has been described as a mode which uses market means to achieve both economic and environment ends **(Anderson and Leal cit. in**

Heynen et al, 2007). Harvey (2007) has called neo-liberalism a process which dismantles old institutions which stood for more social equity and 'egalitarian distributive measures' Market environmentalism asserts that environmental resources will not be wasted if they are treated as economic good simultaneously addressing the issue of inefficient use of resources and environmental degradation **(Bakker, 2005).** Market environmentalism is also seen as a form of green imperialism by many scholars **(o' Connor, 1996; Pratt and Montgomery, 1997; Hudson, 2001 cit. in Bakker, 2005)**. The emphasis shifts from creating new sources to managing demand using technologically advanced techniques, metering, new tariff structures and increasing consumer awareness **(Lacey 2004 cit. in Bakker, 2005).** Economic equity (willingness to pay) replaced social equity (ability to pay) **(Jones, 1998 cit. in Bakker, 2005).**

1.4.2 Research Outcomes in Literature Relevant to Present Study

1.4.2.1 Privatisation versus Public Sector Ownership

There is a very strong pro-privatisation and anti-privatisation debate worldwide. On one hand some believe that since Government has failed to deliver the basic services, the gap needs to be filled based on market principles. Privatisation is seen as a means to achieve efficiency, increase extension of service, bring in more investments and relieve Government from budget deficits **(Ohemeng et al, 2008).** Private companies have access to more human and economic resources including efficient management, sophisticated technology and private equity. **(Sitaraman, 2008).** The benefit of privatisation extend to both the public and the private sector. The public sector benefits from an expanded tax base and reduced expenditure while the private sector benefit from low tariff, less cost, improvement in service quality and more employment **(Benitez et al, 2001).** Since improvement in efficiency is the main reason cited by most for involving private players in municipal water supply, the following paragraphs dwell on this aspect.

Privatisation as a Means to Improve Efficiency

Although, the main idea behind privatisation is that of better efficiency, there is strong evidence in literature regarding efficiency of a firm being independent of nature of ownership. Efficiency in private firms is more of a belief than empirically proven **(Letza et. al, 2004).** Studies, on the effect of privatisation on piped water supply management in

Sub-Saharan Africa, found that the nature of ownership, private or public, did not matter in terms of performance (**Bayliss, 2003)**. Similar findings were revealed in a study based on data from fifty water companies spanning twenty nine Asian and Pacific region countries (**Estache et al., 2002 cit. in Clarke et al 2004)**. In a study involving Spanish firms, findings show that several factors- including political, organisational and dynamic ones, independent of the private-public ownership - deeply influence the effect of privatisation on efficiency **(Villalonga, 2000). Tandon (1997)** surveyed available literature of privatised firms versus public sector enterprises and found presence of competition to be an important factor in improving the efficiency of the firms. Competition and regulation are two important factors without which the privatisation benefit may not reach the people **(Estache et al., 2002 cit. in Clarke et al 2004).** Further, there are scholars whose studies show that as compared to privatisation, competition and regulation can be more critical in improving efficiency **(Bishop et al 1989; Kay et al, 1986; Vickers et al, 1991 and Yarrow, 1986 cit in Perard, 2009)**. A study by the **University of Birmingham (1999)** based on 35 urban centres in India found that private sector participation was unlikely to have a significant impact on delivery of public services such as water supply in the medium term because of too many vested interests in the existing institutional patterns. This research suggested that until there is demand for institutional development from municipalities, which in turn, is generated by demand for better service from customers, there can be no sustainable advances in service delivery **(Sridhar, 2007).** Cost reduction in privatised firms, a way to improve efficiency, may result in compromises in service quality **(Hall, 2003 cit. in Letza et. al, 2004).**

It is interesting to note that if competition is an important element for increasing efficiency in firms as suggested by literature, then would privatisation in water supply sector which is a natural monopoly owing to the high cost of laying infrastructure, help in achieving efficiency? The hypothesis does not seem to hold true for water and sewerage service which are natural monopolies.

Competition rather than the type of ownership seems to be the reason for increased efficiency. Water sector does not have scope for too much competition owing to its nature of being a monopoly, competition only being at the time of bidding. Lack of reliable information about the existing condition of water network infrastructure can be a deterrent for private players **(Rees, 1998).** The flipside is that since the infrastructure is underground, the quality of work might not be understood during the contract period **(Rees, 1998).** Transaction costs have also been cited as one of the reasons for re-municipalisaton. Due to initial lack of correct information, often the contracts have to be renegotiated while being monitored by the Government. These add to the overall cost. Nearly 74 percent of around thousand water and sewerage contracts in Latin America and Caribbean granted in 1985-2000 were renegotiated. Contracts were renegotiated, on an average, after 1.6 years of concession awards **(Guasch 2004 cit in Perard 2009).** Voters, rather than the ideology of the State play an important role in ascertaining whether privatisation will be implemented **(Perard, 2009)**

On the other hand, there are others who believe that **water is a common good** and cannot be sold on the basis of economic principles. Water is one of the most basic needs and cannot be priced like a commodity. This group is of the opinion that the private sector, whose main objective is profit making, will not be able to do justice to this basic need **(Bakker, 2010; Kurland et al, 2011 cit. in Jaffee, 2012). Harvey (2003)** considers privatisation of water as a case of "accumulation by dispossession" whereby public good is appropriated by the private players for profit increasing social inequity

1.4.2.2 Private Sector Involvement in Water Supply and the Poor

There is little empirical evidence in this subject, more so in the Indian context. On one hand, there are scholars who are of the opinion that there is a negative effect of privatisation on the poor while others believe that poor gain from the initiative. Privatisation of utilities may compromise equity, environmental concerns, implicit community service obligations, employment and accountability **(Hopkins, 1999).** Private water supply enterprises also may exploit water resources without any control, thus resulting in further depletion of ground water and compromising alternate means of water for the poor **(Paul, 1985).** Privatisation has generally failed to improve the financial status of the water sector, in some cases the operational efficiency has improved but has not been able to improve access to the poor **(Whitfield, 2006).** Three types of access issues for the poor may emerge: a) potential increase in initial connection fees b) reluctance of the private companies to serve the poor viewing them as high risk for non-payment households and c) reduction in availability of alternate sources of water supply. Moreover, four types of affordability issues may arise: tariff increase to cover costs, increase in costs caused by increase in quality of standard, tariff rebalancing needed to reduce cost subsidies, formalisation for payment of usage **(Estache et al., 2002 cit. in Clarke et al, 2004).**

Privatisation has drawn much flak as it is associated with increase in prices of utilities. Pricing and access are closely linked. Increase in tariff to cover the cost of expanding network often falls on the poor as the proportion of their salary going towards payment of fees is much higher as compared to the rich. Private players also seek to end previous illegal connections, the burden of which again falls on the poor **(Birdsall et al, 2005).** Network expansion also becomes a source of revenue for the private player. It is also not clear whether privatisation of water has improved the access of the poor to water **(Bayliss, 2003).**

In a study in Congo-Brazaville, the private company operated within the existing network thus excluding the peri-urban areas where the poor lived and in cases where the private enterprise expanded the network to include the peri-urban areas, they ran into losses as the residents were not willing to pay the high tariff **(Tati, 2005).** In a study on the water reforms undertaken in Hubli-Dharwad, water standposts were discouraged making access to drinking water more difficult for the poor and the vulnerable **(Sangameswaran et al, 2008).** In the case of South Africa, the private water company used a prepaid meter price policy in which the customers had to pay for water in advance. The connection was cut in the case of non-payment. In the case of non-disconnection, the water flow was restricted in Durban to a basic volume of 200 litres per day **(Loftus, 2009).** Many poor households started using unclean water, there was a cholera epidemic in the year 2000-2001 **(Hemson, 2006).** While the basic minimum water was provided free (6 kl/month), the second tariff slab saw a steep hike which is unaffordable for many households in Johannesburg **(Bond et al, 2008).** Some scholars advocate that its not about private or public, commercialised utilities do not take responsibility for health or environmental damage **(Bond, 2008).**The extent of benefit to the poor also depends on the existing status of the network coverage. The poor tend to benefit more if the proportion of households with access is already high **(Mckenzie et al, 2003).** Private Companies often skip poorer areas as they are often located in non-networked areas and have low demand along with poor paying capacities **(Johnstone et al 1999; Schusterman 2002 cit in Ouyahia, 2006)**

On the other hand, another school of thought believes that privatisation of utilities has benefitted all sections of the society. To begin with, the Government benefits through debt reduction. Both public and private agents benefit from increase in productivity and service access made possible by utility reform in Argentina. **(Benitez et al., 2001).** In another study in Argentina, **Galiani et al (2005)** found that the benefit of privatisation extended to health effects as well. Child mortality declined in areas in which water supply was privatised and the poor areas were benefitted the most. Some scholars say that the poor spend a higher amount on water supply through private tankers, thus they shall be able to afford a higher water tariff **(Whitfield, 2006).** A study undertaken on the effect of privatisation on the urban poor in the Pathumthani province of Thailand showed positive results in terms of access to piped water despite increase in the connection cost and monthly charges **(Zaki et al., 2009).** In Bolivia, the poor specially benefited in terms of access improvements despite reform related adverse effects on pricing (**Barja et al, 2001; Mckenzie et al, 2012)**

1.4.2.3 Role of Regulatory Mechanism

Good governance is important for regulating the private enterprises. The history of the evolution of strong institutions in the developed countries is itself a long one. Developing countries in the absence of constitutional, political and legal traditions required to support the social objectives of privatisation, need more time to implement privatisation successfully (**Baumol, 1993 cit. in Kessides, 2005).** Private participation needs to be preceded by substantial evolution of the institutional system. Decentralisation can result in confusion regarding the responsibilities at various levels of government. Many small municipalities may not have the capability to handle private players **(Ouyahia, 2006).**

In cases where there was weak regulation, the water tariff spiralled up without control **(Sreedhar, 2007; Tati, 2005).** The threat of eroding confidence against the investors also prevents regulatory authorities from taking strict action **(Tati, 2005; Bayliss, 2003).** The bargaining power of the regulatory authority of a less developed country vis a vis the transnational company is also a factor in weak control. Without Government intervention, the benefits of reforms take longer to reach the poor than the rich thus increasing inequality **(Estache et al. 2002 cit. in Birdsall, 2005).** A well-functioning regulator can make a lot of difference in maintaining social equality. The Office of Water in the UK is such an example **(Bakker, 2001).** Corruption is also a factor in the spread of the anti-privatisation sentiments. The case of Grenoble corruption case is one of the most illustrated cases. The 25 year period water management was awarded to COGESE consortium (51 percent controlled by Suez) which gave $3 million in bribes to the Grenoble Mayor and made illegal contributions to his electoral funds. The contract with COGESE penalised the consumers for water conservation, as the price was hiked if the consumption levels would fall. In 1996, Vivendi came under the scanner for paying illegal commissions to political parties for obtaining water contracts in 70 French cities **(Godoy, 2003).** Number of new water connections offered at a pre-determined tariff was a condition for the bids for awarding the water concession in La Paz and El Alto, Bolivia while in Greater Buenos Aires, an increase in coverage from 70 percent to 100 percent by end of the contract period was a pre-requisite **(Estache et al, 2002 cit. in Mckenzie et al, 2012).** In surveys from 1991 to 1997 in Argentina, there was an increase in access in privatised areas as compared to non-privatised areas **(Galiani et al, 2002).** Tariff was reduced in Buenos Aires post privatisation after successful intervention of the regulator **(Galiani et al, 2002).** Mature, well developed set of network facilities should be a prerequisite for unbundling. This is difficult to find in developing or transitioning economies as usually their networks are underdeveloped **(Kessides, 2005).** Costs might be reduced due to privatisation because of increase in productivity but state regulation is required to ensure that the benefits are passed on to the consumers **(Bayliss, 2003)** Prices might be increased in the run up to privatisation to make the venture more attractive for private players **(Bayliss, 2003).** In Guinea, prices increased nearly 6 times post privatisation such that there was a steep fall in connections.

On the other hand, there have been several instances where the regulatory mechanism has failed. In the scene of weak regulation, contracts were not enforced and many a times the contracts themselves were vague **(Chirwa, 2004).**Cochabamba, Bolivia is often cited as a prime example of privatising efforts in water sector going wrong with the tariffs increasing by nearly 43 percent for the poor consumers **(Mckenzie & Mookherjee, 2003).**

1.4.2.4 Absence of Clarity in Awarding Contracts

Literature review suggests that there is lack of clarity in the awarding of contracts which has resulted in renegotiation after awarding of contracts. In some instances, the private player was at fault for arm twisting, in others, the government had misrepresented facts. After privatising Dar es Salaam's Water and Sewerage services, within two years the situation worsened and the Consortium City water had failed to fulfil many terms of the contract. While there was an increase in tariff, the water supply became intermittent. Correspondingly, non-payment of services rose. City water made large scale disconnections affecting communities. The Consortium argued that it was given false information by the Government regarding the number of consumers and status of service lines. In 2005, the contract was cancelled. City water initiated a claim with the International Centre for Settlement of Investment Disputes **(Brown, 2010).** Many a times, the clauses in the contracts are politically motivated, the way it happened in the case of Jakarta, Indonesia. The two city contracts were revisited for corruption and bad practices after the Suharto regime fell in 1998. Issues of legal problems, lack of tendering process, and lack of public involvement and transparency came to the fore **(Kurniasih, 2008).** The contracts were further modified called as Renegotiated Contract Agreement. In 2006, the private companies sold part of their equity shares which were bought by Citibank and Astra **(Kurniasih, 2008).**

1.4.2.5 Role of Political Patronage in Water Service Delivery

Literature review shows that a give and take informal relationship exists between the elected public representatives and the slum dwellers based on votes and facilities. This in a way improves the bargaining power of the poor and enable their voices to be heard which otherwise might not have been possible. In India, as in many other countries, the vulnerable population vote as blocks. Slum dwellers' voting rights are facilitated by political parties, often against the promise of facilities like water and sanitation **(Krishna et al**, **2014)**. In a study in Bangalore, Corporators were found to have a feeling of being the sole benefactors of the poor residing in slums. Water and sanitation were the bargaining points before elections **(Walters, 2013 cit. in Venkateswar, 2016).** Yet **i**n another study in Mumbai, it was found that while promises were made to extend piped water to a slum during election, the promise was realised in the form of temporary arrangements **(Coutard et al, 2015).** In a study in Madagascar, **Moser (2008)** found that the political leaders favoured their political base the most, focussed on getting re-elected and allocated funds accordingly. Often real reasons for not increasing tariff of water services is for pandering to the vote bank rather than actual concern **(Das et al, 2010).** Voters tend to give more weight to the initiatives that have been taken just ahead of the elections **(Mansuri & Rao, n.d).** Social heterogeneity also may lead to deprivation of services as some groups might grudge paying for services others use **(Mansuri & Rao, n.d). Coutard (2015)** speaks about **"**water revanchism" as an attempt by the middle class to claim back city resources as they see it as the right of tax paying citizens.

1.4.3 Review of Research Methods

1.4.3.1 Water Supply Improvement Assessment Studies

Usually two criteria are followed for assessing the water supply quality, the first is objective based on technical or scientific data and subjective based on users' perception **(Estache et al, 2006).** Quality indicators are usually categorised into water quality and service quality. Drinkability, level of sediments or clarity and chlorine levels are often used as measures of water quality while reliability, water pressure and maintenance are taken as measures of service quality **(Lampietti et al, 2001 cit. in Zaki et al, 2008).** Clarity, taste and smell were identified by **(Kessides, 2004)** as quality measures which can be sensed by consumers easily. Similarly, **Zaki et. al (2008)** in his study on the effect of privatisation on the urban poor in Thailand selected the attributes of drinkability, clarity, turbidity, reliability, water pressure and response to consumer complaints. Private projects are vulnerable to political and policy changes as they are usually for long term **(Koppenjan, 2009).**

1.4.3.2 Willingness to Pay (WTP)

Willingness to pay has emerged as an important element in the discourse on neo-liberal reforms and privatisation in the urban water sector. WTP has also come in for a lot of criticism from opponents of commodification and commercialisation of water who claim that WTP has taken over "ability to pay" and is being pushed by the IFIs. The amount a household is willing to pay for better water services largely depends on the cost it is presently incurring in availing the present services. Households usually do not want to pay more than they are paying now **(Whittington, 1991). Rogerson (1996 cit. in Littlefair, 1998)** stated in his study that the development agencies overestimate the willingness to pay while the Government underestimates. A WTP study by **Tussupova (2015)** found that households with a private connection were willing to pay a higher price for improved services. In the same study, households with children were also found to be willing to pay a higher price. In a study in Canberra, the households were willing to pay for an incremental increase in service, personalised customer care service and notification of service interruption **(Hensher, 2005).** Household income, number of children, perception of existing water quality and awareness of environmental issues played an important role in determining WTP **(Brox et al, 2013)**

There are various methods for WTP such as alternative method, travel cost method, hedonic price method and Contingent Valuation Method (CVM) **(Fujita et al, 2005).** CVM seems to be the most popular method for willingness to pay surveys (**Tussupova, 2015**; **Fujita et al 2005**)

1.4.4 Gaps in Literature

There is very little empirical work on the PSP projects in water supply and distribution in India. Most of the studies are either, hypothetical and based on ideological inclination or studies sponsored by International Financial Institutions. There is a dearth of independent research studies. Besides, most of the available literature focuses on either the African or the Latin American countries among the developing countries. With more and more cities opting for private sector participation in water supply in India, it is imperative that a study be undertaken to understand the interplay of various conditions associated with private sector participation in the public water system in a city in India.

Most of the studies are from a techno-social perspective and discuss the effect of privatisation through compromise in expansion in low income areas, disconnection of taps due to non-payment, reduction of alternate sources of water supply etc. In reality, other than price rise, other conditions also prevail in a state run utility scenario where the poor have been constantly underserved. There is limited work on the inequalities in access to water among households managed by private and public utilities and delineation of reasons based on political, social and economic aspects, for inequalities in access to water among various groups with different entitlements.

Besides the geographical relevance, most of the studies in this field have focussed on the effect of price rise associated with privatisation of water supply on the lower income groups. There are barely any studies focussing on the effects of neo-liberalisation of the water sector commodifying and commercialising water which also entail price rise and mimic several of the conditions associated with privatisation. The Delhi case study gives an opportunity to understand the effects of the reforms in the water sector on the residents with different entitlements and socio-economic groups.

1.5 A BRIEF OVERVIEW OF THE POLICIES, ACTS AND REGULATIONS IN THE PRIVATE SECTOR PARTICIPATION SPACE IN INDIA

1.5.1 Historical Background

Discussion of the present day water and sanitation policies would be incomplete without touching upon the approach to water during the British times as many of our present day policies and laws are either remnants or influenced by laws prevailing during those times.The British became active in consolidating their power after the 1957 mutiny. Control over water and rights to water were regulated through the introduction of common law principles. Landowners were given the right to water flowing through their property **(Cullet, 2009).** Several laws were enacted such as the Embankment Regulation 1829; Bengal Embankment,Act 1855, Northern India Ferries Act 1878; Indian Fisheries Act 1897). Northern India Canal and Drainage, Act (1873).The last Act recognised the right of the Government to' use and control for public purposes the water of all rivers and streams flowing in natural channels, and of all lakes' **(Cullet, 2009).** Division of responsibility was also charted out during the colonial times with the provinces being responsible for water supply, irrigation,canals, drainage and embankments,water storage and hydropower. The arrangement has continued to the present times with water being a state budget. India's present water supply and distribution system and the precedence of the state over customary rights is the legacy of the British.

1.5.2 Provisions in the Constitution of India

The Constitution of India does not explicitly state the Right to Clean Water. Access to safe drinking water has been understood as part of Right to Life under Article 21. The

Courts of India have played an important role in including right to safe drinking water and right to pollution free water under Right to Life in their judgements.

Besides the aspect of Right to Safe Water , the 73rd and 74th amendment to the Constitution of India are other important Articles which have a bearing on access to safe water. The amendments are a step towards decentrailisation and empowering of local bodies. The 73rd amendment made it constitutionally mandatory for States to empower panchayats with powers and authority to enable them to function as institutions of self government. Drinking water, water management, minor irrigation and watershed development are under the jurisdiction of Panchayats **(Upadhyay, 2011)**.Similarly, the 74th amendment recognises local self governance as enforcable and seeks to empower municipal bodies such that they act as institutions of self government. Water supply among others are to be entrusted to Municipal bodies. Both the amendments are yet to be implemented in many states where water supply is still the duty of parastatal organisations under the State Government.

1.5.3 National Water Policy 1987

The first National Water Policy was adopted in September, 1987. Water was accorded the status of a prime natural resource, basic human need and a precious national asset. It stated water allocation priorities with drinking water being given the highest priority, but left it flexible to region specific considerations. There was no mention of the instrument of provisioning of water.

1.5.4 National Water Policy 2002

NWP 1987 was revisited and subsequently revised and was adopted by the National Water Resources Council in 2002. The policy also accorded highest priority to drinking water allocation similar to its predecessor but did away with the flexibility in priorities. It emphasised on the importance of making water resources as utilisable resources to the maximum extent possible. It also suggested giving adeqaute attention to the physical and financial sustainability of existing water resources. Water charges were also recommended to be fixed for various uses such that at least the operation and maintenance costs are covered. There was a mention of inviting private sector participation in planning, development and management for water resources.

1.5.5 National Water Policy 2012

National Water Policy 2002 was reviewed in the light of growing stress on water, increasing population and the looming threat of climate change. National Water Policy (2012) recognises water as a scarce natural resource and attempts to propose a framework of laws and institutions for a plan of action. It also advises Governments and local bodies to ensure access to a minimum quantity of potable water to every household for essential health and hygeine. Water was given the status of an economic good for the first time, over and above the minimum quantity required for leading a healthy and hygienic life. Principle of equity and social justice shall be the governing principle on allocation of water. Water pricing is to be determined on the basis of volumetric basis to keep it fair. Project finacing has been suggested for incentivising efficiency of water use. Mismanagement of water has been held responsible for the critical water scarity situation in the country. It also proposes the reversal of under-pricing of electricity. While the draft national water policy 2012, suggested the reassessment of the role of the state as the service provider and encouraged public private partnerships, there is no mention of this in the final version. The policy does not deter use among users who can afford to pay for water.

A review of the three national water policies suggests that there has been a gradual shift towards recognising water as a scarce resource in the light of the increasing population and climatic uncertainities. The recognition has been accompanied by treating water as an economic good and thus attaching an economic value to it. Tthere has been a call for need of increasing efficiency in managing water and subsequently the entry of private firms in doing so.

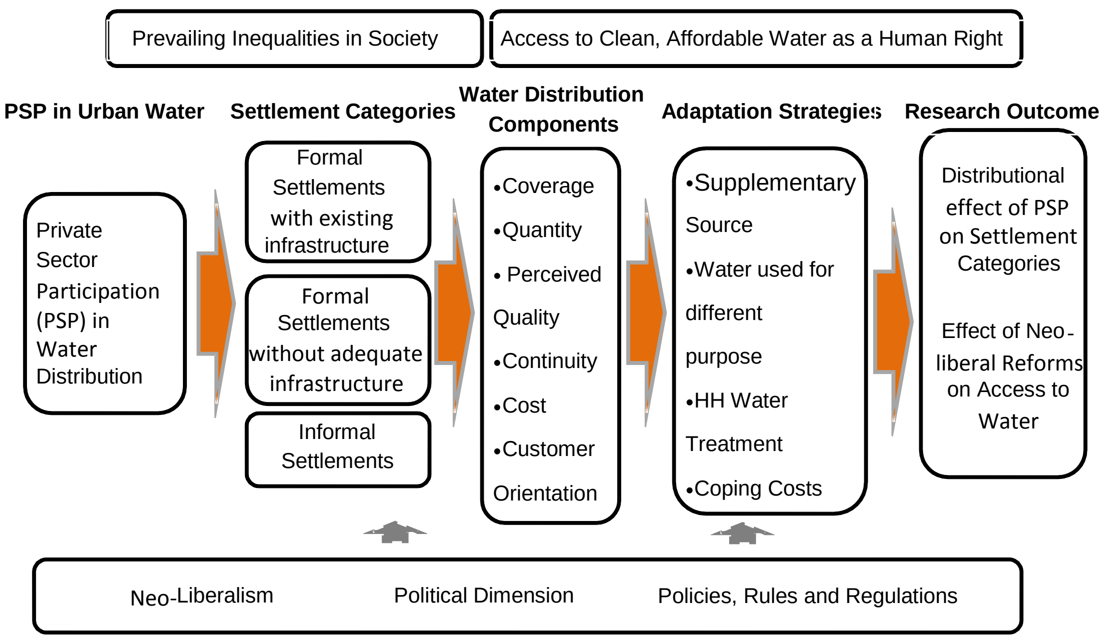
1.6 THEORETICAL FRAMEWORK

The present study draws heavily from urban political ecology (UPE) which largely explains the relationship between environment and social change. UPE is an offshoot of political ecology and has contributed in contextualising political ecology in cities. Political ecology has been linked to the rise of environmentalism in the 1970s and the realisation of the environmental problems and the injustices, many of them a result of the neoliberal policies **(Batterbury, 2015).** Political ecology was considered to be concerned with politics of environmnetal rehabilitation and degradation **(Paulson et al cit. in Angelo et al, 2014)** and was assumed to be relevant to non-urban fields as urban already meant the subjugation of nature and the antithesis of environment in literature **(Trepl, 1996 cit. in Angelo et al, 2014).** One of the earliest works on political ecology was by **Blaikie and Brookfield (1987).** They described political ecology as a combination of ecology and political economy. **Schmink and Wood (1987)** added to this by proposing that political ecology helps in explaining the exploitation of natural resources through economic and political processes.

Urban political ecology allows the study of cities in the context of natural elements. One of the major contribution of UPE has been to emphasise that scenarios that are represented as natural crisis is actually produced through socio-natural and material processes. At the heart of urban political ecology is the argument that social power relations determine access to environmental resources, often working at various scales **(Batterbury, 2015).** UPE seeks to answer "who produces what kind of ecological processes for whom" **(Heynen et al, 2007). Heynen et al (2007)** have argued that political processes cannot be separated from the socio-environmental changes that take place in a city. Historical-geographical processes of urbanisation of nature are intrinsically linked to the environment of the city **(Swyngedouw et al cit. in Heynen et al, 2007)** and urban socio-ecological processes are intimately connected to the socio-ecological processes at a much larger scale, even the global scale **(Heynen et al, 2007).** The underlying economic, social, cultural and political processes which make up segregated and differentiated urban landscapes has been brought to fore by past UPE studies **(Heynen et al, 2007).** UPE is against the Malthusian view of naturalising the scarcity of resources, rather arguing for the acknowledgment of the power relations through which resources are produced and distributed **(Robbins cit. in Loftus, 2009)**. Few scholars are of the opinion that UPE has restricted itself to the city through emphasis on analytical and empirical focus excluding other aspects of contemporary urbanisation **(Angelo et al, 2014).**

Water has emerged as an important entry point in the urban political ecological studies. In the neoliberal context, urban configurations are routinely being characterised by privatisation of common goods and public services in the city. According to **Swyngedouw et al, (2005),** "….the material conditions that comprise urban environments are controlled, manipulated and serve the interests of the elite at the expense of marginalised populations". Society and nature become one to produce the socio-spatial fabric of cities that favours some and marginalises others **(Swyngedouw et al, 1997),** Water as an economic good has been perpetuated by economic globalisation and by the hegemonic ideas of neo-liberalism **(Larson, 2010).** The rise of supra-national institutions has played an important role in changing the discourse about water **(Larson, 2010).** The prevailing deep rooted power equations result in unequal appropriation of material flows and stocks through market forces **(Delgado-Ramos, 2015).** There is a growing consensus among policy makers and decision makers that nature needs to be saved, the emerging global environmental imaginary promotes technical fixes to address the problem **(Kaika, 2012 cit. in Gabriel, 2014).** An important part of the technical solution that has been promoted, is the privatisation of water. Harvey has termed the privatisation of water and the focus on full cost recovery in the water sector as accumulation by dispossession **(Loftus, 2009).** Harvey suggests that privatisation of water has followed the exhaustion of other avenues of accumulation, new areas of profiteering have been opened up which were earlier outside the purview of capital accumulation **(Loftus, 2009). Budds and McGranahan** have argued that neither privatisation nor an unreformed public sector can address the problems plaguing the urban poor in Global South **(Loftus, 2009)**.

1.7 CONCEPTUAL FRAMEWORK



1.8 OBJECTIVES

a) Assess the prevailing inequalities in access to water and service provisioning of formal water supply in urban India.

b) Understand the patterns and trends of PSP in the urban water sector in the world and in India

c) Study the present situation of water supply and distribution in Delhi and understand the existing inequalities among the various settlement categories.

d) Assess the influence of nature of management on access to clean, affordable water across the settlement categories

e) Understand the other factors which influence distributional equity in the neo-liberal regime.

1.9 CENTRAL RESEARCH QUESTION

Does the type of management in urban water sector influence inequality in household access to water

1.10 RESEARCH QUESTIONS

a) What are the levels of existing inequalities in access to urban water supply between states, urban size classes, million plus cities and income classes in the backdrop of present hydraulic State paradigm

b) Does the type of agency influence the adoption and implementation of water sector reforms in the million plus cities of India

d) What are the factors influencing the award and the continuation of PPP projects in urban water supply in India

e) What are the causes of the inequalities in water service provisioning in Delhi and the justifications for introducing PSP in water supply and distribution in Delhi

f) How does the type of management influence the access to clean, affordable water among the settlement categories

g) What are the various factors acting as barriers against/or resulting in acceptance of private sector innovative measures in water provisioning in non-networked areas.

h) What are the key factors responsible for distributional inequity among the settlement categories.

1.11 METHODOLOGIES

1.11.1 Overview of the Research Design

The research design selected for the study is such whereby the effect of private player participation in water distribution is seen on the households in different settlement groups, by taking one group of respondents as the focus group (households in the area managed by the private player) and the other as the control group (households in the area managed by the public utility). Further, the variables were selected on the basis of the literature survey and World Health Organisation (WHO) water and sanitation survey reports. The primary data collection technique was decided upon, which was through sampling, interviews and FGDs. Subsequently, a survey was conducted in the study area. The collected data was cleaned, collated and fed into the statistical software, SPSS 17.0. Further, analysis of the data was carried out and inferences were drawn.

1.11.2 Sampling Framework

1.11.2.1 Networked Water Supply

Areas where private sector is involved in water distribution comprises the focus group area while areas where the public sector is still responsible for water distribution comprises the control group. Within these respective areas, all the urban villages and JJ clusters were selected. The planned colonies were further divided into categories on the basis of residential categories of Municipal Corporation of Delhi (A, B, C and D). An attempt was made to ensure adequate representation from each category. Households were sampled from within the colonies. Two tiered stratified random sampling was utilised for selecting the samples in all cases. The first tier comprised the settlement categories of planned colonies, unauthorised colonies, urban villages and JJ clusters. Disproportional sampling was selected as the preferred method for deciding on the sample size within each first tier strata. The reason was the different levels of variation in availability of public water supply in each of these settlements. Although planned colonies have the highest population, they exhibit the least variation while the other three settlement categories show high level of variation even within the locality. The second tier comprised the selection of households within each settlement category. Proportional to Population Size sampling method was selected as the preferred method. Samples proportional to the number of households in each colony/locality was taken. Each locality was divided into spatial units so that the entire settlement was well represented. Special care was taken to ensure household selection from areas near and away from water pipelines. In planned colonies, after the colonies were selected from among the MCD categories, snowballing method was used since people were not willing to be a respondent unless some reference was given. A total of 400 samples were taken for networked water supply and 60 samples were taken for non-networked water supply.

a) Focus Group- Pilot Project Area with PPP model of water management

There are three private operators involved in distribution of piped water supply in Delhi at the pilot stage- Malviya Nagar Water Services Private Limited, MVV Water Utility Private Limited and Nangloi Water Services Ltd. Areas under the former two companies have been taken as the focus group areas as rehabilitation work is still going on in the latter in large phases. Even within the former two areas, some areas have been excluded as pipeline had not been laid there during the survey period.

Four categories of settlements were selected for the primary survey; planned colonies,unauthorised colonies, urban villages and jhuggi jhompdi clusters. The number of samples are given in the parenthesis. There are only planned colonies within the MVV Pvt Ltd. (Vasant Vihar Project) area.

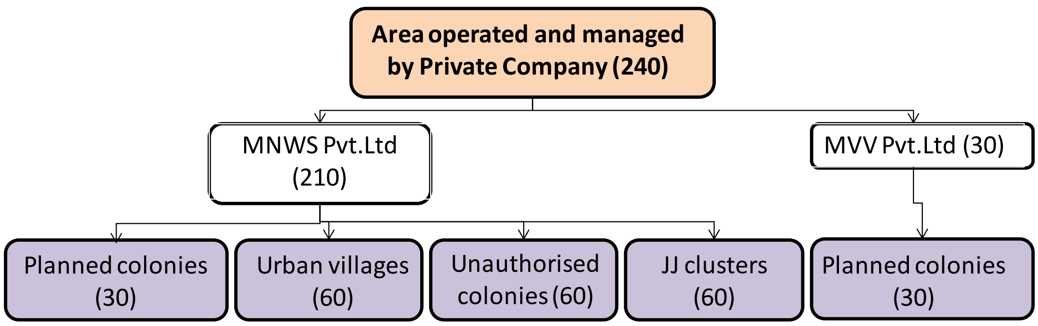


Figure 1.2: **Sampling Framework in Areas Operated and Managed by Private Companies**

The planned colonies have around a total of 31,392 households in the MNWS Pvt.Ltd area (Detailed Project Report, DJB Malviya Nagar Project 2011) and 11,000 households in the MVV Pvt. Ltd area (Detailed Project Report, DJB Vasant Vihar and adjoining area, 2011) and the urban villages and unauthorised colonies together have 34,253 households). The JJ clusters had around 4000 households (MCD, 2008) Thus, keeping this mind, the sample size has been fixed within the larger number of 380 as the appropriate sample size with 95 percent confidence level and confidence interval of 5.

b) Control Group- Water Management by Public Sector (Delhi Jal Board)

Area under Kalkaji Underground Reservoir and colonies near Vasant Vihar have been selected as the control group area as it is contiguous to the focus group areas and has similar kind of settlement typologies as the focus group areas. These areas also receive water from Sonia Vihar WTP and the piped network had recently undergone upgradation. 160 household samples were taken.

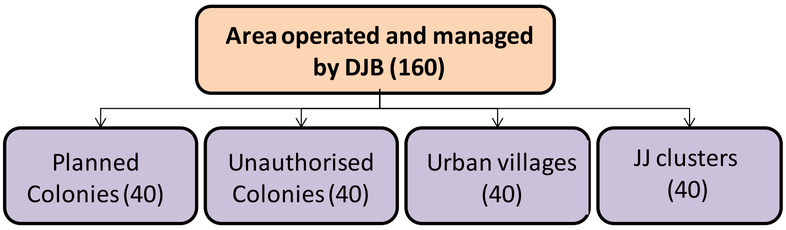


Figure 1.3: Sampling Framework in Areas operated and managed by Public Utility

1.11.2.2 Non-Networked Water Supply

A Private company, more specifically Piramal has set up potable water dispensing units in the resettlement colony of Savda Ghevra. Sixty households were surveyed; 30 households using water ATMs and 30 households not using water ATMs. Stratified random sampling was used for selecting the households. A certain numbers of households were selected from each residential block which had the dispensing units.

Key informants were identified from various sections of the service providers as well as the consumers. Office bearers who could give an insight into the supply side of the story included officials from Delhi Jal Board, MNWS Pvt Ltd and MVV Pvt Ltd. The consumer version was sought from representatives of Residents Welfare Associations (RWA), slum associations and political representatives of the community.

1.11.3 Research Tools and Methods

Research Method: Mixed Method involving both quantitative and qualitative analyses were used. Both have their advantage and disadvantages. Quantitative data from structured questionnaires allow capturing of variables across a large number of cases and allow for statistical precision. Rigorous statistical tests can also be applied making the results valid and reliable. Qualitative methods allow generation of in-depth and collateral data regarding cases, allow space for opinions and also help in explaining the findings from the quantitative data.

Data Collection: Various methods were used for collecting both primary and secondary data. They have been discussed separately below.

Secondary data was collected at different points of time throughout the research period. They were largely restricted to data available in the public domain. Both published and unpublished work was referred to. Different data sources were referred for meeting different objectives. WHO, UNICEF websites were referred for understanding the global situation regarding water and sanitation. Census of India (2001, 2011) and NSS (2012) were referred to unearth the status of water and sanitation in India. Official websites of both public water utilities and private water service providers were searched for relevant data. The Delhi Jal Board website was a major source of secondary data for water situation in Delhi.

Table 1.5: Secondary Database

S.No	Data Source	Purpose
1	Drinking Water Database,WHO/UNICEF, 2015	To Assess the status of access to safe water across global regions and countries
2	JMP Progress on Sanitation and Drinking Water 2015 data dashboard, WHO/UNICEF, 2015	
3	Census of India, 2001 and 2011; A Series (General population Tables), Office of the Registrar General & Census Commissioner (India).	To understand the inequality in access to water among states, urban size classes, million plus cities, income classes and slum and non-slum households
4	Census of India, 2011; H Series (Tables on Houses, Household Amenities and Assets), Office of the Registrar General & Census Commissioner (India).	
5	Census of India, 2001; H Series (Tables on Houses, Household Amenities and Assets), Office of the Registrar General & Census Commissioner (India).	

6	Primary Census Abstract for Slum, 2011, Office of the Registrar General & Census Commissioner (India).	
7	Housing stock, *amenities* and assets in *slums*—*Census* 2011. , Office of the Registrar General & Census Commissioner (India).	
8	Drinking water, sanitation, hygiene and housing condition in India; NSS 69th Round (2012)	
9	Service Levels in urban water and sanitation sector, Status Report, 2010-2011, 2012, MoUD	To study the status of urban water supply in the million plus cities of India in terms of various parameters from the suppliers' end.
10	2007 Benchmarking and Data book of water utilities in India, Asian Development Bank	
11	Official websites of private and public utilities	In the absence of a compendium of water projects with private players, official websites of private and public utilities were referred for data on the details of the projects.

Primary data was collected by canvassing questionnaire, conducting interviews, Focus Group Discussions (FGDs) and through observations. Structured questionnaires with both closed and open ended questions were canvassed to the sample households using stratified random sampling and snowballing sampling. These were used mainly to generate quantitative data. Purposive sampling was used to identify representatives for in-depth interviews with the help of semi-structured questionnaires. The interviews were conducted with the key informants. FGDs (Table 1.6) were also conducted in usually a group of 7-10 people. The size was kept in mind to allow an interactive and productive discussion allowing everyone to talk and share their views and at the same time encourage diversity of opinions. Visual observations about the water and sanitation situation in the colonies played an important role in confirming and reiterating the findings from the questionnaire or vice versa. Case studies have also been done to highlight certain situations.

Table 1.6 Locations of FGDs

S.No	FGD Locations	Settlement Category	Main Theme
1	Vasant Vihar DDA Junta Flat	Planned Colony	Effect of private management on water supply
2	Savda Ghevra Resettlement Colony	Resettlement Colony with Non-Networked Water	Benefits and issues - Water ATM

3	Manav Kalyan Camp, Giri Nagar	JJ Cluster	Effect of electricity privatisation
4	Jahapanah Mohalla	Unauthorised Colony	Resistance to taking authorised water connections
5	Jagdamba Camp, Sheikh Sarai	JJ Cluster	Effect of private management on water supply

Quantitative Methods:

Various methods have been used for analysing quantitative data throughout the research work. These methods were employed for both primary and secondary data. Statistical Analysis software package of SPSS 17.0 was used for the analysis.

Table 1.7: Quantitative Methods used for Research Work

S.No	Purpose	Methods used
1	Descriptive Statistics	Frequency distribution, Coefficient of Variation
2	Inferential statistic	Pearson’s correlation coefficient, Cross tabulation, Binomial Regression
3	Statistical testing	Chi square test, p value, Fischer’s test
4	Weighting	Z Score, Principal Component Analysis

Principal Component Analysis

Principal components analysis (PCA), a popular multivariate technique, is mainly used to reduce the dimensionality of multi-attributes to two or three dimensions. PCA is appropriate when there is data on a number of variables and there may be redundancy in some variables which means that there may be high correlation between variables and consequently they may be measuring the same construct. Because of this redundancy, it could be possible to reduce the observed variables into a smaller number of principal components (artificial variables) that will account for most of the variance in the observed variables.

Principal component can be defined as a linear combination of optimally-weighted observed variables. Below is the general form for the formula to compute scores on the first component extracted (created) in a principal component analysis:

$C_1 = b_{11}(X_1) + b_{12}(X_2) + \ldots b_{1p}(X_p)$

where

C_1 = the variable's score on principal component 1 (the first component extracted)

b_{1p} = the regression coefficient (or weight) for observed variable p, as used in creating principal component 1

X_p = the variable's score on observed variable p.

The first component extracted in a principal component analysis accounts for a maximal amount of total variance in the observed variables. The second component extracted will have two important characteristics. First, this component will account for a maximal amount of variance in the data set that was not accounted for by the first component. Again under typical conditions, this means that the second component will be correlated with some of the observed variables that did not display strong correlations with component 1. The second characteristic of the second component is that it will be uncorrelated with the first component in case orthogonal rotation has been used.

Qualitative Tools and Methods:

Interview transcripts, field notes and media stories (newspaper articles) were used as the base for applying qualitative analysis techniques. Interviews allowed for collection of detailed information regarding the present situation of water supply, factors including behaviour and values that play an important role in contextual understanding of water. Data from the interview transcripts were coded and response patterns identified. Case study method has been used for both primary and secondary data. Purposive sampling was done to select the interviewees from among the Residents Association representatives which further have been used for qualitative analysis. Likert Scale was adopted for scaling some of the responses.

1.11.4 Variables Selected for the Study

Variables were selected based on literature review and standard WHO survey questionnaires.

Table 1.8: Variables Selected for the Study

S.No	Variable	Indicator
A	Water	
1	Source of Water supply	Main source of water supply (other than drinking)
2		Supplementary source of water supply (other than drinking)
3		Alternate Source of water supply (seasonal)
4		Type of water supply (Hard/Soft)
5		Main source of drinking water supply
6		Supplementary source of drinking water
7	Water Supply Reliability	Duration of piped water supply
8		Frequency of piped water supply
9		Water storage
10	Perceived quality	Ideal expected duration and frequency
11		Smell
12		Taste
13		Appearance
14		Overall quality
15	Perceived sufficiency of water	Perceived sufficiency
16		Inconvenience arising out of insufficiency
17	Treatment of drinking water	Method used for treatment of water
18	Expenditure on water	Monthly Expenditure on formal water supply
19		Monthly expenditure on supplementary water
20		Usage of Motor pump for drawing water
21		Average time for which the pump is run
22		Willingness to pay for better services
23		Higher than expected bill amount
24		Inability to pay
25		Frequency of receiving bill
26	Customer care	Approached service provider in the past one year
27		Reason for contacting service provider
28		Mode of contacting the service provider
29		Resolution of the issue/complaint
30		Time taken for resolution
31		Perceived Difficulty level of bill payment process
32		Mode of bill payment
33	Perception about PSP	Effect of PSP on water quality
34		Effect of PSP on duration and frequency of water supply
35		Effect of PSP on regularity of supply
36		Effect of PSP on coverage
37		Effect of PSP on bill amount
38		Grievance redressal
B	Sanitation (JJ clusters)	
1	Latrine Facilities	Type of toilet facility
2		Reliability of water availability in the public toilets
3		Issues with the new system
C	Electricity (JJ clusters)	
1	Reliability	Frequency of load shedding in the past one week
2		Frequency of load shedding same as nearby planned colony
3	Expenditure	Average monthly bill

4		Frequency of getting bill
5		Instances of overbilling
6		Inability to pay bill
7		Disconnection threat due to non-payment
8	Satisfaction with electricity supply	Privatised services better or worse
9		Issues with the new system

1.12 LIMITATIONS OF THE STUDY

The water supply and distribution sector is presently a dynamic sector with changes being brought about very frequently across cities and towns of India. With respect to secondary data pertaining to PSP efforts in the water sector, the main data base has been restricted to the Government service agency websites and private company websites. In some cases, the latest development might have been missed as it was not updated on the websites.

PSP water supply and distribution has been a controversial subject in Delhi since the first time it was attempted, attracting lot of civil society opposition. This has also meant that it was difficult to get written data from the service agencies. Thus, limited quantitative data is available for the different PPP areas.

Conducting surveys and getting responses in high income areas was problematic with most residents not willing to spare time for the survey thus the snowballing method was adopted instead of random sampling in these areas. This has limitations as residents often refer the person who shares their way of thinking. This may have resulted introducing certain biasness.

During the pilot household survey, it was seen that the respondents, especially those belonging to higher income groups, were not willing to share the monthly income figure with the interviewer. Respondents were found to be more forthcoming when income was divided into categories. Thus, household income could be collected only as an ordinal variable instead of a continuous variable in all settlement categories other than JJ clusters and Savda Ghevra. Also, most people in the higher income groups responded with their monthly salary and excluded income from other sources like rent etc.

Non-probability sampling method was chosen for deciding on the sample strength for each of the settlement categories. This was done to accommodate enough samples for all the settlement categories as the number of households in planned colonies far exceeds JJ households while at the same time exhibiting lower variation in water sources than the latter.

1.13 CHAPTER SCHEME

The background of the study is given in the first chapter titled "Introduction" followed by the statement of problem, relevant details of the study area, literature review, conceptual framework, objectives and the research questions. The methodology as adopted for the study is explained followed by limitations and the chapter scheme.

The second chapter titled "Urban Water Supply and Distribution: A Background" dwells on the prevailing inequalities in access to water in the urban system at various levels. The chapter begins with a brief overview of the inequalities in access to water among the cities of the Global North and South. It moves forward to explore the disparities existing between states, urban size class and million plus cities. It also discusses the inequalities arising out of socio-economic differences reflected in the inequality in access to water among the various income groups and households in slums and in other parts of the city.

The purpose of the third chapter titled "Private Sector Participation in Urban Water Supply- Post 1990s" is to present the global discourse of PSP in water supply and distribution in which the Indian case is embedded. It gives a background of the history, trends and pattern of PSP in the urban water sector at the global level and in India. It explores the reasons for PSP being introduced in various countries and the benefits and the issues arising from PSP. The India level study discusses the trends and patterns of PSP focussing on the prevailing type of contract, preferred hierarchical level of urban centres, implementation agency, factors associated with award and continuation of PSP projects in the urban water sector and some case studies to further elucidate the Indian scenario.

The water governance and the PSP efforts in Delhi is discussed in the fourth chapter titled "Water Governance and Private Sector Participation Efforts in Public Water Supply in Delhi: A Macro Analysis". To begin with, the British legacy of water supply through a historical account of the water supply and distribution system prevailing in Delhi has been discussed. The water governance from the demand-supply lens and the reasons given as justification for introduction of PSP in the context of Delhi have been explored. The influence of political and social process on the prevailing inequalities in availability and access to potable water among the various settlement categories has also been assessed.

The household access to clean, affordable water in the areas managed by the private companies and DJB is discussed in the fifth chapter titled "Inequalities in Networked Water Supply: A Micro Study". The importance of the political, social and economic role in determining the household access to water in the various settlement categories has been explored..

The study area (Savda Ghevra) where water ATMs have been introduced through public private partnership have been discussed in the sixth chapter titled "Private Sector Participation in Non-Networked Water supply: A Case of Savda Ghevra". The factors influencing the use of the ATMs have been focussed upon.

The underlying social, political and economic factors determining the inequality in access to water has been studied through the lens of political ecology framework in the seventh chapter titled "Political Ecology of Neo-liberalised Water".

The research is summarised and concluded in the last chapter.

Notes:

Definitions and Terminologies of Frequently Used Words

a) Definition of urban as per Census 2011

Statutory town, census towns and urban outgrowths constitute urban areas. Statutory towns are places with a municipality, corporation, cantonment board or notified town area committee. Places which fulfil the following criteria are called census towns a) A minimum population of 5000 b) at least 75 percent of the adult male population (main working) engaged in non-agricultural occupation and c) A density of population of at least 400 per sq.km. Outgrowth should be a viable unit such as a village or part of a village contiguous to a statutory town and possess the urban features in terms of infrastructure, and amenities.

b) Urban Size Class

In India, Urban size class varies from I to VI. Million plus cities are part of Class I size class. Urban centres belonging to class I size are termed as cities, class II and Class III urban centres are termed as medium towns and urban centres with less than 20,000 population are called small towns.

Table 1.8 : Size Class and Corresponding Population

Size class	Population
I	100,000 and above
II	50,000-99,999
III	20,000- 49,999
IV	10,000-19,999
V	5000- 9,999
VI	Less than 5000

c) **Category of Settlements as per Municipal Corporation of Delhi**

Municipal Corporation of Delhi, earlier, and now the trifurcated municipal corporation bodies have categorised the settlements of Delhi into eight categories- A,B,C,D,E,F,G and H. This is to facilitate tax collection. The unit area cost is the highest in Category A.

Table 1.9: Cost (Per unit) of Residential land as per MCD categories (2015)

S.No	Category	Unit Cost for Residential Plots (Rs./sq.m)
1	A	Rs.774,000
2	B	Rs.245,520
3	C	Rs.159,840
4	D	Rs.127,680
5	E	Rs.70,080
6	F	Rs.56,640
7	G	Rs.46,200
8	H	Rs.23,280

Source:www.mcdonline.gov.in

d) Definition and Types of Slums – Census 2011

*Notified Slums***:** All notified areas in a town or city notified as 'Slum' by State, Union territories administration Or Local Government under any Act including a 'Slum Act' may be considered as Notified slums.

Recognised slums: All areas recognised as 'Slum' by State, Union territories Administration or Local Government, Housing and Slum Boards, which may have not been formally notified as slum under any act may be considered as Recognized slums.

Identified Slums: A compact area of at least 300 population or about 60 – 70 households of poorly built congested tenements, in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities. Such areas should be identified personally by the Charge Officer and also inspected by an officer nominated by Directorate of Census Operations. This fact must be duly recorded in the charge register. Such areas may be considered as Identified slum.

The definition of a jhuggi jhompdi as per Delhi Urban Shelter Improvement Board (DUSIB) Act, 2010: Jhuggi means a structure whether temporary or pucca, of whatever material made, with the following characteristics ,namely:-(i)it is built for residential purpose; (ii) its location is not in conformity with the land use of the Delhi Master Plan; (iii) it is not duly authorized by the local authority having jurisdiction; and (iv) it is included in a jhuggi jhopri basti declared as such by the Board, by notification

"jhuggi jhopri basti" means any group of jhuggis which the Board may, by notification, declare as a jhuggi jhopri basti in accordance with the following factors, namely:-(i)the group of jhuggis is unfit for human habitation; (ii)it, by reason of dilapidation, overcrowding, faulty arrangement and design of such jhuggis, narrowness or faulty arrangement of streets,lack of ventilation, light or sanitation facilities, or any combination of these factors, is detrimental to safety, health or hygiene; and (iii) it is inhabited at least by fifty households as existing on 31st March, 2002.

e) Private Sector Participation (PSP) and Private-Public partnership (PPP)

Private Sector Participation is a broader term and includes PPP as one of the models. PSP can range from relatively limited service and management contracts, to public - private partnerships (PPP), to full or partial public divestiture **(OECD, 2007).**

There is no single internationally accepted definition for PPP. **World Bank (2015)** defines PPP as a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance. The Government of India defined PPP as “Public Private Partnership (PPP) means an arrangement between a Government / statutory entity / Government owned entity on one side and a private sector entity on the other, for the provision of public assets and/or public services, through investments being made and/or management being undertaken by the private sector entity, for a specified period of time, where there is well defined allocation of risk between the private sector and the public entity and the private entity who is chosen on the basis of open competitive bidding, receives performance linked payments that conform (or are benchmarked) to specified and pre-determined performance standards, measurable by the public entity or its representative” **(Department of Economic Affairs, Government of India, 2017)**

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CHAPTER II

URBAN WATER SUPPLY AND DISTRIBUTION: A BACKGROUND

2.1 INTRODUCTION

Water has always played an important role in the history of civilisation. Be it the Harappan civilisation of ancient times which had Indus river as its source of water or the modern cities which were planned near waterbodies, the availability of water has always been a pivotal factor for settlements. Water has also changed the fate of cities such as Fatehpur Sikri which ceased to be the capital, arguabely, due to water shortage. Globally, water distribution networks have been both state and privately owned in the major cities, depending on the time frames. A good so precious has also been a tool for oppression by the Ruler or vice versa. Controlling water meant controlling the subjects. Before the British established themselves in India, water was more of a community responsibility with some canals constructed for irrigation purposes in northern India and tank irrigation being popular in Southern India. The British brought with them the mindset and technology to tame nature and changed the relationship which Indians shared with nature forever. This was also the beginning of large hydraulic structures which allowed the State to control the flow, quantity and quality of water **(D'Souza, 2006).** This development was not limited to India, but rather extended to large parts of the world with spreading colonialism. India has not been able to emerge out of this hydraulic state model and still relies heavily on large engineering projects to quench the thirst of its people, especially its urban dwelllers. The deep association between the State and water also implies that governments which are weak and financially unstable are not able to meet the water demand of its citizens. This has given rise to inequality among states with usually the lesser developed states facing the brunt. This is not only limited to India, but is a global phenomena with the less developed countries having poorer state of water and sanitation. State controlled centralised water sources and distribution systems have not only made the citizens dependent on the state provided water supply but has also led to inequality among the income groups as usually the vertical segregation of income is juxtaposed as settlements on the spatial scale. These ageing water distribution systems are virtually collapsing under the weight of increasing population demand and low sectoral investments.

With the intention of correcting the situation of poor state of water supply and increase access to all sections of the society, reforms in the urban water sector have been introduced from time to time with JNNURM introducing the most comprehensive reforms. The reforms are at various levels; institutional and financial, and are primarily aimed at full cost recovery. Earlier, infrastructure financing was the sole responsibility of the governments mainly through grants, but with the changing role of the Government and it becoming more of a facilitator, the focus has shifted to the water utilities becoming financially self sufficient.

The purpose of the chapter is to present the inequality in access to water which is visible at various levels and the conditions.which have acted as the justification for introduction of structural reforms in the water sector in India. Thus, the chapter seeks to bring forth the past and present condition of water supply coverage and other relevant parameters in India, at the level of the state, urban classes and million plus cities. A brief analysis for the global regions has also been done in order to contextualise the Indian case and facilitate a comparison between the global and the Indian scenario. An attempt has been made to disaggregate data and capture the inequalities at different levels as well; i.e among major states of India, urban size classes, million plus cities and income groups in the form of MPCE quintile groups and slum households. The major quantifiable reforms introduced in the water sector have been analysed at the level of million plus cities. The present chapter begins with the introduction and then the history of urban water supply and distribution services in the world is discussed followed by a comparison of status of access to water across global regions. This is followed by an analysis of the Indian urban water scenario with focus on the inequalities across states, urban size classes and million plus cities. Further, the inequalities in access to water among different income groups and slum and non-slum households is explored. After a thorough understanding of the present status of urban water at various levels, reforms introduced in the urban water sector in India have been studied. This is followed by the summary of the chapter.

2.2 HISTORY OF URBAN WATER SUPPLY AND DISTRIBUTION SERVICES

The historical journey of urban water supply and distribution services traces the evolution of water supply systems from initially being private to being taken over by the State and again being privatized and further being re-municipalised. Over the years, the sinuous movement of the ownership has been led by different factors with firefighting, health concerns, morality and human rights being an important part of the discourse whenever water supply has gone back into the hands of the Government. Water as commodity in terms of being priced has been prevalent in urban centres in pre-modern times, particularly the Roman times, as well. In fact, the parallels between the Roman water supply system and the present system in many cities of the developing countries is striking. In India, the state control of water resources and water supply during the British times set the tone for the nature of post-independence ownership. History of water supply and distribution has been traced from the pre-modern times to the important milestones in the 19^{th}, 20^{th} and the 21^{st} centuries.

2.2.1 Pre-Modern Period (8000 BC- 1450 AD)

The history of water supply and distribution dates back to nearly 8000 B.C with water wells used for storing water being discovered in Jericho, Israel. Evidences have been found of water being transported through channels in rocks and through bamboo trunks in China. Mohenjo Daro (now in Pakistan) shows archeological evidence of extensive network of water supply distribution. Network of wells supplied fresh water through sunken cylindrical shafts, several meters deep, built of wedge shaped standard size bricks. The waste water from the houses were channeled into drains running parallel to the streets **(Jansen, 1989).** In another instance, the history of water supply engineering in Crete dates back more than ca.4,500 years. Aqueducts, cisterns, wells, water distribution, domestic water supply and other water facilities have been discovered dating back to 3200 B.C belonging to the Minoan civilization (present day Crete). Terracotta devices used as water filters were connected with domestic water supply aqueducts and/or reservoirs for providing suitable quality water. The Romans built on the Greek systems but at a much larger scale. The Roman era witnessed the further development and expansion of the advanced water and wastewater technologies developed in Minoan and Hellenistic Crete. Interestingly, Rome was the first major city where water was priced. Water had a dual character in Rome, it was chargeable for the rich who were supplied water inside their houses through pipes and free for the common man who could take water from the community fountain. It is estimated that 40 percent of all the water delivered within Rome went to private buildings, and not all of this was for baths. A special water tax, known as a vectigal, was charged for people who had pipes running from the main system to their houses or baths. It was a continuous flow of water as the aqueduct was free flowing. Thus the tax was assessed by the size of the supply pipe nozzle rather than the amount consumed **(Salzman, 2005).** Slowly, a system arose wherein water was sourced into houses through illegal pipes attached to the main pipeline. This became such a problem that a section of the Roman law code was dedicated specifically to this type of offense, made punishable by a 100,000 sesterces fine (Salzman, 2005). Pollution of public water was also punishable at the same rate **(Biswas, 1985).**

Sinnors (water tunnels) were used in Palestine prior to 1200 B.C. since usually water was brought into the city from streams outside the boundary walls, the cities were vulnerable in the case of an invasion attack. To protect the water, tunnels were dug with one end providing a secret approach to the stream and the other end within the city's boundary. Similarly *qanats* were artificial underground channels which carried water over long distances for irrigation or domestic purposes. These were prevalent in Middle East extending from Saudi Arabia to Pakistan **(Biswas, 1985).** Their presence has been found in Latin America and China as well. Although they were used primarily for irrigation purposes, Madrid and Cordoba in Spain are examples where *qanats* have been used for urban water supply **(Taghavi-Jeloudar et al, 2013).**

Arguably, the most impressive ancient water engineering in the Americas was constructed by the Incas at Machu Picchu (in present day Peru), who faced the challenge of moving water from a distant spring to their capital, located at over 7,000 feet. Machu Pichhu was established in 1450 A.D as the royal estate of the Inca Ruler Pachacuti. Sloping canals delivered water through agricultural terraces to the Emperor's residence and then, through a series of 16 fountains, down the mountain slope to the city's residents. The common man lived in a separate sector away from the nobility and leaders. There were channels which would transport water from a holy spring to nearly the vicinity of every house **(Brown cit. in Salzman, 2005)**

2.2.2 The Modern Period (19th Century)

The 19th century was a time period which is characterized by great advances in technology, medicine, sciences, metallurgy that heralded the industrial revolution. The industrial revolution not only led to a boost in manufacturing but was a watershed for urban water supply as well. Urban water supply systems were making fast advances and thus have been discussed separately for Europe and America. The focus has been mainly on these two continents as later their systems were adopted by countries all over the world including countries of the Global south.

2.2.2.1 Europe

In the modern times, post 19th century, London was one of the first cities to get its own water supply and distribution. The common man took water from the distribution points while the rich had it brought to them by the water carriers. The sanitation scenario was also grim with human feces being disposed into cesspools. This was taken to the agricultural fields to serve as manure. By 1850, water closets were adopted on a large scale. This confounded the problem as cesspools of those times were not designed to handle that extra sludge generated by usage of water closets. Four cholera epidemics were witnessed between 1800 and 1860. In 1845, parliament bill was passed which made it compulsory for all buildings to be connected to storm sewers. As a result, Thames river became so polluted that the parliament had to be adjourned because of the stench in 1958 (The Great Stink). This laid the foundation for extensive renovation of the sewer system and eventual disappearance of cholera **(Bakker, 2005).** The expansion of modern water systems was driven by private companies. The unsatisfactory performance led to a re-evaluation. The share of municipal water supply rose from 40 to 80 percent in the provincial towns in England from 1861 to 1881. By the 19th century, London water supply was concentrated in the hands of nine water companies. The major cholera outbreak in 1840 resulted in the water companies becoming regulated entities. They were required to supply filtered piped water to residences. The water entities were municipalized in 1902 with the Metropolis Water Act. Some water was provided free as charity through the city fountains. In the early 1800s, the authorities were concerned that the poor might not be able to afford water being supplied by the private companies and some poor areas did not have supply. The rich had their own supply whereas the poor bought water from the private water vendors at high prices (nearly equivalent to their rent) or collected it from wells and rivers. “In 1861 the share of private provision of water supply in larger towns was 60 per cent, which decreased over time reaching 20 per cent in 1881 and only 10 per cent in 1901” **(Juuti et al cited in Prasad, 2007).** During the period 1900-1974, the municipalities were in charge of the water supply with the exception of 20 per cent of the population who were supplied by private water companies. The 1974-1989 period saw largely ten regional water structures based on river basins, there were 29 private companies supplying between a fifth and a quarter of the population of England and Wales with water and after 1989, the regional water supplies were privatised **(D.Hall et al cited in Prasad, 2007).**

In Paris, water management has been the responsibility of the private sector right from the beginning. Way back in the 18th century (1782), the Perrier brothers were granted license to supply piped water in Paris. Generale des Eaux (later Vivendi and now Veolia) won its first municipal country in 1853 during the reign of Napolean III **(Financial Times, August 1999 cit. in Prasad, 2007)**. Concerns about cholera outbreak in Paris led to the authorities in 1894 to make it mandatory for each household to be connected to sewerage system **(Gandy, 2006 cit in Prasad, 2007)**. In France, private operators such as Veolia (earlier known as Vivendi and the Compagnie Generale des Eaux) have survived and expanded since 1953. The main reason cited for operation by private companies are the large number of municipalities in France, without financial strength. Policy instruments have also favoured the use of private operators (**Juuti**, **2005).** In Berlin, the initial water supply system was developed by the private sector in 1852 primarily for cleaning streets and for fighting fire. Although, water charges were levied for private use but the water quality was doubtful as it was untreated water from river Spree. The city of Berlin acquired the water company in 1873 due to unsatisfactory service. On the other hand, the city of Munich financed its own investment for its water supply system in 1883 **(Prasad, 2007)**

2.2.2.2 North America

Public water supply and distribution in United States of America was less developed as compared to England with responsibility of arranging for own water lying with the users. Many households depended on rain cisterns, local wells and small water companies **(Bakker, 2005).** Early public water systems often supplied water only to the prosperous neighbourhoods while leaving the poorer ones to fend for themselves. Philadelphia was the first city to get its own public water supply system in 1802. Water supply system did not expand quickly to other cities as by 1880 there were only 598 public water systems. After the mid-19th century, all major cities adopted the public water system providing connections to all households at minimal cost. Chlorination, as a water treatment method, was first started in Jersey City in 1908 and then was adopted by the other cities **(Bakker,**

2005). Initially, annual flat fees were paid for piped water. In the early 20th century, many municipal bodies levied charges according to the volume of water used. Even in cities with well-developed water systems, water services did not reach the poorer areas as a result of which they were extremely vulnerable to diseases and fire outbreaks **(Cutler et al, 2006).** Private Water Companies proliferated in United States after the revolutionary war. Manhattan company started in April 1799 in New York used hollow logs to transmit water from a well to a reservoir and further to customers' houses **(Smith, 2013).** Most of the public water supplies in larger cities in United States of America (USA) were taken over by the local government but small private companies continued to operate in sub-urban areas **(Ratnayaka et al, 2000).** By the end of the 19th century, the trend of water outsourcing reversed and municipal ownership became more popular. In 1896, only nine of the 50 largest cities had private water supply **(Jacobson et al 1994 cit in Perard, 2009).**

2.2.3 The Modern Period (20th century)

In United States of America, engineered water and sewer systems replaced the old ones at the end of the 19th century and early 20th century. For undertaking public works projects, $1.5 billion was authorized by 1932 Federal Relief and Reconstruction Act to be lent to state and local governments. Water and sewerage systems improvement formed a sizable part of the expenditure **(Cutler et al, 2006).** During this time, water access was extended to most households including the poorer ones.

Although the initial thrust was given by the private sector, the improvement in water supply was brought about by the direct involvement of the State. Over time, the realisation dawned that the private sector was unwilling to extend the coverage to the poor neighbourhoods.There was also a growing distrust regarding the quality of water being supplied by the private companies. As the link between water, health and poverty came to be established, the need for universal coverage grew. With this, the public investments in water supply also increased. A contrast in the coverage levels of the public and the private sector is demonstrated in 96 percent of the households being connected to water supply in London compared to only 17.5 percent in Paris in 1911 **(Phillips, 2014).**

The colonial legacy has left its imprint on the water supply systems. Ex-British colonies evolved to view water as a fundamental right even after independence while the former French colonies adopted the private sector mode of water supply **(Lewis et al, 1987 cit. in Prasad, 2007)**.During the British rule in India, piped water was supplied to the city priced at an increasing block rate with the poor getting water from the fountains. Similarly in Colonial Lagos, there was a segregation between the wealthy and the rest of the city dwellers. After independence in 1960, only 10 percent of the households were connected to piped water while the rest depended on shared pipes, standposts and wells **(Gandy, 2006 cit. in Prasad, 2007).**

At present, among the major developed countries, UK and France have privatised water supply systems with USA and Canada having it in some states. Most of the countries have water supply owned and managed by the State. The late 20th century and the early 21st century has seen a shift from public water supply being managed by the State to the management by the private sector, mostly in developing countries. There has been remunicipalisation in several of these cases. These have been dealt in detail in chapter three.

2.3 URBAN PUBLIC WATER SUPPLY AND DISTRIBUTION IN THE GLOBAL CONTEXT

2.3.1 A Comparison across Global Regions

Millenium Development Goals (MDG), 2000 has been instrumental in expediting the improvement in water and sanitation by setting goals and getting national governments to commit to achieving the targets. Although, the global MDG target (88 percent) for drinking water was met in 2010, the situation is still grim in terms of absolute numbers.

Table 2.1: Use of Improved water source and piped water within premises-Comparison across Global Regions (2015)

S.No	Country/Region	Population with access to improved water source (Percent)			Population with access to piped water within premises (Percent)		
		Rural	Urban	Total	Rural	Urban	Total
1.	**World**	84	96	91	33	79	58
A	Developed Countries	98	100	99	89	98	96
B	Developing Countries	83	95	89	28	72	49
C	Least Developed	62	86	69	3	32	12
2.	***Developing and Least Developed Region***						
A	Oceania	44	94	56	74	11	25
B	Sub-saharan Africa	56	87	68	5	33	16
C	Caucasus and Central Asia	81	98	89	38	83	61
D	South Eastern Asia	86	95	90	51	17	33
E	Southern Asia	91	96	93	56	17	30
F	Northern Africa	90	95	93	78	92	86
G	Western Asia	90	96	95	83	92	89
H	Latin America and the Caribbean	84	97	95	68	94	89
I	Eastern Asia	93	98	96	56	88	74

Source: http://www.data.unicef.org

In 2015, 663 million population lacked improved drinking water sources **(UNICEF, 2015).** Share of global population with access to improved sources has increased in the past decade. Presently, 91 percent of the world's population get their household water from improved sources. Inspite of an improvement, there exists much disparity between urban and rural and between global regions as well. The urban population is better positioned with 96 percent of the urban population getting their water from household sources while the figure is 84 percent for the rural population.Population share with access to piped water on premises has also increased from 44 percent in 1990 to 58 percent in 2015. Urban-Rural disparity has declined, more on account of the rural scenario improving.While piped water coverage for urban population has remained the same at 79 percent in the 1990-2015 period, the coverage has improved from 18 percent in 1990 to 33 percent in 2015.

2.3.2 Access to Water in South Asia

The global region of South Asia comprises Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Islamic Republic of Iran, Maldives and Sri Lanka. Access to water in terms of access to improved source of water and piped water within premises has been studied. Not only is there a lot of inequity within the region, inequity persists at the level of wealth quintiles in urban and rural areas as well.

2.3.2.1 Access to Water from Improved Sources

An equity tree is a good tool to understand the disparity in access levels of various services and tells the story beyond the national averages (Joint Monitoring Programme). Figure 2.1 presents the equity tree for household access to water from improved sources for South Asia and displays the level of inequity which exists not only between the countries but also within the countries among the rural and urban sectors.

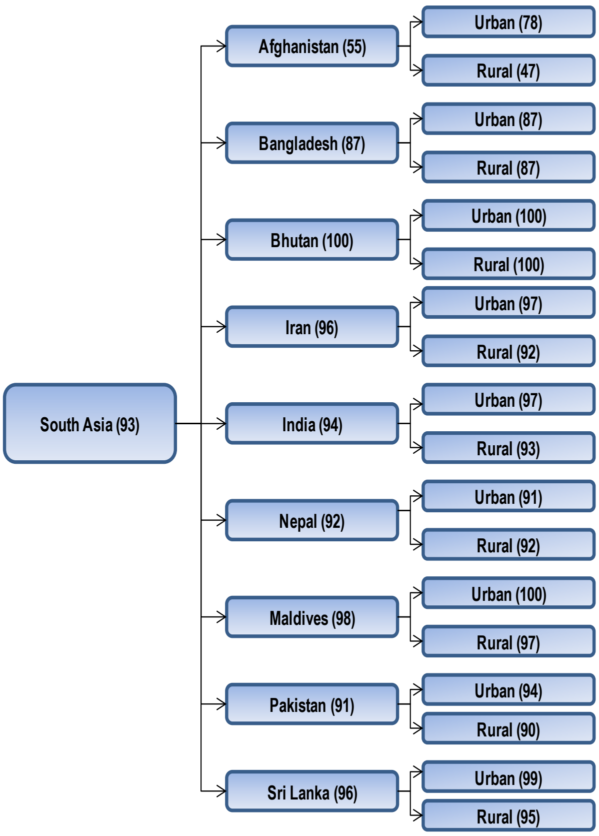


Figure 2.1 :Equity Tree for South Asia : Access to Water from Improved Sources (2015)

Source: Modified from JMP, WHO/UNICEF (2015); Data from The World Bank databank

It is evident from figure 2.1 that there is not much variation within South Asia in terms of household access to improved sources of water, with only Afghanistan being the outlier. The difference in the access of rural and urban households are similar again with only Afghanistan being the exception. This scenario changes drastically when access to piped water within premises is taken.

2.3.2.2 Access to Piped Water within Premises

Access to piped water within premises is a more refined indicator of access to water. As a result, the percentage household access to piped water is much less than household access to piped water on premises for South Asia. Figure 2.2 gives a more detailed look into the inequity at various levels and helps to understand the scenario in a disaggregated manner.

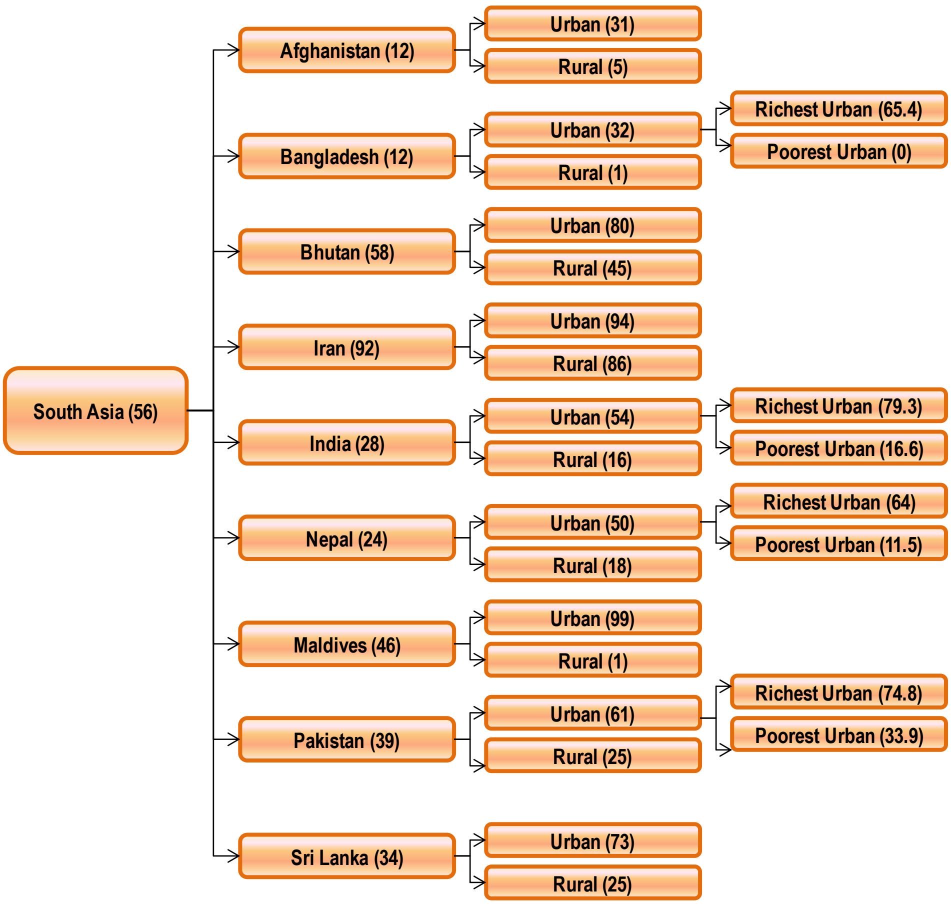


Figure 2.2 :Equity Tree for South Asia : Access to Piped Water on Premises (2015)

Source: Modified from JMP, WHO/UNICEF (2015); Data from The World Bank databank

The differences between countries, in access to piped water on premises are stark as seen in figure 2.2. While the average percentage household access to piped water is 56 percent for South Asia, the individual country figures vary from a low 12 percent for Bangladesh and Afghanistan to the highest of Iran (92 percent). India is placed third from the bottom among nine countries. Among all the countries in South Asia, Maldives (98 percent) has the highest disparity between urban and rural households while Iran (8 percent) has the lowest. India (38 percent) fares poorly in this respect as well with it having the highest disparity after Maldives (98 percent) and Sri Lanka (48 percent). Unfortunately, data for variation with respect to urban wealth quintiles is available for only four countries out of the nine countries. Bangladesh fares very poorly in this aspect with none of the poorest households having access to piped water within premises as compared to 65.4 percent of its richest households. Pakistan is the best placed in this regard with 74.8 percent of its richest households having access to piped water within premises compared to 33.9 percent of the poorest households.

2.3.3 Water Supply Scenario in Mega Cities of the World

In a fast urbanising world, there are bound to be grave implications on water use and consumption. These implications become more intense with concentration of large population in smaller areas such as metropolises and megalopolises.

There are 35 megacities; with population of above 10 million, in the world. One representative megacity has been taken from each global region. In cases, where the region had both developed and developing country such as Japan and China, one megacity each has been taken from both. Also in the case of South Asia, one more city has been taken besides Delhi (Case study for the present research work). All over the world, there is a considerable focus on improving efficiency in the water utilities. It is being touted as the solution for all urban water problems including expansion of coverage to include poor households in the fold of tap water. Some of the indicators that have been selected to compare the performance of public water supply scenario in cities are household coverage, per capita water supply and non-revenue water.

Table 2.2: Select Indicators of Water supply in Some Megacities of the World

S.No	Megacity	Percentage households with access to tap water	Per Capita water supply (lpcd)	Non-Revenue Water (Percent)
1	New York, USA	-	475 (data.cityofnewyork.us)	NA
2	London, UK	100 (UNESCO)	164 (Thameswater)	10.8
3	Paris, France	100 (UNESCO)	150 (Mishra, 2013)	10 (UNESCO)
4	Mexico city, Mexico	98 (WWF,2011)	364 (WWF,2011)	>40 (WWF,2011)
5	Sao Paulo, Brazil	-	180 (World Bank, 2012)	25 (World BANK, 2012)
6	Jakarta, Indonesia	-	78 (Asian Green City Index)	50 (Asian Green City Index)
7	Manila, Phillipines	89 (ADB, 2014) East Zone Connections	135 (1998) (Ali, 2001)	11 (ADB, 2014)
8	Megacity	Percentage households with access to tap water	Per Capita water supply (lpcd)	Non-Revenue Water (Percent)
9	Singapore	100 (https://data.gov.sg)	150 (2014) (https://data.gov.sg)	5 (ADB, 2010)
10	Beijing, China	-	410 (water consumption) http://news.xinhuanet.com	20 (www.ewb.org.au)
11	Tokyo, Japan	100 (www.japantimes.co.jp)	268 (Rai et al, 2017)	2.7 (Asian Water, 2012)
12	Istanbul, Turkey	-	186 (http://www.turkstat.gov.tr)	30 World Bank (2010)
13	Cairo, Egypt	96 (Fact Sheet, CESR)	140 (Fact Sheet, CESR)	31 (https://database.ib-net.org)
14	Lagos, Nigeria	88 (African Green City Index)	90.1 (African Green City Index)	30 (African Green City Index)
15	Delhi	82 (Census of India,2011)	241 (CSE, 2011)	53 (2009)
16	Karachi	60 (WWF,2011)	165 (WWF,2011)	25 (WWF,2011)

Source:Sources mentioned alongside data figures

The household coverage in the megacities of the developed countries is cent percent as expected, while the cities of the developing countries lag behind. The figures of the per capita water supply is a surprise with much variation between the cities irrespective of the development status of the countries they are situated in. New York, Beijing and Mexico city show excessively high per capita water supply, all three being from different countries and development status. London, Paris and Singapore have an ideal per capita per day water supply as per international standards with very low non-revenue water. Cities with low per capita per day water supply such as Lagos and Jakarta also have high percentage of non-revenue water.

Be it the developed or the developing countries, across all the cities, the same theme of over exploitation of water resources is pre-dominant with increasing population putting pressure on the city's water resources. As the cities get bigger, they are no longer able to sustain themselves on the basis of the local resources. Cities are going deeper and farther to meet the demands of their population. Along with infringing on other areas' resources, the water treatment and transportation costs are also increasing. New York gets its water from 250 kms away, Paris from 100 kms away, Jakarta from 70 kms away and Beijing gets its water from southern China, thousands of kilometres away. Mexico city is drawing its groundwater too fast leading to subsidence of the city.

Besides the inequality that exists between the countries within the same region, much disparity is also there within a country, specially in a large country like India. The difference is manifested at various levels which all have a bearing on each other. The inequalities that exist in urban public water supply and distribution is discussed in the next section.

2.4 URBAN PUBLIC WATER SUPPLY AND DISTRIBUTION IN THE INDIAN CONTEXT: A STUDY OF INEQUALITY

Urbanisation has been an integral part of India's growth story. India's cities have grown fast not only in terms of population size but also with respect to number. In 1941, before independence, there were 13.86 percent population residing in 2250 towns and cities which shot upto 17.29 percent in 1951 (post independence), due to the influx of refugee migrants from across the border. The rate of urbanisation increased at an increasing rate till 2001 and at a declining rate in the period 2001-2011. The number of urban centres has increased from 2250 in 1941 to 7935 in 2011, an increase of 252 percent. These figures are from Census of India. According to an alternate source such as the World Bank's Agglomeration Index, the share of India's population living in areas with urban like features was 55.3 percent in 2010; a phenomena being termed as hidden urbanisation **(India's Challenge of Disordered Urbanisation, 2016).** One of the striking features of Indian urbanisation is its top heavy structure with the concentration of urban population in a few cities. Much of the population flowing into these cites have settled in squatter settlements or in unauthorised colonies. The development of water supply infrastructure of the Indian cities have not kept pace with the growth, as a result depriving lakhs of people of basic amenities. While the household coverage has suffered because of population growing faster than infrastructure development, water demand has also outpaced supply. Reflecting the global situation, the Indian cities are also going deeper and farther to quench their cities' thirst.

In the previous section, the differences in the coverage levels at the global level was seen, where it was seen that while India is placed poorly with respect to the developed countries and it is in a comparative position in South Asia. Even in urban India, there is much variation, among the states, urban classes and the cities themselves. It could be a function of the level of development, sectoral investments, but nevertheless has implications on millions. Water supply infrastructure for domestic purpose is intrinsically linked to the state of housing. There is an estimated shortage of 1.8 crore houses in India. Around 95.6 percent of the housing shortage is in economically weaker sections/low income group segments **(Economic survey of India, 2015-16)**.At the same time 1.2 crore houses are lying vacant underlying the irony of the situation and also showing that houses are being largely made for the middle class and the rich which even they might not be able to afford.

Although there are many indicators for water supply efficiency and adequacy such as per capita water supply, quality and quantity of water; household coverage still remains the most popular and accepted indicator on a large scale as it usually forms a part of the Census surveys and is easier to enumerate than others. The data for the other indicators is still not easily available. Thus, this section begins with the household coverage levels across major states, urban classes and million plus cities. More detailed information regarding the other indicators is available for the million plus cities, as a result of Ministry of Urban Development's (MoUD) initiative of Service Level Benchmarking exercise, and thus further and probably a more wholesome analysis could be attempted for these cities.

2.4.1 Household Access to Urban Water Supply (Coverage) : A Comparison across States

Level of household access to safe drinking water varies considerably across the states in India. The internationally accepted definition of safe drinking water refers to water from improved water source which include tap water, treated tap water, public standpipe, borewell, protected dug well, protected spring and rainwater collection **(Joint Monitoring Programme, WHO, 2012),** but since Census of India does not collect data related to protected spring and rainwater separately thus, for the present analysis, water from sources such as tap, tubewell, handpump, covered well have been taken. Given the poor ground water quality in several areas in India, this definition is questionable. The access is not influenced only by the development levels but also by the socio-cultural practices. For instance, Kerela, despite its development status, shows a low level of access to safe drinking water as a large number of households depend on uncovered wells for their drinking water supply **(Kundu, 1999).** A comparison of the percentage household access to safe drinking water from 1981 to 2011 has been done in table 2.3 to understand the variation among states and the change in levels of access over the years.

Table 2.3: Household Access to Safe Drinking Water in Select States of Urban India- 1981-2011

S.No	States	Safe Drinking Water (Percent)			
		1981	1991	2001	2011
1	Andhra Pradesh	63.3	73.8	90.16	94.97
2	Bihar	65.4	73.4	91.23	95.49
3	Chhattisgarh	-	-	88.78	94.81
4	Delhi	94.9	96.2	97.75	95.28
5	Gujarat	86.8	87.2	95.40	97.45
6	Haryana	90.7	93.2	97.31	97.10
7	Jharkhand	-	-	68.20	81.07

8	Karnataka	74.4	81.4	92.12	93.24
9	Kerala	39.7	38.7	42.84	54.45
10	Madhya Pradesh	66.6	79.4	88.55	93.41
11	Maharashtra	85.6	90.5	95.36	96.73
12	Odisha	51.3	62.8	72.32	85.06
13	Punjab	91.1	94.2	98.88	99.10
14	Rajasthan	78.6	86.5	93.52	94.79
15	Tamil Nadu	69.4	74.2	85.91	94.51
16	Uttar Pradesh	73.3	85.8	97.16	98.24
17	West Bengal	79.8	86.2	92.29	94.82
18	INDIA	75.1	81.4	90.01	93.04

Source:Kundu (1999); Census of India 2001 and 2011

In 2011, Punjab (99.10 percent), Uttar Pradesh (98.24 percent), Haryana (97.10 percent) fared the best with respect to household access to safe drinking water while Kerala (54.45 percent) fared the worst. In the case of Punjab, tapwater (76.34 percent) is a major source of safe drinking water in the urban areas with only 22 percent of the households depending on handpumps and tubewells. Though, Uttar Pradesh is a close second, tapwater is a source of safe drinking for only 51 percent of the urban households with water from handpump being a source for 37 percent of the urban households. Large parts of Uttar Pradesh are located on the Gangetic belt where the ground water levels are still at depths that can be withdrawn by handpumps. Haryana also shows a pattern similar to Punjab with 77.4 percent of the households relying on tapwater and 19.22 percent of the urban households getting their safe water from handpumps and tubewells. At the other end is Kerala, with only a little more than half of the urban households having access to safe drinking water. Only 34.8 percent of the urban households depend on tapwater for their drinking water, an astonishing 43.85 percent households rely on uncovered wells. Despite this, Kerala has a medium rate of water borne diseases (cholera, typhoid,acute diarrhoeal diseases,viral hepatitis) with reported cases for only 1.1 percent of the total population compared to the highest of 4.8 percent for Andhra Pradesh and the lowest of 0.34 percent for Tamil Nadu **(Ministry of Health and Family Welfare, 2012).** This could be attributed to a long tradition of drinking boiled water in Kerala **(Mishra et al, 2013).**

Table 2.4: Variation among Select States (Urban) in Access to Safe Drinking Water

Year	Coefficient of Variation
1981	20.07
1991	17.73
2001	15.54
2011	11.47

Source: Computed by Author

Note: Excludes Chhattisgarh and Jharkhand

The variation in the household access to safe drinking water, among the states has declined over time. A declining variation could have been a result of either the weaker states catching up with the more developed states or the situation in developed states deteoriating to be at par with the weaker states. In this case, it is a positive sign since the improvement has been higher for the states which had fared poorly in 1981. Notable among these are Odisha, Andhra Pradesh and Bihar which have made substantial improvements.

States not only show variation in the levels of improvement in the total study period of 1981-2011 but also show variation in the census decades in which the highest improvement took place. Figure 2.3 presents the percentage household access to safe drinking water for all the selected states.

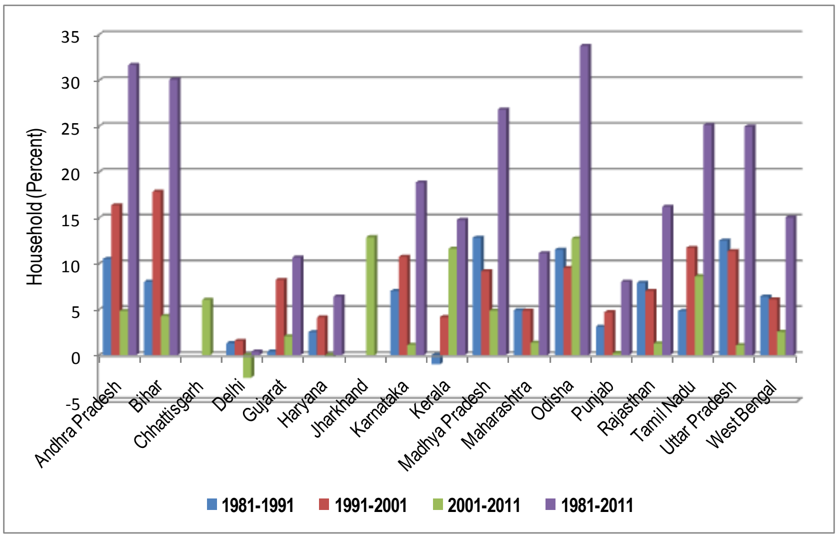


Figure 2.3: Change in Household Access to Safe Drinking Water (Urban) in Major States (1981-2011)

Source: Computed from Kundu (1999); Census of India 2001 and 2011

Odisha (33.76 percent), Andhra Pradesh (31.67 percent), Bihar (30.09 percent) and Madhya Pradesh (26.81 percent) have witnessed the highest improvement in percentage of households with access to safe drinking water in the period 1981-2011. All these states had low levels of household access to safe drinking water in 1981 and have made considerable improvement by 2011. Other than Andhra Pradesh, the states which have improved the most are largely the under developed states.

The states of Madhya Pradesh (12.8 percent), Uttar Pradesh (12.5 percent), West Bengal (6.4 percent), Maharashtra (4.9 percent) and Rajasthan (7.9 percent) witnessed the highest level of improvement in terms of percentage household access to safe drinking water in the period 1981-1991. The Empowered Action Group states seem to have benefited. This period was also the International Drinking Water Supply and Sanitation decade and India as a signatory introduced measures.

In the period, 1991-2001, the highest improvement was seen in Andhra Pradesh (16.36 percent), Bihar (17.83 percent), Gujarat (8.2 percent), Haryana (4.11 percent), Karnataka (10.72 percent) and Tamil Nadu (11.71 percent). Other than Bihar, all the other states are economcally developed states. In the next decade (2001-2011), Kerala (11.61 percent), Odisha (12.74 percent) and Jharkhand (12.87 percent) experienced higher percentage improvement among all the selected states. Although, these states are still not at par with the others, these states were the late bloomers and experienced growth in coverage of safe drinking water after the other states.

While the present sub-section gave a glimpse into the levels of inequality among the states for all the urban centres, the analysis is not enough because as it is known that much inequality exists because of the big city bias in infrastructure funding **(Findley, 1977; Kundu, 2014; Lanjouw, 2010)** Thus, the ensuing section delves into and explores inequality among the urban size classes with respect to access to water and its various components.

2.4.2 Household Access to Urban Water Supply (Coverage): A Comparison across Class Sizes

The major states exhibit different population share in the various urban size classes. The two highly urbanised states of Maharashtra (45.2 percent, 2011) and Gujarat (43 percent, 2011) show a top heavy structure and have the highest share of population in the million plus cities while the less urbanised states of Bihar (11.3 percent) and Chhattisgarh (23.24 percent) have the lowest share of population in their million plus cities. One of the critical fallouts of urbanisation is the deterioration in the availability and access to water and sanitation initially and then improvement, mostly through improved income and Government intervention. But, sometimes government intervention can end up aggravating the differences between the higher order cities and the lower order towns, UIDSSMT being an example **(Khan, 2014).**

Million Plus cities are cities which are at the top of the urban pyramid and while they are few in number, they are home to a large share of the urban population. Class I cities have more than one lakh population. Medium towns in this case are urban centres with population above 20,000 and below one lakh and small towns comprise urban centres having less than 20,000 population.

Table 2.5 : Population Share in Urban Size Classes in Select Indian States (2011)

S.No	States	Class I Cities (Percent)		Medium Town (Percent)	Small Town (Percent)	Total (Percent)
		Million Plus	Rest of the Class I Cities			
1	Andhra Pradesh	17.93	16.89	13.76	51.43	100
2	Bihar	14.32	43.12	37.15	5.40	100
3	Chhattisgarh	13.33	50.45	18.56	17.66	100
4	Gujarat	50.88	21.69	19.59	7.84	100
5	Haryana	16.00	52.06	15.32	16.62	100
6	Jharkhand	28.18	26.37	27.29	18.16	100
7	Karnataka	35.96	31.79	24.32	7.94	100
8	Kerala	-	19.91	62.28	17.81	100
9	Madhya Pradesh	29.53	26.07	18.99	25.40	100
10	Maharashtra	54.64	21.97	17.93	5.46	100
11	Odisha	-	38.69	39.17	22.13	100
12	Punjab	26.79	30.54	30.08	12.59	100
13	Rajasthan	28.61	34.41	28.16	8.83	100

14	Tamil Nadu	19.22	20.40	36.76	23.61	100
15	Uttar Pradesh	28.10	32.99	25.39	13.53	100
16	West Bengal	18.78	43.94	16.35	20.93	100

Source: Census of India, 2011

An analysis of the status of access to water in the major states of India has been undertaken for the year 2011 to understand the differences in the levels of availability of infrastructure among the various sizes of urban centres. The parameters include safe drinking water and treated tap water. From here onwards, instead of access to all sources, access to sources near and within premises have only been studied. The rationale being that water being an indispensable aspect, households will get safe water from any distance possible but that may not necessarily capture the convenience or the efficiency of urban local bodies. While safe drinking water could be a function of the natural and social factors prevailing in the state, access to treated tap water may be considered as an indicator of municipal efficiency. Census of India defines “near premises” as a source of water within 100 m of the household. Near premises has been selected as a criteria to include slum households as most of the slum households have water source outside the premises but within 100 m.

Table 2.6: Household Access to Safe Drinking Water (Within and Near Premises) across Categories of Urban Centres -2011

S.No	States	Class I Cities (Percent)		Medium (Percent)	Small (Percent)	Total (Percent)
		Million	Rest of the Class			
1	Andhra	97.74	94.66	92.50	90.95	94.95
2	Bihar	94.62	91.43	87.57	88.38	90.26
3	Chhattisgar	71.86	69.46	68.69	68.73	69.70
4	Gujarat	96.65	92.13	91.39	89.38	94.12
5	Haryana	86.09	96.12	94.12	91.75	94.96
6	Jharkhand	70.85	77.71	63.07	57.25	68.15
7	Karnataka	92.37	87.90	79.69	72.61	85.49
8	Kerala	-	75.93	46.88	40.16	51.74
9	Madhya	86.70	83.06	81.93	75.14	81.90
10	Maharashtr	95.32	92.37	86.82	83.24	92.59
11	Odisha	-	79.62	64.13	60.99	70.30
12	Punjab	98.60	98.05	97.29	96.18	97.76
13	Rajasthan	92.81	91.53	86.09	84.35	89.72
14	Tamil	96.70	90.31	88.37	87.53	90.10

15	Uttar	94.42	94.75	93.34	89.56	93.63
16	West	91.06	81.42	75.11	70.13	79.74
17	AVERAGE	93.99	88.87	81.48	78.12	87.00

Source: Census of India, 2011

A higher share of households has access to safe drinking water in the higher classes of urban centre hierarchy except in the states of Haryana and Jharkhand. Punjab (98.60 percent), Andhra Pradesh (97.74 percent) and Gujarat (96.65 percent) have the highest percentage of households with access to safe drinking water within and near premises in 2011.The small towns have the lowest share of households with access to safe drinking water. Usually, the amenities improvement plans and programmes are targeted at larger cities as these have higher visibility and also seen as more favourable destinations for investment by business houses. The smaller towns also do not have financially strong urban local bodies and are unable to generate revenues which gets reflected in the weakening infrastructure **(Kundu, 2001).**

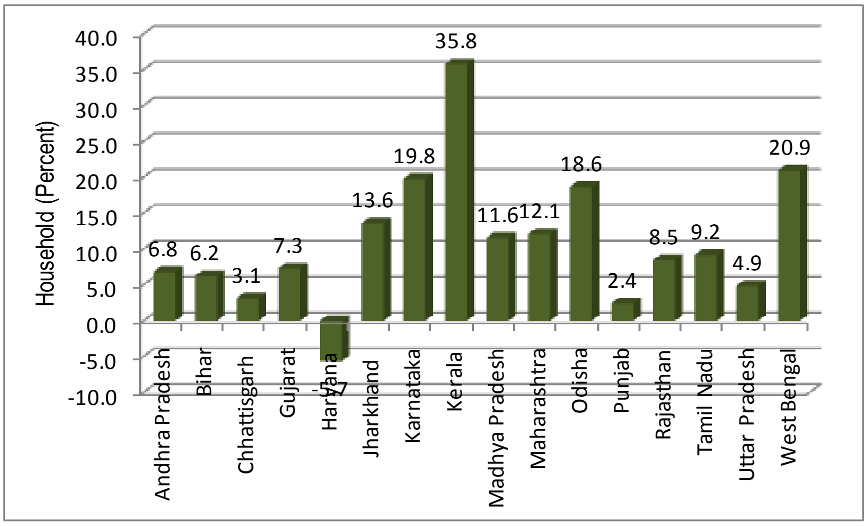


Figure 2.4: Disparity between Highest Order Cities and Small Towns in Household Access to Safe Drinking Water (Near and Within Premises) 2011

Source: Census of India, 2011

Among the states, Kerala (35.8 percent) followed by West Bengal (20.9 percent) and Karnataka (19.8 percent) has the highest difference in household access to safe drinking water between the Highest order cities and small towns while Haryana (-5.7 percent) followed by Punjab (2.4 percent) has the lowest.

The contrast between household access to safe drinking water and tap water from treated source is very stark for some states such as Bihar, Jharkhand, Uttar Pradesh, Haryana and Chhattisgarh. This shows that in these states a large percentage of population depend on other means of safe drinking water such as covered well, hand pump, borewell etc. Sometimes, it may so happen that unless there is demand for treated tap water, the water service providers may continue their lackadaisical approach as the water demand is being met from other sources.

Table 2.7: Household Access to Treated Tap Water (Within and Near premises) across Categories of Urban Centres -2011

S. No	States	Class I Cities (Percent)		Medium Town (Percent)	Small Town (Percent)	Total (Percent)
		Million plus	Rest of the Class I			
1	Andhra Pradesh	87.97	78.89	65.71	64.29	70.82
2	Bihar	47.15	12.58	6.21	4.73	14.59
3	Chhattisgarh	50.43	51.88	29.79	34.77	43.38
4	Gujarat	79.02	63.85	53.26	40.46	67.87
5	Haryana	50.92	74.26	74.29	64.95	72.52
6	Jharkhand	35.97	40.78	22.63	22.87	31.30
7	Karnataka	69.72	74.28	54.07	41.43	60.96
8	Kerala	-	58.72	22.16	14.49	28.42
9	Madhya	58.83	49.32	46.48	34.41	47.80
10	Maharashtra	91.03	81.03	68.71	57.51	83.29
11	Odisha	-	50.42	30.72	23.01	37.81
12	Punjab	75.83	71.21	57.79	45.10	65.50
13	Rajasthan	80.60	76.50	68.34	60.16	73.93
14	Tamil Nadu	82.23	65.50	61.36	53.15	64.08
15	Uttar Pradesh	59.41	43.10	35.18	28.53	43.93
16	West Bengal	78.57	48.88	28.30	16.10	43.96
17	AVERAGE	77.84	60.84	47.95	38.05	58.64

Source: Census of India, 2011

On the whole, the urban centres of Maharashtra (83.29 percent) and Rajasthan (73.93 percent) followed closely by Haryana (72.52 percent) have the highest level of household access to treated tap water while Kerala (28.42 percent) and Bihar (14.59 percent) have the least. Both Rajasthan and Haryana are states which receive moderate rainfall and have over- developed, poor ground water quality. This reiterates the earlier statement and shows that lack of other sources of safe drinking water can attract attention of the Government and force the water service provider to take initiative for supplying treated water to households.

The small towns fare better in states which have higher percentage of households with access to treated tap water in the higher order cities. A positive medium correlation (r= 0.566 at significance level 0.01) was found between percentage household access to treated tap water in the highest order cities of a state and the lowest order urban centres. The small towns of developed states also seem to fare better than the small towns of the under developed states.

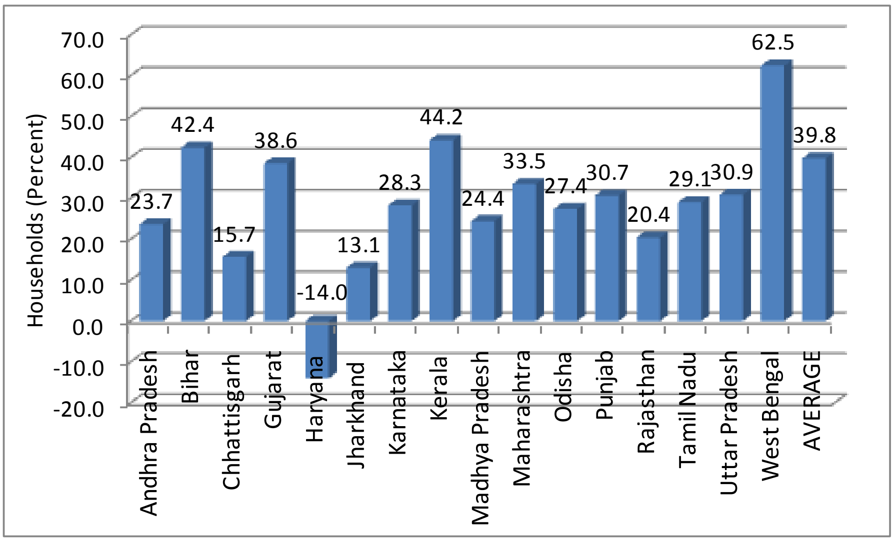


Figure 2.5: Disparity between Highest Order Cities and Small Towns in Household Access to Treated Tap Water (Near and Within Premises) 2011

Source: Computed from Census of India, 2011

The disparity in the percentage of households with access to treated tap water is the highest in the states of West Bengal (62.5 percent), Kerala (44.2 percent) and Bihar (42.4 percent). As seen earlier, small towns of the developed states perform better than the small towns of the under developed states with respect to percentage household access to treated tap water, but this is marred by the high disparity between the highest order cities and small towns. The smaller municipalities have not been able to keep pace with the water utilities of big cities. In an anomalous situation, the small towns of Haryana fare better than its million plus city, Faridabad.

To assess the variation in the level of access of households to the selected water indicators, standard deviation was calculated and t-test was applied at 95 percent significance level. All were found to be of statistical significance at that level.

Table 2.8: Variation (Coefficient of Variation) of Various Water indicators -2011

Indicator	**Million Plus Cities**	**Class I Cities**	**Medium Towns**	**Small Towns**
HH access to Safe drinking water (Within and Near Premises)	9.82	9.57	17.28	19.75
HH access to treated tap water (Within and Near Premises)	25.27	30.86	45.27	49.59

Source: Computed by Author from Census of India, 2011

The result of the variation analysis reveals a very interesting trend. The variation among states is highest among the small towns for both household access to safe drinking water (within and near premises) and household access to treated tapwater (within and near premises), but the level of variation is much higher for small towns with respect to the finer indicator of household access to treated tap water representing municipal efficiency. The small towns of the less developed states have much lower levels of household access as compared to the developed states. West Bengal and Rajasthan are aberrations but again can be explained through the easy availability of well water in West Bengal and the Government interventions in Rajasthan.

2.4.3 Sources, Coverage and Availability of Urban Water Supply: Million Plus Cities of India

The rise of the million plus cities in India is commensurate with the situation in the world. Worldwide, there were 75 million plus cities in 1950 with 23.7 percent of the total urban population which increased to 456 in 2011 with 39 percent of the total urban population (World Urbanisation Prospect, 2011). The growth of million plus cities has been the fastest in the developing countries.Among the regions, Latin America and the Caribbean, Africa and Asia have registered the highest growth in not only the number of million plus cities in the period 1950-2011 but also the percentage of population residing in the million plus cities. In Africa, number of million plus cities increased from 2 in 1950 to 51 in 2011 with the share of urban population residing in million plus cities increasing from 10.7 percent to 33.9 percent (+23.2 percent) in the same period. In Asia and Latin America and the Carribean, the number of milion plus cities increased from 26 to 231 and 8 to 63 from 1951 to 2011 respectively. For the same period, the share of urban population residing in million plus cities increased from 22.8 percent to 40.3 percent (+17.5 percent) in Asia and 26 percent to 44 percent (+18 percent) in Latin America and the Caribbean. On the other hand, in Europe, the number of million plus cities increased from 23 to 53 (1950-2011) and the share of urban population in million plus cities increased from 19.8 percent to 23.1 percent (+3.3 percent) in the same period.

In India, million plus cities have increased from five in 1950 to to 35 million plus cities in 2001 and to 53 in 2011. Nearly 42.5 percent of the urban population live in million plus cities in 2011 as compared to 37.6 percent in 2001.

2.4.3.1 Growth of Million Plus Cities

The million plus cities have grown at various rates in the period 2001-2011. Not only the growth rates, but the population itself varies tremendously among the cities. The largest city (Greater Mumbai) has nearly 18 times more population than the smallest city (Kota). Malappuram UA has grown at the highest rate (AAGR) of 0.259 percent followed by Thrissur (0.188 percent) and Vasai Virar (0.153 percent) in 2001-2011. On the other hand, Kolkata’s population has grown the slowest in the same period (0.007 percent) (Appendix 2.1)

2.4.3.2 Access to Water in Million Plus Cities

There is a large variation between the million plus cities with respect to access to water. Household coverage along with other parameters such as water availability, reliability and source were taken into account for the analysis on access to water in million plus cities.

2.4.3.2.1 Household Coverage

For 2011, percentage household access to treated tap water within and near premises has been analysed to understand the variation among the cities.Cities have been categorised on the basis of percentage share of households with availability of tap water within and near the premises for 2001 and 2011 to facilitate a comparison. For both 2001 and 2011, 53 million plus cities as enumerated in 2011 by Census of India have been taken for the analysis. The city wise data for both percentage household access to taps is given in Appendix 2.2.

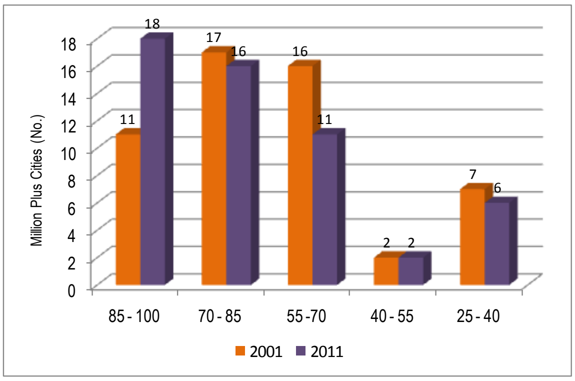
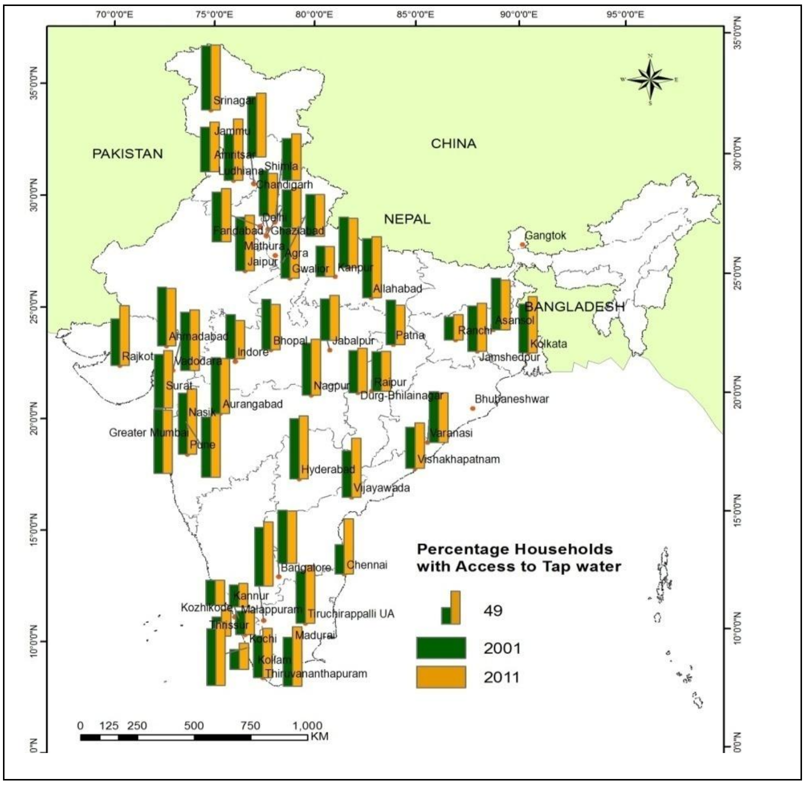


Figure 2.6: Household Access to Tap water (Within and Near) in Million Plus Cities : 2001 and 2011

Source: Census of India, 2001 and 2011

In 2001, more than 85 percent of the households had access to tap water in 11 cities which increased to 18 cities in 2011. Although this is an improvement over the past decade, but it also shows that in only 33.9 percent of the million plus cities, more than 85 percent of the households have access to tap water in 2011 which was higher than the percentage (20.7 percent) in 2001. The variation in both the decades has remained similar with the standard deviation for 2001 being 18.17 and 18.44 in 2011.

With respect to change in terms of percentage household access to tap water (2001-2011), while majority of the cities have improved, the coverage in some cities such as Indore (-8.69 percent), Bhopal (-7.20 percent), Patna (-7.59 percent), Ghaziabad (-4.74 percent), Gwalior (-4.24 percent), Kota (-2.99 percent), Asansol (-2.50 percent), Lucknow (-1.82 percent), Ahmadabad (-1.75 percent), Varanasi (-1.54 percent), Aurangabad (-1.19 percent), Greater Mumbai (-1.12 percent), Bangalore (-1.10 percent), Vasai Virar (-0.89 percent), Kannur (-0.33 percent), Thrissur (-0.29 percent), Agra (-0.28 percent) and Kanpur (-0.18 percent) has actually deteriorated. (Refer map 2.1)



Map 2.1: Variation in the Improvement in Percentage Household Access to Tap Water (Within and Near)- 2001 and 2011

Source: Census of India, 2001 and 2011

2.4.3.2.2 Source, Water Quantity and Reliablity

The previous section delved into the coverage and access aspect of safe drinking water and its various components. Adequate coverage does not imply good service. Certain trends and aspects related to water supply have been explored in this section.

a) Water Source : Dependence on Surface and Ground Water

Cities are dependent on both surface water and ground water sources. In a study by NIUA (2005), among the 22 million plus cities, 12 of the cities depended entirely on the surface water sources while only one (Ludhiana) depended solely on ground water sources. The rest nine cities sources their formal piped water from both surface and ground water. The result drawn from the findings pointed to the increasing dependence on groundwater with decline in size of urban centre.

Distance to Surface Water Source

Along with a change in the source of water supply, the distance to the surface water source has also undergone much change in the past two decades. There is a growing trend of the source being located farther away from the city. The distance has increased manifold for many of the million plus cities. An increase in distance also means higher transportation costs and higher chances of wastage. A comparison (1999 and 2015) for the distance to the surface water source for some of the cities is given in table 2.9. Although, 100 percent of the water is not brought from these sources, but a large amount is. There is also a shift from the use of open/bore wells to dams on rivers far away due to depleting ground water reserves.

Table 2.9: Distance of Source to Surface Water from Cities- 1999 and 2015

S.No	City	1999 (km)	2011 (km)
1	Delhi	26	250* (Tehri dam)
2	Greater Mumbai	29 to 119	29 to 119
3	Hyderabad	15 to 18	160*
4	Jaipur	25	150 (Bisalpur dam)
5	Nagpur	5 to 46	70 (Pench Dam)
6	Vishakhapatnam	15 to 73	150 (Yeleru Reservoir)

*Source:CPHEEO,2005, *Chaturvedi(2012)*

b) Per Capita Water Availability

Domestic water consumption depends on many factors such as climate, water availability, level of development, lifestyle habits etc. Not only does it vary among countries, it differs among cities and within cities as well. Many a times, there is a gap between the consumption levels and the supply levels with the former being higher. In such cases, water is usually supplemented from other informal sources. In India, there are several norms and standards for water supply which have been proposed from time to time. For instance, according to Bureau of Indian Standards (BIS), cities with sewerage network need to be supplied with a minimum of 200 litres per capita per day of water supply. Central Public Health and Environmental Engineering Organisation (CPHEEO) manual (1999) prescribes 70 litres per capita per day(lpcd) for towns with piped water supply but without sewerage system, 135 lpcd for towns with piped water supply and sewerage system, 150 lpcd for metropolitan and megacities with piped water supply and sewerage and 40 lpcd for public standposts. According to the Manual on Water Supply and Urban Development, GoI (1991), small cities should be supplied with 70-100 lpcd of water while large cities should get 150-200 lpcd. Besides, these every state has its own norm and standard for supplying water.

The data for per capita per day availablity of water could be found for only 48 million plus cities. Among the metropolitan cities, Kannur (7 lpcd) has one of the lowest per capita water supply while Delhi (222 lpcd) has one of the highest. There is a great amount of variation among the metropolitan cities with respect to per capita per day water supply. Since 135 lpcd is the lowest and 200 lpcd is the highest standard for large cities, 135-200 lpcd range has been taken as the indicator to gauge the adequacy.

Table 2.10: Per Capita Per Day Water Supply in Million Plus Cities of India (2010-11)

Per Capita per Day Water Supply	**Less than 135 LPCD**	**More than 135 lpcd and Less than 150 LPCD**	**More than 150 lpcd and Less than 200 LPCD**	**More than 200 lpcd**
No. of Million Plus Cities	33 (Hyderabad, Vishakhapatnam, Agra, Allahabad, Kanpur, Meerut, Varanasi, Patna, Asansol, Kolkata, Rajkot, Bangalore, Kochi, Bhopal, Indore, Jabalpur,Jaipur, Chennai, Coimbatore, Madurai, Kozhikode, thrissur, Malappuram, Kannur, Vasai Virar city, Aurangabad, Ranchi, Raipur, Kollam, Gwalior, Durg-Bhilai Nagar, Ghaziabad, Srinagar)	7 (Vijaywada, Surat, Greater Mumbai, Nagpur, Nashik, Jodhpur, Kota)	6 (Faridabad, Lucknow, Ahmedabad, Pune, Thiruvananthapuram, Chandigarh)	2 (Delhi, Jamshedpur)

Source: SLB Data Book, 2011

Unfortunately, nearly 68.75 percent of the cities were found to have water supply below the minimum prescribed 135 lpcd. Faridabad, Lucknow, Ahmedabad, Pune, Thiruvananthapuram and Chandigarh, all from different states and agro-climatic regions have an above average per capita per day water supply levels. Delhi being the capital of India is the privleged of the cities and has the highest average per capita per day water supply, although there is much ineaquality in distribution within the city. This shall be further discussed in chapter four. Jamshedpur has been under a private operator , now JUSCO, since its inception and has one of the better management practices in India **(ADB, 2012).**

A positive medium correlation (r=0.551 statistical significance at 0.01 level) was found between per capita per day water supply and percentage household coverage using Pearson's Correlation Coefficient.

c) Continuity and Reliabiity of Water Supply: Duration and Frequency

Duration and frequency of water supply is dismal in the Indian cities, million plus cities included. Data on average duration in terms of hours is available in the public domain but such data on frequency of water supply is not available, thus the analysis is limited to duration of water supply.

Among the million plus cities, Thiruvananthapuram and Kochi have the highest number of hours of water supply (18 hours) which is very good considering that the average is 4.5 hours per day (excluding Thiruvananthapuram and Kochi). The figures are an average for the cities, intra city variation exists. Data was available for 44 cities.

Table 2.11: Duration of Water Supply in Million Plus Cities of India (2010-11)

Duration of water supply	**Less than 2 hours per day**	**2-6 hours**	**6-10 hours**	**More than 10 hours**
Cities N=44	9 (Indore, Hyderabad, Vishakhapatnam, Asansol, Jaipur, Jodhpur , Rajkot, Chennai, Vadodara)	20 (Vijaywada, Agra, Lucknow, Ahmedabad, Surat, Greater Mumbai, Nashik, Bhopal Pune, Bangalore,	8 (Faridabad, Kanpur, Meerut, Patna, Kolkata, Kozhikode, Malappuram, Jamshedpur)	7 (Allahabad Varanasi, Nagpur, Kochi, Amritsar, Thiruvananthapuram, Chandigarh)

		Jabalpur, Coimbatore, Madurai, Thrissur, Kannur, Ranchi, Kollam, Ghaziabad, Kota, , Vasai Virar)		

Source: SLB Data Book, 2011

The highest percentage (45.45 percent) of the cities get two to six hours of daily water supply on an average. Nearly 20.45 percent of the cities get water for less than two hours a day. These mainly comprise cities which are either located in water scarce regions such as Indore, Jaipur, Jodhpur,Hyderabad and Rajkot or have fresh water scarcity such as Chennai. About 15.9 percent of the cities get water for more than 10 hours a day, which in the Indian situation is very good, but still well below 24 hours.

Besides the absence of continuous water supply, there is unreliable water supply as well with the supply duration and volume varying with seasonal changes or sometimes getting affected by political protests. The summer months are typically very harsh when the water levels go down and at the same time demand rises. Most cities reduce the duration of their supply timings or the pressure to cope with the shortage. Political protests have also disturbed the water transmission in the recent past with the Jat protests over reservation issues being a prime example. Water supply to Delhi got disrupted during the protests. **(Indian Express, 16 February 2016)** Larger distances of water transportation also mean water supply being more vulnerable to external factors.

d) Ranking of Cities (Composite Index)

An attempt was made to understand the composite status of the cities by using z score. Data for all the three indicators (Household access to tap water from treated source, Amount of water available, duration of water supply) was available for only 42 cities, thus the analysis includes only those cities. Kochi fared the best while Thrissur was the worst in terms of these indicators. Refer Appendix 2.3 for details on the variables.

Table 2.12: Rank of Cities: Water Supply Status on the Basis of Composite Index

Rank	City	Rank	City	Rank	City
1	Kochi	15	Jodhpur	29	Chennai
2	Thiruvananthapuram	16	Kota	30	Vasai Virar City
3	Chandigarh	17	Surat	31	Jabalpur
4	Pune	18	Lucknow	32	Agra
5	Nagpur	19	Ahmadabad	33	Patna
6	Allahabad	20	Hyderabad	34	Kozhikode
7	Jamshedpur	21	Madurai	35	Asansol
8	Kolkata	22	Rajkot	36	Malappuram
9	Nashik	23	Meerut	37	Kanpur
10	Vijaywada	24	Bangalore	38	Ranchi
Rank	City	Rank	City	Rank	City
11	Greater Mumbai	25	Jaipur	39	Kollam
12	Faridabad	26	Bhopal	40	Indore
13	Varanasi	27	Ghaziabad	41	Kannur
14	Coimbatore	28	Vishakapatnam	42	Thrissur

Source:Computed from data collected from SLB Data Book, 2011; Census of India, 2011

The paradox of the Indian urban water story is captured in table 2.12. The best two cities are from Kerala and the worst two cities are also from Kerala. Further, the water utility is the same for both, Kerala Water Authority. Other than Thrissur, the rest three are coastal cities. Thrissur and Kannur are new cities in the million plus category. While other parameters are comparable for all the cities, Thrissur and Kannur have poorer coverage levels and per capita per day water supply. These two cities, though million plus cities, are much behind Thiruvananthapuram and Kochi in terms of general infrastructure. Thrissur, till 2005, did not even have a sewerage network **(ADB, 2005).**

2.4.4 Inequality in Access to Water in Urban Areas: A Study across Income Groups and Settlement Categories

Variation, skewed in favour of the developed states and larger cities, in household access to water amenities has been seen in the earlier sections. This section focusses on the variation in access to water amenities and related aspects among income groups in urban areas and seeks to understand the levels of disparity between the income classes. Monthly per Capita Expenditure (MPCE) is taken as the proxy for income. Data from National Sample Survey (NSS), 69th round (2012) relevant to water supply has been analysed to understand the income inequality in access to water and its related aspects in urban areas.

2.4.4.1 Access to Drinking Water

Three indicators have been taken to assess the scenario of access to drinking water across income groups; improved source of drinking, principle source of drinking water and nature of access to principal source of drinking water. Improved water source, as an indicator, was introduced in NSS as an intiative of WHO/UNICEF JMP for water supply and sanitation.

a) Improved Source of Drinking Water

As per NSS definition, improved sources of water comprise bottled water, piped water into dwelling, piped water to yard/plot, public tap/standpipe, tubewell/borewell, protected well, protected spring and rain water collection.

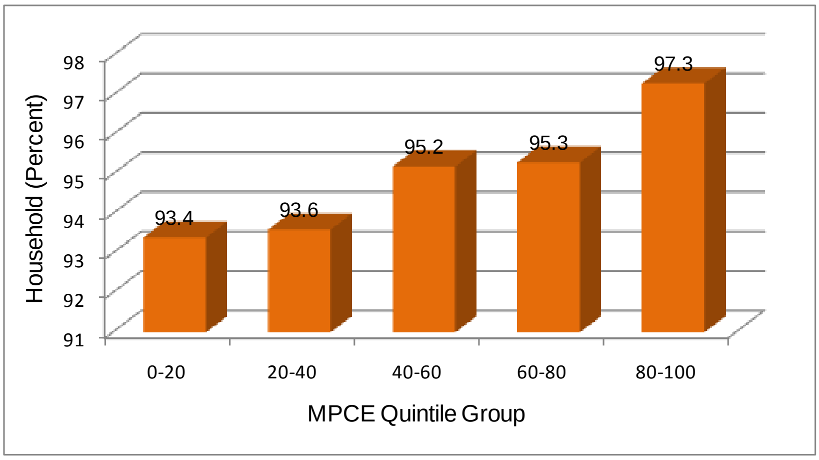


Figure 2.7: Distribution by MPCE of Access to Improved Source of Drinking Water in Urban areas – 2012

Source: NSS Report No.556, 69th Round, July 2012-December 2012

The overall difference between the income groups is not much, that is primarily due to the indicator being improved source of drinking water. The difference is much higher when access to tap water is taken into account.

b) Principal Source of Drinking Water (Improved Sources) in Urban Areas

Principal source of water is the source from where the households get their water for more number of days in the 365 days time frame (NSS). Among the improved sources,household access to piped water is the most common among the highest MPCE class, 48 percent for piped water into dwelling and 19 percent for piped water to plot compared to only 14 percent households getting piped water to dwelling and 14 percent to plot in the lowest MPCE quintile class. The lowest quintile class also largely depends on tubewell/borewell water (44 percent), the highest among all the classes. The usage of bottled water (9 percent) is the highest among the highest MPCE quintile class. Interestingly, the highest MPCE quintile group also has the highest use of bottled water. This could be more of perception related to the purity of water as this group usually uses water purifier for making the water potable i.e clean and bacteria free. Use of public taps/standposts is the highest among the lowest MPCE quintile group largely because most of them live in slums or squatter settlements where household taps are stll a luxury.

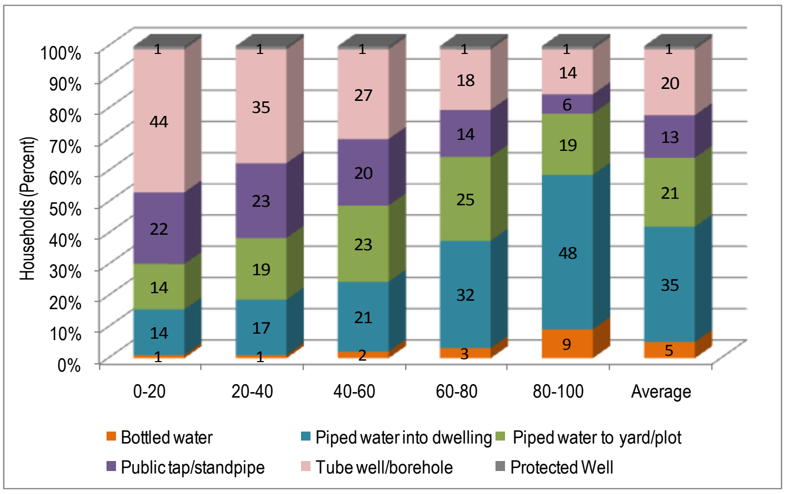


Figure 2.8: Distribution by MPCE of Principal Source of Drinking water (Improved sources) in Urban areas – 2012

Source: Computed by Author, 69th Round, July 2012-December 2012

c) Supplementary Source of Drinking water in Urban Areas

If a household, during the last 365 days, obtained drinking water from more than one source, then the one most commonly used was treated as the principal source and the next one (in terms of frequency of use) was treated as the supplementary source (NSS)

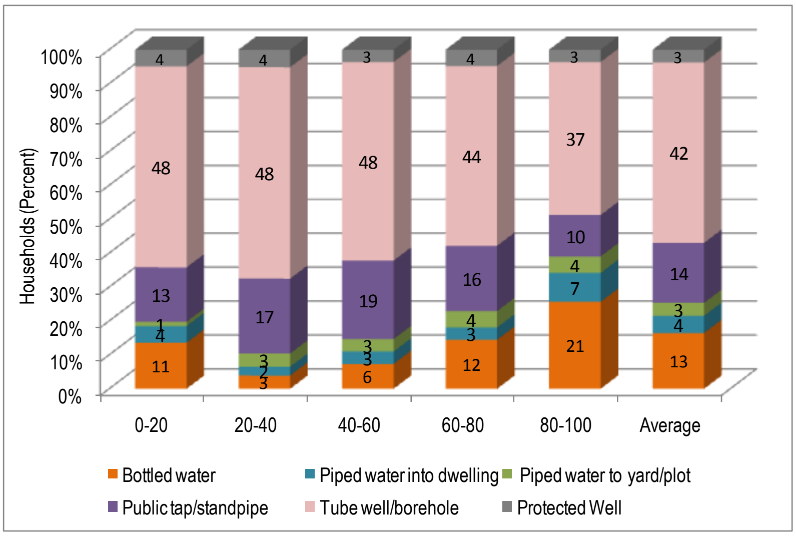


Figure 2.9: Distribution by MPCE of Supplementary Source of Drinking water (Improved sources) in Urban areas – 2012

Source: Computed by Author, 69th Round, July 2012-December 2012

It is evident from figure 2.9 that the dependence on the supplementary source of water varies considerably among the MPCE quintile classes. Use of tubewell/borewell water is more prevalent among the lower quintile classes than the others with 48 percent of the households in the lowest three classes compared to 37 percent of the highest MPCE quintile class depending on tubewell/borewell water as supplementary source. Among the highest MPCE quintile class, bottled water (21 percent) is a major supplementary source of drinking water. This would not be surprising as bottled water has emerged as a symbol of purity irrespective of its actual quality and is also costlier than other sources of water.

d) Nature of Access to Principal Source of Drinking water in Urban Areas

In addition to the above two aspects, the nature of access determines the ease or difficulty of access to drinking water. It also determines the effort and the time a household puts in to meet a basic need.Household's exclusive use is the best scenario.

Table 2.13: Distribution of Percentage Households by MPCE of Nature of Access to Principal Source of Drinking water in Urban areas - 2012

MPCE Quintile Class	Household's exclusive use (percent)	Common use of households in the building (percent)	Neighbour's source (percent)	Public Source (percent)	Private source (percent)	Others (percent)	Total (percent)
0-20	31.79	18.70	3.55	42.98	1.01	1.97	100
20-40	30.40	24.01	4.48	36.08	1.71	3.32	100
40-60	37.60	24.06	3.37	28.95	1.63	4.39	100
60-80	44.69	27.25	2.39	18.58	1.52	5.57	100
80-100	55.95	25.24	0.62	7.79	0.51	9.89	100
Average	46.78	25.32	1.99	17.90	1.10	6.92	100

Source: Computed by Author,NSS, 69th Round, July 2012-December 2012

The inequality among the MPCE quintile classes regarding the nature of access to principal source of drinking water is very evident from table 2.13. The lower quintile classes depend largely on public or shared sources which again has implications on the efforts and time, they have to put in to procure water. It also means that they are sharing resources and thus may not get adequate water to meet their needs. Percentage household's exclusive use is the least in the lower MPCE quintile classes; 31.79 percent and 30.40 percent in 0-20 and 20-40 MPCE quintile class respectively compared to 55.95 percent in the highest MPCE quintile class. A higher percentage of the lowest MPCE quintile class (3.55 percent) depends on neighbour's source as compared to the higher MPCE quintile class (0.62 percent).

2.4.4.2 Distance to Drinking Water Source

Distance to drinking water source is an important indicator as it captures the time and the effort households put into accessing a basic need. A higher distance to a public tap also increases the substitution effect and households tend to use an unimproved source closer to their residence, thus increasing chances of diseases **(Boone, 2011).** It is often that female members of the household are involved in fetching water, they are also involved in other household activities. A higher distance to the source leaves with less time for other activities and is also detrimental for their health.

Table 2.14: Distribution by MPCE of Distance to Drinking Water Source in Urban areas - 2012

MPCE	Within Dwelling (percent)	Within Premises, Outside Dwelling (percent)	Outside Premises		Total (percent)
			Less than 0.2 km (percent)	More than 0.2 km (percent)	
0 - 20	23.9	27.6	41.2	7.20	100
20- 40	24.5	32.2	36.6	6.73	100
40 -60	29.9	34.6	30.0	5.47	100
60 -80	40.9	35.1	18.9	5.01	100
80 -100	62.0	27.4	8.4	2.22	100
Average	46.3	31.2	18.4	4.11	100

Computed by Author,NSS, 69th Round, July 2012-December 2012

In 2012, percentage of households with access to drinking water source within dwelling was the highest (62 percent) in the 80-100 MPCE quintile group and the lowest in the 0-20 MPCE quintile group (23.9 percent). The share of households with the source of drinking water outside premises is the highest in the lowest MPCE quintile group (48.20 percent) and it declines drasticaly with increase in MPCE quintile class.

2.4.4.3 Frequency of Water Supply

This indicator includes both potable and non-potable water. As discussed earlier, 24x7 water supply is considered the best frequency, both from the engineering and ease of access perspective.

Table 2.15: Distribution by MPCE of Frequency of Supply of Water in Urban Areas- 2012

MPCE Quintile Group	Daily (percent)	Once in two days (percent)	Once in three days (percent)	Once in a week (percent)	Others (percent)	Total (percent)
0 – 20	75.34	17.33	2.63	3.37	1.33	100
20- 40	77.22	14.38	4.32	3.02	1.06	100
40 -60	70.41	17.44	5.57	5.70	0.88	100
60 -80	72.33	17.54	4.93	3.88	1.33	100

80 -100	78.36	14.43	3.98	2.46	0.78	100
Average	75.24	15.89	4.47	3.40	1.00	100

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

Overall, 75.24 percent of the urban households in India receive water daily. In this case, least percentage of households in the 40-60 MPCE quintile group (70.41 percent) and 60-80 MPCE quintile group (72.33 percent) receive water daily. These two groups also seem to be the most disadvantaged, with higher percentage of households in these two groups receiving water once in a week. Frequency of water supply is a supplier driven aspect and thus greatly depends on the efficiency of the water utility which greatly differs among the Indian cities, both within the same class size and across class sizes.

2.4.4.4 Quality of Drinking Water

Quality of drinking water has been assessed on the basis of perception by NSSO. This is an interesting survey finding. Despite the not-so-good quality of water supply in urban areas of India, the general perception is that of water having no defect.

Table 2.16: Distribution by MPCE of Quality of Drinking Water in Urban areas - 2012

MPCE	Bad in taste (percent)	Bad in smell (percent)	Bad in taste and smell (percent)	Bad due to other reasons (percent)	No defect (percent)	Total (percent)
0 - 20	2.18	1.07	2.05	5.14	89.56	100
20- 40	4.82	1.21	2.42	5.01	86.54	100
40 -60	2.86	1.17	2.35	4.88	88.75	100
60 -80	3.24	1.27	2.96	4.80	87.73	100
80 -100	2.96	0.95	2.91	4.78	88.41	100
Average	3.16	1.10	2.77	4.83	88.14	100

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

Around 88.41 percent of households in the 80-100 MPCE quintile group reported that there was no defect in the water they were using, while a higher percentage (89.9 percent) of households in the lowest quintile reported water to have no defects. The variation in indicators among the quintile groups is too less for any meaningful analysis.

2.4.4.5 Sufficiency of Water and Drinking Water

Perceived sufficiency of water has been assessed for both potable and general water supply according to the MPCE quintile groups. Figure 2.10 shows the percentage households in each MPCE quintile group with access to sufficient water.

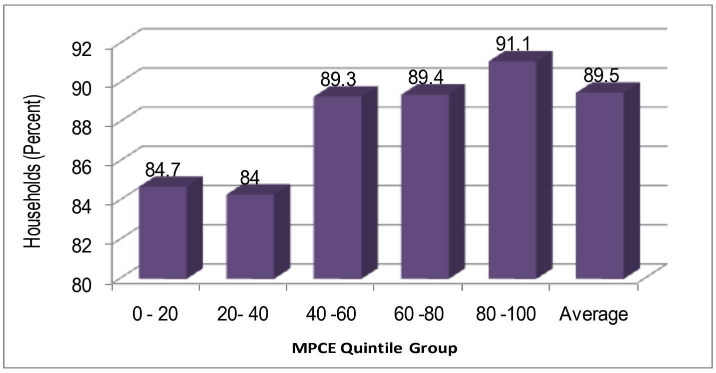


Figure 2.10: Perceived Sufficiency of Water- 2012

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

The perceived sufficiency is much higher among the highest MPCE quintile group with 91.1 percent of the households in this particular group reporting sufficiency of water compared to 84.7 percent in the lowest MPCE quintile group.

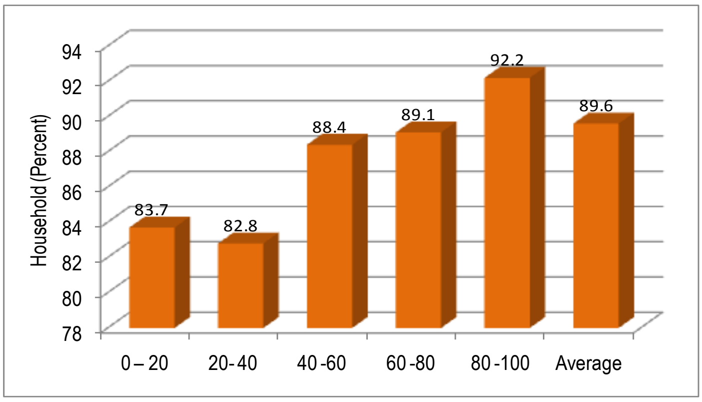


Figure 2.11: Perceived Sufficiency of Drinking Water- 2012

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

Highest percentage of households in the 80-100 quintile group (92.2 percent) reported availability of drinking water to be sufficient. The perceived sufficiency levels were lower among the lowest two quintiles. Drinking water is more difficult to get as it has to conform to certain official standards and households also consider water to be of drinking quality if it conforms to their perception of purity.

2.4.4.6 Time to Fetch Water

Time to fetch water is largely dependent on the distance and the waiting time for water. While the distance might not be a constraint in urban areas as compared to rural areas, the waiting time can be high with larger population densities in urban areas. In India, the sources within 500 metres in rural areas and sources within 100 metres in urban areas are considered to be near (Census of India). In India, 86.8 percent of urban households have access to improved water sources within and near premises which also implies that 13.2 percent or 49 lakh households have to travel more than 100 metres to get water for their daily use.

The time burden of fetching water influences the volume of water collected and has repurcussions on hygeine, income generating activities and child care **(Pickering et al, 2012).** As per WHO guidelines, if more than 30 minutes is required to fetch drinking water, it is considered inaccessible.

Table 2.17: Distribution by MPCE of Average time to fetch and wait for water from outside the premises in Urban Areas – 2012

	Less than 5 mins		**6-15 mins**		**16 to 30 mins**		**31 to 45 mins**		**More than 46 mins**	
MPCE Quintile	Average time to fetch (% HH)	Waiting time (% HH)	Average time to fetch (% HH)	Waiting time (% HH)	Average time to fetch (% HH)	Waiting time (% HH)	Average time to fetch (% HH)	Waiting time (% HH)	Average time to fetch (% HH)	Waiting time (% HH)
0 – 20	17.90	19.44	48.12	41.68	32.59	29.68	11.14	5.62	8.16	3.58
20- 40	29.72	21.39	51.61	37.11	32.81	29.70	6.96	7.31	8.62	4.48
40 -60	29.67	21.04	64.67	40.32	24.41	29.46	6.06	5.71	4.86	3.46
60 -80	38.49	24.65	61.86	43.80	29.21	23.62	5.92	4.45	3.01	3.48
80 -100	63.49	33.45	70.66	43.35	22.15	18.96	2.89	3.19	4.30	1.04
Average	36.41	24.40	60.61	41.59	27.97	25.69	6.22	5.11	5.19	3.21

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

There is a stark difference between the MPCE quintile groups with respect to average time to fetch water and the waiting time. The average time to fetch water (11.14 percent) and the waiting time (5.62 percent) is much more for the lowest MPCE quintile group as compared to the highest. This is largely because the lowest quintile class households depend on sources outside their premises which are also shared by other households as seen in table 2.17.

2.4.4.7 Treatment Methods for Water

Considering that the quality of water supplied or otherwise is not of potable quality in most urban areas, treatment assumes an important role in ensuring public health. Choice of method of water treatment not only depends on the actual quality of water but also on the perception of the households on what can be called clean, potable water. The perception may be influenced by factors such as education, income etc.

Table 2.18 : Distribution by MPCE of Treatment Methods for Water

MPCE Quintile	Treatment of Water						No Treatment of Water (% HH)	Total
	Electronic Purifier (% HH)	Boiling (% HH)	Chemical treatment (alum and chlorine) (% HH)	Filter (Water Filter) (% HH)	Filter (Cloth) (% HH)	Others (% HH)		
0-20	1.94	3.30	1.04	5.11	18.58	2.86	67.17	100
20-40	1.46	6.66	1.55	3.36	21.15	3.42	62.40	100
40-60	1.76	8.73	1.36	5.49	22.23	3.25	57.19	100
60-80	5.72	11.86	1.63	9.20	19.55	3.14	48.85	100
80-100	26.34	13.54	0.92	12.50	11.27	1.36	34.07	100
Average	13.48	11.35	1.26	9.43	16.48	2.40	45.59	100

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

Nearly 67.17 percent of the lowest quintile group do not treat water as compared to 34.07 percent of the highest income quintile households not treating water. The lowest quintile might be getting water of worse quality than the households of the highest quintile yet a higher percentage of the households in the former do not treat water reiterating the influence of other factors on treatment behaviour. Boiling (13.54 percent) and electronic purifier (26.34 percent) are the most popular choices for treatment among the highest income group while cloth filter (18.58 percent) is more popular among the lowest quintile. This could be because of two factors, affordability and the lack of awareness of the presence of disease causing germs in water.

2.4.4.8 Distribution by Metered Water Connections and Water Charges

There has been a move towards metered water connections in the urban areas to facilitate full cost recovery post JNNURM.

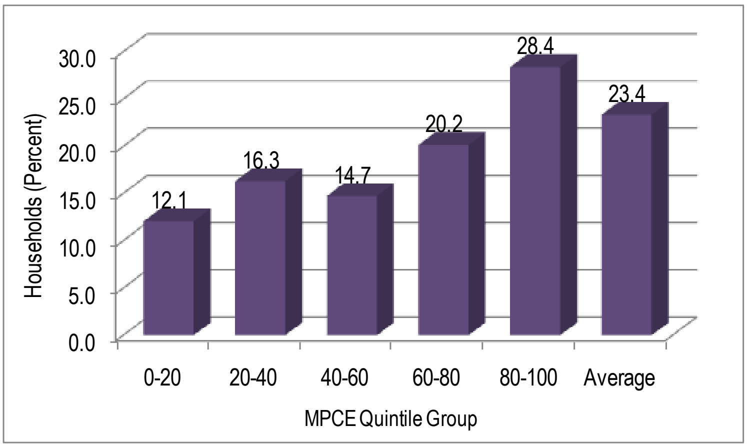


Figure 2.12:Distribution by MPCE of Metered Connections in Urban Areas – 2012

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

Metered water connections are still not very prevalent in the urban areas with only 23.4 percent of the urban households being connected to meters. A higher percentage (28.4 percent) of households in the highest quintile are connected to meters as compared to the households in the lowest quintile (12.1 percent). This could be attributed to a higher percentage of households in the highest quintile group being connected to piped water supply provided by the public utility.

Municipal water is chargeable in most cities and towns, although the criteria varies considerably. Also the charges might not be sufficient for meeting even the O&M costs.

Table 2.19: Distribution by Amount of Water Charges Paid per Month in Urban Areas - 2012

MPCE	Not required to pay (Percent)	Average Amount paid per month (Rs.)	
		Full information is available	Partial Information is Available
0-20	64.5	86	98
20-40	52.7	103	130
40-60	46.2	112	123
60-80	40.0	125	134
80-100	34.2	159	194
Average	45.7	125	147

Source:Computed by Author,NSS, 69th Round, July 2012-December 2012

A higher percentage of households in the 0-20 MPCE quintile group (64.5 percent) are not required to pay as compared to the households in the 80-100 MPCE quintile group (34.2 percent). Out of those who pay, households in the highest MPCE quintile group also pay a higher average amount per month as water charges.

After the analysis for MPCE quintiles, an attempt has been made to study the access to tapwater in slums.

2.4.5 Access to Water Supply : A case of Slums in India (2011)

About 137 lakh population (17.4 percent of the urban population) resides in slums (Census of India, 2011). Access of slum dwellers' to drinking water, sanitation and other basic necessities of life has always been a challenge for planners and policy makers.Although, previously several surveys and studies have been attempted to capture the dismal situation in slums including the NSS surveys, they have all been sample surveys. In 2011, Census of India for the first time enumerated the slum population along with capturing availability of basic amenities in all statutory towns of India. The survey has revealed some very startling facts regarding water supply which is contrary to the popular assumption as well. Nearly 70 percent of the non-slum population has access to tap drinking water while the figure is 74 percent for the slum population **(Satapathy, 2014).** This scenario changes when tap water at home is considered; higher percentage of non- slum households have access to tap water at home **(Satapathy, 2014).**

2.4.5.1 Household Access to Water and Sanitation in Slums : A State wise Analysis

Much variation is seen among the states with respect to the percentage of slum population to the urban population. Andhra Pradesh (35.93 percent) has the highest percentage of slum population to the urban population and Kerala has the lowest (1.27 percent). There is no distinct pattern with more developed states having both higher (Andhra Pradesh, Maharashtra) and lower (Gujarat, Kerala,Punjab, Tamil Nadu) percentage of slum population.

Table 2.20: State wise Slum Population : 2011

S.No	States	Slum Population	Percentage of Slum Population to Urban Population
1	Andhra Pradesh	101,86,934	35.93
2	Bihar	12,37,682	10.55
3	Chhattisgarh	18,98,931	31.99
4	Gujarat	16,80,095	6.53
5	Haryana	16,62,305	18.84
6	Jharkhand	3,72,999	4.70
7	Karnataka	32,91,434	13.96
8	Kerala	2,02,048	1.27
9	Madhya Pradesh	56,88,993	28.36
10	Maharashtra	118,48,423	23.31
11	Odisha	15,60,303	22.30
12	Punjab	14,60,518	14.06
13	Rajasthan	20,68,000	12.11
14	Tamil Nadu	57,98,459	16.59
15	Uttar Pradesh	62,39,965	14.03
16	West Bengal	64,18,594	22.03
17	INDIA	654,94,604	17.37

Source: Census of India, 2011

To further understand the variation among the states and the difference between slum and non-slum households with respect to safe drinking water, the following analysis was done. Since the slum HH were from statutory towns as Census 2011 has enumerated slums only in statutory towns, non slum households in only statutory towns were selected for the analysis.Table 2.21 presents the state wise household access to safe drinking water and household access to safe drinking water away from the premises.

Table 2.21: HH Access to Safe Drinking Water in Slum and Non-Slum across Select States of India (2011)

S.No	State	HH access to Safe Drinking Water (Percent)		HH access to Safe Drinking Water- Away from Premses (Percent)	
		Slum	Non-Slum	Slum	Non-Slum
1	Andhra Pradesh	95.25	95.78	8.92	5.29
2	Bihar	94.99	95.80	9.05	4.71
3	Chhattisgarh	94.03	95.18	14.21	10.30
4	Gujarat	95.32	97.78	7.46	2.85
5	Haryana	96.03	97.22	6.18	2.68
6	Jharkhand	79.94	83.34	19.35	12.03
7	Karnataka	94.74	93.88	12.29	5.52
8	Kerala	74.39	69.68	3.87	2.90
9	Madhya Pradesh	92.03	94.28	16.34	9.15
10	Maharashtra	97.06	97.15	5.87	3.20
11	Odisha	84.26	86.92	23.73	11.05
12	Punjab	98.60	99.23	2.27	1.15
13	Rajasthan	94.30	95.46	7.56	4.22
14	Tamil Nadu	94.78	94.65	5.49	3.65
15	Uttar Pradesh	98.01	98.44	6.40	4.20
16	West Bengal	96.29	96.16	14.86	10.26
17	INDIA	95.07	94.77	9.36	4.90

Source: Census of India, 2011

Among the selected states, Kerala and Jharkhand have the least percentage of households with access to safe drinking water, both for slum and non-slum households. Odisha is close behind with 84.26 percent slum households and 86.92 percent non slum households with access to safe drinking water. The figures for rest of the states are within a five percent range.

It is evident from table 2.21 that in both the parameters, the non-slum households perform better than the slum households. It is interesting to note that with respect to safe drinking water when all three criteria of within premises, near premises and away from premises are taken into account, there is very little difference between the slums and the non-slum households for each state. Further states such as Karnataka, Kerala, Tamil Nadu and West Bengal exhibit nearly equal levels of household access to safe drinking water. It is heartening to note that in these states, access to safe drinking water in slums, irrespective of the distance, is enhanced through provision of treated water through taps. The picture drastically changes with respect to the other parameters.

The gap between the slum and non-slum households increases when limit in distance to water source is taken. The change is the most drastic in the case of Odisha and Jharkhand implying that more people residing in the slums have to walk a higher distance to fetch safe drinking water in these states compared to others. In the case of Odisha, there was a difference of 2.66 percent between slum and non slum households when access to safe drinking water irrespective of the distance was taken. The gap percentage increased to 12.68 percent when access to safe drinking water away from premises was taken. Similarly in the case of Jharkhand, the gap percentage between slum and non-slum households increased from 3.4 percent for safe drinking water to 7.32 percent for safe drinking water away from premises. The least change was seen in the case of Punjab and Kerala. While Kerala has the one of the lowest percentage household access to safe drinking water among the selected states, it has the least amount of difference in percentage household access between slum and non slums.

Table 2.22: Variation (Coefficient of Variation) among States for Household Access to Safe Drinking Water

HH Access to Safe Drinking Water (Percent)		**HH Access to Safe Drinking Water- Away From Premises (Percent)**	
Slum	**Non-Slum**	**Slum**	**Non-Slum**
6.86	6.67	10.60	8.42

Source: Computed by Author from Census of India, 2011

As seen in table 2.22 ,the variation among states is similar for slum and non-slum households in the case of the safe drinking water but the variation increases with respect to percent household access to safe drinking within and near premises.

Moving on to more specific parameters which also exemplify the efficiency of the Municipalities, it is seen that the gap between the slum and non slum households considerably increase.

Table 2.23: HH access to Treated Tap Water in Slums and Non-Slums across Select States- 2011

S.No	State	Treated Tap Water within premises		Treated Tap Water within and near premises	
		Slum HH	Non-Slum HH	Slum HH	Non-
1	Andhra Pradesh	52.66	66.35	72.11	76.53
2	Bihar	9.01	14.07	10.91	15.48
3	Chhattisgarh	18.41	32.18	38.57	42.93
4	Gujarat	53.72	65.44	68.90	69.80
5	Haryana	54.69	68.63	62.33	71.99
6	Jharkhand	13.16	26.86	17.78	32.49
7	Karnataka	37.87	59.42	61.25	67.98
8	Kerala	37.82	40.02	49.63	46.06
9	Madhya Pradesh	26.38	40.79	43.88	50.99
10	Maharashtra	61.08	78.83	83.20	86.01
11	Odisha	16.30	36.87	27.43	44.47
12	Punjab	56.00	65.68	59.43	68.18
13	Rajasthan	64.44	70.79	73.65	75.93
14	Tamil Nadu	29.86	45.96	64.06	66.89
15	Uttar Pradesh	33.20	42.54	37.59	46.11
16	West Bengal	29.59	44.97	48.22	57.83
17	INDIA	42.46	53.61	61.11	63.91

Source: Census of India, 2011

While in the previous section, percentage slum household access to safe drinking water in states such as Bihar, Jharkhand,Odisha was still above 60 percent, in this case (table 2.23) the percentage household access has reduced drastically. In the case of percent household access to treated tapwater within and near premises, the less developed states perform poorly with Odisha, Jharkhand and Bihar having the least percentage of both slum and non-slum households with access to treated tap water within and near premises. There is a high correlation between percentage household access to treated tap water within and near premises for slum and non-slum as exhibited by a high pearson’s coefficient of correlation (r=0.97 statistical significance at 0.01 level). This also implies that the overall development of water infrastructure has a bearing on the level of access in slums. Ironically, the gap between slum and non slum household is also the highest for Odisha (17.04 percent) and Jharkhand (14.71 percent). The gap is the lowest for Gujarat

(0.9 percent), Rajasthan (2.28 percent) and Tamil Nadu (2.83 percent). Kerala is an anomaly with higher percentage of slum households having access to tap water from treated source within and near premises.

Analysis of treated tap water within premises show that even lesser percentage of households have access to treated tap water within premises as compared to the other parameter. In the case of slum households, the states of Bihar (9.01 percent), Jharkhand (13.16 percent) and Odisha (16.3 percent) have figures much below the national average of 42.46 percent. The figures for non-slum households for these states are also below the national average (50.83 percent). Karnataka is the only state where the percentage slum household access to treated tap water within premises (37.87 percent) is below the national average (42.46 percent) despite the figures for non-slum household access (59.42 percent) being above national average (50.83 percent).Karnataka is also the state with the highest disparity (21.55 percent) between slum and non-slum households with respect to this parameter. Rajasthan (64.4 percent), Haryana (54.69 percent),Gujarat (53.72 percent) and Andhra Pradesh (52.66 percent) have the highest percentage of slum households with access to treated tap water within premises. Among the select states which have household access figure above the national average, Rajasthan (6.81 percent) followed by Punjab (10.83 percent) have the lowest disparity in percentage access of slum and non-slum households.

Table 2.24:Variation (Coefficient of Variation) among States for Household Access to Treated Tap Water within premises, Treated Tap Water within and near premises

Treated Tap Water within premises		Treated Tap Water within and near premises	
Slum	**Non-Slum**	**Slum**	**Non-Slum**
18.06	18.52	20.74	18.96

Source: Computed by Author from Census of India, 2011

It is interesting to note that there is not much difference in variation between percentage household access to treated tap water within premises in the slum and non-slum category, among the states. This is contrary to the general perception that for a refined indicator, the variation for slum households would be more than the non-slum households. This also implies that scenario of access to treated tap water in the slum households reflects the overall situation of the urban households in the state. In the other indicator, the variation in percentage access is higher, but not very different among the slum households as compared to the non-slum households.

2.4.5.2 Access to Water in Slums of Million Plus Cities

In this section, data has been analysed for access to water supply in the Million plus cities of India. Malapuram has been excluded as data for slums is not available for the town. The status of household access to all the selected indicators , both among slum and non-slum households is much better in million plus cities as compared to all statutory towns.

Table 2.25: Access to Treated Tap Water (Near and Within Premises) in Slums in Million Plus Cities -2011

Residence	HH with Treated Tap water (within)	HH with Treated Tap water (within and near)
Slum Households	56.42	75.08
Non-Slum Households	70.10	75.94
Difference	13.68	0.86

N=52
Malapuram excluded
Source: Census of India, 2011

Slum dwellers seem to be at par with the overall population with respect to availability of treated tap water within and near the premises (100 metres). This may not be taken as an evidence of efficiency of the Service provider, but rather as an indication of the innovation and "j*ugaad*" of the residents as most of these taps are drawn from the main pipeline usually without the consent of the authorities.

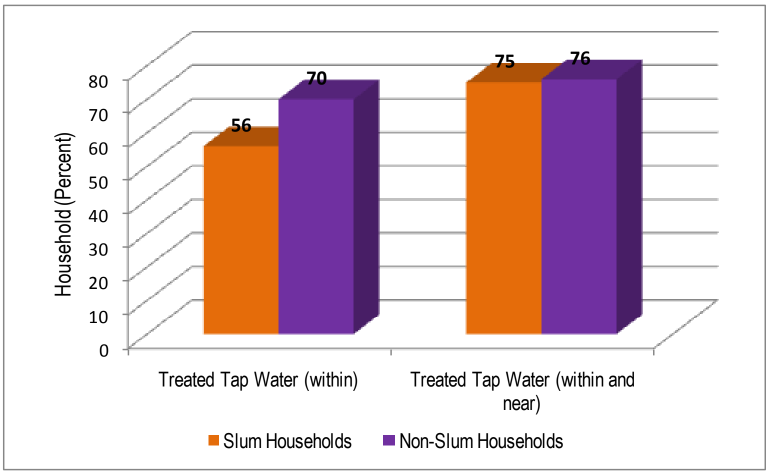


Figure 2.13: Access to Treated Tap Water in Slums in Metropolitan Cities -2011

Source: Census of India, 2011

Analysis has been undertaken for all the 52 Million plus cities (Malapuram excluded) and a fair amount of variation is seen, not only in the availability of treated tap water in the slums but also in the disparity between the slum households and the non-slum households. Treated tap water has been taken as an indicator as it is understood that there is a need to move from just availability of water to provision of "good quality" water.

For ease of understanding, the cities have been divided into quartile groups and the percentage slum household access to treated tap water; both within premises and within and near premises in highest and the lowest quartile have been discussed in this section. This facilitates understanding of the situation of various million plus cities with respect to this indicator.

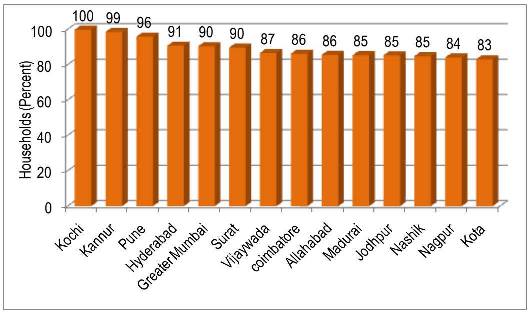


Figure 2.14: HH Access to Treated Tap water within and near Premises in Slums-Highest Quartile of Million Plus Cities (2011)

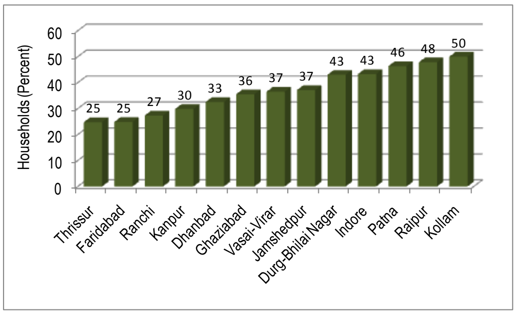
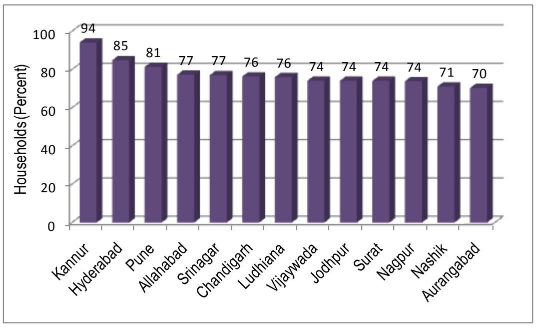


Figure 2.15: HH Access to Treated Tap water within and near Premises in Slums-Lowest Quartile of Million Plus Cities (2011)

Source: Computed by Author,Census of India, 2011

With respect to household access to treated tap water within and near premises in slums, the southern and western cities perform much better than their Northern counterparts. The cities of Kerala, Kochi and Kannur seem to be doing very well with nearly cent per cent of its slum households having access to treated tap water within and near premises. The lowest quartile cities with the poorest household level access to treated tap water within and near premises primarily comprise industrial cities, besides Patna, Ranchi and Raipur. The slum households in Thrissur and Faridabad are in the worst situation with only a quarter of the households getting treated tap water.



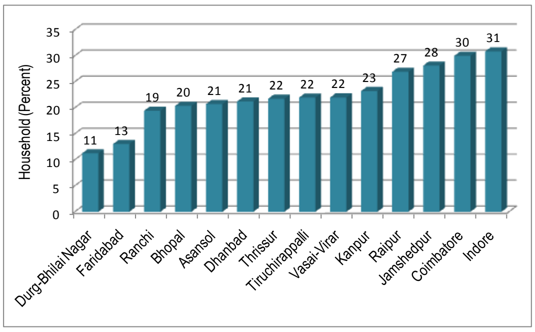


Figure 2.16: HH Access to Treated Tap water within Premises in Slums- Highest Quartile of Million Plus Cities (2011)

Figure 2.17: HH Access to Treated Tap water within Premises in Slums- Lowest Quartile of Million Plus Cities (2011)

Source: Computed by Author,Census of India, 2011

With respect to household access to treated tap water within premises in slums, Kannur (94 percent), Hyderabad (85 percent) and Pune (81 percent) have the highest percentage. Among these Kannur seems to be an anomaly as Kannur in general, has a low percentage of household access to tap water within premises. This could be explained by firstly, the slum population presence in Kannur is negligible with only 272 slum households (Census 2011) and there has been an emphasis on slum improvement through various programmes like IHSDP, BSUP etc. Durg Bhilai Nagar (11 percent), Faridabad (13 percent) and Ranchi (19 percent) have the lowest percentage household access to treated tap water within premises in slums.

Disparity in Access to Treated Tap Water (Within and Near Premises) in Slum and Non-Slum Households

There is a disparity in access to treated tap water between slum and non-slum households. All the 52 cities were arranged according to their disparity score. The highest quartile and the lowest quartile have been considered.

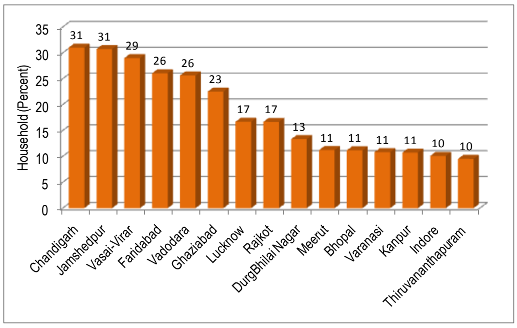


Figure 2.18: Disparity in Access to Treated Tap Water within and near Premises-Highest Quartile Group of Million Plus Cities

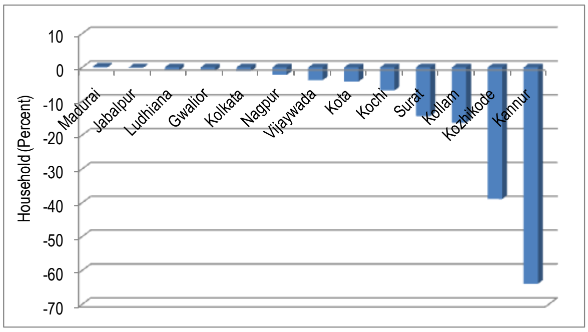


Figure 2.19: Disparity in Access to Treated Tap Water within and near Premises-Lowest Quartile Group of Million Plus Cities

Source: Computed by Author,Census of India, 2011

The cities with highest level of disparity between slum and non-slum households are dominated by Northern cities. Chandigarh and Jamshedpur fare very poorly with the access to treated tap water in slum households as these cities are lagging far behind their non-slum counterparts. These two cities also have the lowest non-revenue water as seen in the previous sections. This could also mean that in the rush to reduce non-revenue water, social welfare is getting compromised.

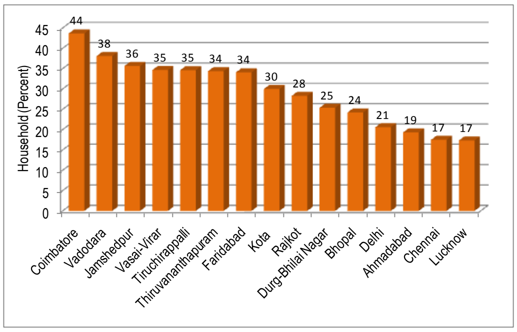


Figure 2.20: Disparity in Access to Treated Tap Water within Premises-Highest Quartile Group of Metropolitan Cities

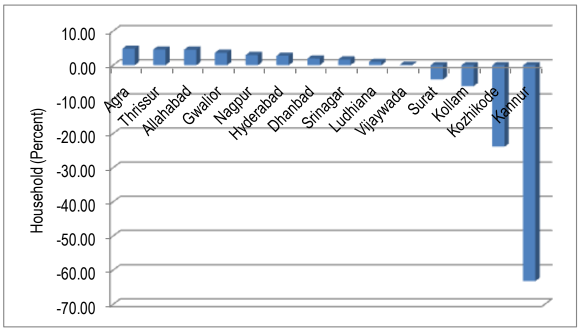


Figure 2.21: Disparity in Access to Treated Tap Water within Premises-Lowest Quartile Group of Metropolitan Cities

Source: Computed by Author,Census of India, 2011

The cities of Kerala show a different trend from rest of the cities with the slums having higher percentage of households with access to treated water as compared to overall city population.

2.5 REFORMS IN THE URBAN WATER SECTOR: A BRIEF ANALYSIS OF THE MILLION PLUS CITES

Metropolitan cities, by the virtue of their position in the hierarchy, enjoy the best services in terms of water supply. While metropolitan cities have large populations to cater to, they also enjoy economies of scale for infrastructure. Further, the municipal institutions are stronger in these cities. On the other hand, these cities attract migrants from across the country. Ceteris Paribus , growing population puts pressure on the existing water supply systems in terms of the resource, infrastructure and management.

The significance of institutional capability in the urban sector has been recognised for long. The 74th Constitutional Amendment Act (1992) was a landmark decision in strengthening the role of Municipal bodies and empowering them to act as autonomous self-sustained city governments. Water supply and sewerage which were discretionary functions of all ULBs were made obligatory functions by the Amendment from March 1996. Till the early 2000s, the focus for improving water supply and distribution was on technical improvement and upgradations. Water being a State subject, the Central Government had less influence on the fiscal instruments. In 2002, Minister of Rural Development, in his keynote address at Water Forum, World Bank affirmed that improved management and correct pricing are the solution to the exisitng water supply and distribution problem **(World Bank, 2002).** In this changing climate, Jawaharlal Nehru Urban Renewal Mission (JNNURM) was launched in 2005. Till then, it was the most comprehensive attempt at reform and laid great emphasis on institutional reforms along with infrastructure upgradation. It was envisioned as part of the larger vision of commitment to attaining the Millennium Development Goals. It was also the outcome of a need to improve the quality of infrastructure and thereby, ready the cities for economic activities emerging out of the neo-liberal economic policies. The Mission released reform linked grants for improvement in infrastructure through projects.

Reforms were a very important part of JNNURM as the release of the Central government share for projects is linked to the percentage of reforms implemented as agreed upon in the Memorandum of Understanding (MoU). The reforms were of two types namely mandatory and optional. There were 23 reforms that were to be implemented by the State/ULB/Parastatal, out of which 13 were mandatory and 10 were optional reforms. The reforms to be implemented at the state level comprised implementation of 74th Constitution amendment Act, repeal of Urban Land Ceiling and Regulation Act (UCLRA), reform of rent control laws, rationalise stamp duty, enactment of public disclosure law, enactment of community participation law, city planning delivery functions. Then there were reforms to be executed at the ULB/parastatal level comprising accrual based-double entry accounting system, e-governance using MIS and GIS, property tax reforms with GIS, budget for urban poor, **basic services for the urban poor**, **levy of user charges**. Optional reforms included revision of building by-laws, simplification of legal and procedural frameworks of agricultural land for non-agricultural purposes, property title certification, cross subsidization for EWS/ LIG Housing, computerized land property registration, mandatory rain water harvesting, recycled water by-laws, administrative reforms, structural reforms, **encouraging PPP**. In the revised strategy (2011) the thrust was on improved urban governance to make ULBs financially sound with enhanced credit rating so that they can access market capital for taking up new development projects.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT) has gone a step further and seeks to ensure that every household has access to a tap with assured water supply of potable quality and sewerage connection. In order to expedite the process of projection award and completion, AMRUT unlike its predecessor incentivises achievement of reforms by keeping apart 10 percent of the budget allocation. Simultaneously the smart city mission launched by the Government of India lays emphasis on water metering, leakage identification, preventive maintenance and water quality monitoring **(Smart Cities Mission Statement and Guidelines, 2015).**

Ministry of Urban Development (MoUD) recommended 28 service level benchmarks (SLB) for ULBs spanning across four basic urban services namely, water supply, sewerage, solid waste management and storm water drainage. Nine of these pertain to water supply. They are listed in table 2.26. The SLBs are seen as a shift from creation of infrastructure to delivery of service outcomes.

Table 2.26: Service Level Benchmarking for Water Supply by Ministry of Urban Development

S.No	Indicator	Benchmark
1	Coverage of Water Supply connections	100%
2	Per Capita Supply of Water	135 LPCD
3	Extent of Non-revenue Water	15%
4	Extent of Metering	100%
5	Continuity of Water supplied	24 hrs
6	Efficiency in redressal of customer complaints	80%
7	Quality of Water Supplied	100%
8	Cost Recovery	100%
9	Efficiency in Collection of Water Charges	90%

Source:SLB Data Book, 2011

As seen in the last section, most of the cities have poor levels of treated tap water coverage. The utilities were also seen to be running at huge losses with them barely recovering the O&M costs and not being able to invest in new infrastructure. To combat this issue, since 2005, when JNNURM was launched, there has been focus on full cost recovery. Full cost recovery is expected to turn around the ailing utilities and improve the coverage, quantity and quality of water.

A brief analysis has been done for the 53 million plus cities in order to understand the water supply scenario. The indicators taken for the analysis comprise type of service provider agency, per capita water supply , unaccounted for water, metered connection (percent), collection efficiency ,tariff structure and cost recovery

2.5.1 Institutional Set up for Water Service Delivery

Much variation is seen in the type of agencies responsible for water service delivery. Not only is there variation at the inter city level, but even within a city, different agencies are responsible for different apects such as construction of OHTs, pipeline laying and upgradation, operation and mangement etc.

Table 2.27:Institutional Set up for Water Service Delivery in Million Plus Cities

S.No	Type of Agency	No of Cities (Percent)
1	Parastatal Organisation	16.98
2	Municipal Corporation	60.38
3	PHED	9.43
4	MC and PHED	1.89
5	Municipal Corporation/Parastatal	7.55
6	Private	3.77
7	Total (N=53)	100

Source: Computed from Census 2011 and Official Websites of the Utilities

Municipal corporation is in charge of water supply in large number of cities. Out of the 53 cities, Municipal Corporation is solely responsible for water supply in 32 cities (60.3 percent) while in five (15.6 percent) other cities, it has joint responsibility either with a parastatal or PHED.There are parastatal organisations which come directly under the state government such as Delhi Jal Board, Kerala Water Authority, Bangalore Water Supply and Sewerage Board etc. Others such as the water supply of Hyderabad and Chennai are taken care of by their respective metropolitan water boards which are parastatal organisations as well. Parastatal organisations are a by-product of the economic liberalisation, set up to deal with the inefficiency in the Municipal Corporations. These parastatal organisations also do not have elected representatives and are perceived to be free of political activities. **(Chandrashekhar, 2011 cit. in Baindur, 2016).** So instead of strengthening the urban local bodies, new agencies were created to solve the problems of water supply and distribution in the cities. This can be seen in contravention of the 74th constitutional Amendment. PHED is responsible for water supply in the cities of Rajasthan. In Bhopal, the capital works is undertaken by PHED while the operation and management is done by the Municipal Corporation.

In Agra, Lucknow, Kanpur, Allahabad, water supply provisioning is handled by Uttar Pradesh Jal Nigam and the respective City Jal Sansthan. UP Jal Nigam is like a parent body responsible for overall development of water supply and sewerage at the state level. It reviews the technical, financial, economic etc of Jal Sansthans. It also has the power to advise Jal Sansthans on the tariff. The development and upgradation works are also undertaken by the agency.On the other hand, Jal Sansthans' responsibilities include operation and maintenance, sanctioning of new house conections, distribution of water and billing and collection of water charges. In India, Nagpur and Jamshedpur are the only two cities in which water supply and distribution is in private hands. While in Jamshedpur, JUSCO owns the utility, Orange City Water Private Limited, a subsidiary of Veolia Water India Pvt. Ltd has been contracted by Nagpur Municipal Corporation. In several other cities, pilot projects have been launched but these are still not at a city scale. They have been discussed in detail in chapter three.

A brief analysis of the association between type of agency and and the percentage household coverage of treated tap water within and near premises has been undertaken. This is based on the Census 2011 data for 53 million plus cities.

Table 2.28 : Institutional set up for Water Service Delivery and Household Coverage (Percent) 2011

S.No	Type of Agency	HH with Treated Tap Water (Percent)
1	Parastatal Organisation	76.11
2	Municipal Corporation	77.77
3	PHED	73.70
4	MC and Parastatal	58.42
5	MC and PHED	62.00
6	Private Company	78.92
7	Average (N=53)	75.73

Source: Computed from Census 2011 and Official Websites of the Utilities

Although the cities with private companies have the highest household coverage in terms of treated tap water within and near premises (78.92 percent), the figures cannot be taken literally as there are only two such cities, Nagpur and Jamshedpur. Cities under parastatal organisation (76.11 percent) , municipal corporation (77.77 percent) have similar coverage. Cities where there are multiple agencies seem to fare the worst. These comprise most of the million plus cities of Uttar Pradesh and Bhopal.

2.5.2 Metered Connections

One of the major service level benchmarks which has being pushed by JNNURM and now Smart Cities Mission has been 100 percent metering of water connections. Metering is considered an important factor in efficient passing of subsidies where charges are levied through increasing block tariff **(Kommives, 2006).** Post 2005, several cities have started implementing metering but there is still a long way to go. While installing new meters is one challenge, most of the cities where meters are installed, the meters don't function properly. Out of the 53 cities, information was available for 46 cities. Metered connections are available in 69.56 percent (32 No.) of the 45 cities. Out of the 32 cities which had metered water connections, 11(34.37 percent) of the cities had percentage of metered water connections below 25 percent while again 12(37.5 percent) had above 75 percent of their water connections metered. These figures show that only Chandigarh has 100 metered water connections.

Since there is a lot of variation among the cities with respect to percentage of metered connections, an attempt has been made to understand the variation with respect to the type of agency.

Table 2.29: Type of Institution and Percentage of Metered Connections

Type of Agency	**Status of Metered Water Connection (Cities Percent)**					
	Unmetered Connections	1-25	25-50	50-75	75-100	Total
Parastatal	0	22.22	0	11.11	66.67	100
Municipal Corporation	42.31	23.08	11.54	7.69	15.38	100
Parastatal/Municipal	75.00	25.00	0	0	0	100
PHED	0	25.00	0	75.00	0	100
Municipal and PHED	0	100	0	0	0	100
Private	0	0	50	0	50	100
Grand Total	30.43	23.91	8.70	13.04	23.91	100

Source:SLB Data Book (2011), ADB (2007)

Cities with the highest percentage of metered connections are the ones in which the water is supplied and managed by parastatal organisations and metropolitan water boards. There is only one city (Jaipur) being managed by PHED for which data is available, thus to conclude on the efficiency of PHED management will be inappropriate.

An attempt has been made to understand the association between metered connections and household coverage of treated tap water.

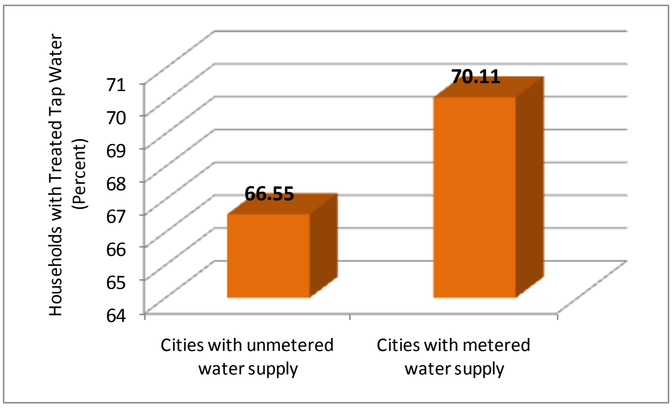


Figure 2.22: Metered Water Connection and Households with Treated Tap Water

Source: Computed from Census 2011 and Official Websites of the Utilities

Cities with metered water supply exhibit a slightly better household coverage level with 70.11 percent of the households getting treated tap water as compared to cities with unmetered water supply (66.55 percent).

Table 2.30 : Metered Water Connection (Percent) and Percentage Household coverage of Treated Tap Water

Metered Connection (Percent)	HH with treated tap water (Percent)
1- 25	68.06
25 – 50	78.75
50- 75	67.11
More than 75	66.50
Average	68.03

Source: Computed from Census 2011 and Official Websites of the Utilities

There is no correlation of statistical significance between the percentage of metered connections and coverage. Cities with 25-50 percent of metered connections had the highest coverage in terms of households getting treated tap water.

2.5.3 Emphasis on Reduction of Non-Revenue Water

Non-revenue water is the difference between the amount of water released into the distribution system and the amount of water billed to consumers.It is usually categorised into physical losses due to leakage etc and commercial losses due to meter not working, unmetered connection etc.The estimate of non-revenue water is sketchy for most Indian cities as these cities do not have bulk meters or district metering, thus there is no way of knowing how much water is actually unaccounted for. Utilities all over the world try and reduce their non-revenue water in order to maximise their revenues. Utilities in Singapore, Pnom Penh, Manila (East zone) have been able to reduce NRW below 20 percent **(ADB, 2010).** The water reforms in JNNURM lay emphasis on reduction of NRW and the SLB for NRW was set as 15 percent.

Data for NRW was available for 47 of the 53 million plus cities and the following analysis is based on that. Among the million plus cities, the average NRW is around 39.79 percent. Ranchi has the highest NRW of 92 percent while Jamshedpur has the lowest NRW of 13 percent.

Table 2.31: Type of Institution and Percentage of Non-Revenue Water

Type of Agency	**NRW (Percent)**				
	Cities with Less than 20	Cities with 20-40	Cities with 40-60	Cities with More than 60	Total
Parastatal	11.11	44.44	44.44	0	100 (9)
Municipal Corporation	3.70	44.44	37.04	14.81	100 (27)
Parastatal/Municipal	0	50	50	0	100 (4)
PHED	25.00	50	25.00	0	100 (4)
Municipal and PHED	0	100	0	0	100 (1)
Private	50	0	50	0	100 (2)
Grand Total	8.51	44.68	38.30	8.51	100 (47)

Source: www.moud.gov.in and Official Websites of the Utilities

It is clear from table 2.31 that more number of cities where Municipal Corporations are responsble for water supply are in the worst situation with 14 of the 27 cities having NRW above 40 percent. Ranchi (92 percent), Amritsar (86 percent), Asansol (81 percent) and Raipur (61 percent) have the highest NRW among all the million plus cities and the water supply in these cities is managed by the respective Municipal Corporations. There are only two cases where private companies are responsible for water supply either through operation and management or ownership for the entire city. Ltd has been responsible for water supply since the city's inception has the lowest NRW of 13 percent while Nagpur where Orange Water Pvt Ltd took over in 2011, the NRW is more than 40 percent. Cities with water supply under PHED seem to be in a better position than the cities with water supply under Municipal corporations and Parastatal organisations but the sample size is really to small to come out with any concrete findings. Jaipur (32 percent), Jodhpur (32 percent) and Srinagar (17 percent) are among the PHED managed water supply with less than 40 percent NRW.

Table 2.32: Non-Revenue Water and Percentage Households with Treated Tap Water

S.No	NRW (Percent)	HH with Treated Tap Water (Percent)
1	0-20	78.48
2	20 - 40	64.91
3	40- 60	71.33
4	More than 60	56.13
5	Average	67.78

Source: :SLB Data Book (2011), Census of India, 2011

Million plus cities which had less than 20 percent NRW also had the highest percentage (78.48 percent) coverage of households with treated tap water and cities with more than 60 percent NRW had the lowest percentage (56.13 percent) of coverage of households with treated tap water, although correlation of any statistical significance was not found between these two variables.

2.5.4 Water Tariff Structure

Way back in 1992, Vaidyanathan Committee had recommended user charges for water and recovery of O&M costs to begin with followed later by recovery of capital costs (Financial Express, 22 June, 2016). But even in 2016, although cities have water charges, often it is not enough to meet the O&M costs. The water tariff structure has been discussed in this section to give a better understanding of the prevailing instruments to charge consumers for water.

Since most cities have both metered and unmetered connections, they have tariff for both types of connections. Some cities, despite not having metered connections in place, have already fixed the tariff system mainly to adhere to the JNNURM requirements. While metering is a first time experience for many cities, there are others such as Vadodara (1981) and Chennai where metering was earlier there but had been abolished. The main reasons for discontinuing with metering were reported to be low pressure, poor meter quality, tampering by customers, alternate wet and dry state etc. **(Turell et al, 1999).** Information was not available for Asansol and Madurai, thus the following analysis has been restricted to 51 milliion plus cities. The telescopic volumetric tariffs are the most popular with 41.18 percent of the cities having telescopic volumetric tariff as the basis for water charge.

Table 2.33 : Basis of Calculation of Water Charges

S.No	Basis of Calculation	Cities (No.)	Cities (Percent)
1	Volumetric		-
1.a	Telescopic	21	41.18
1.b	Non-telescopic	18	35.29
2	Non-Volumetric		-
2a	Property tax	11	21.57
2b	Water Tax	7	13.73
2c	Ferrule Size	6	11.76
2d	Carpet Area	4	7.84
2e	Flat	1	1.96
3	No Charge for Domestic connections	1	1.96

Source: Computed from Census 2011 and Official Websites of the Utilities

Note: The figures are not excusive as many cities have both volumetric and non-volumetric charges

The volumetric tariff can only work in the case of 100 percent metering of water connections. As discussed earlier, most of the million plus cities do not have 100 percent metering and depend on tax, carpet area or ferrule size for raising the bill amount. So while table 2.33 shows that a large percentage of cities have volumetric method for calculating bill amount, it is not functional for a large proportion of the households in reality.The disadvantage of such a system is that there is no incentive for conserving water as households are billed on factors other than the volume of water consumed.

Since telescopic volumetric tariff is considered to be the ideal type for promoting conservation of water and efficient chanelling of subsidies, an attempt has been made to understand the prevalence of this tariff structure in the type of agency.

Table 2.34: Institutional Set up and Telescopic Volumetric Tariff

Type of Agency	**Cities (Percent)**
Parastatal Organisation	100.0
Municipal Corporation	21.88
PHED	60.0
MC and PHED	0
MC and Parastatal	0
Private	100.0
Total (N=21)	39.62

Source: Computed from Census 2011 and Official Websites of the Utilities

Out of all the cities being managed by parastatal organisations and private companies, all the cities have telescopic volumetric tariff. Only 60 percent of the PHED provisioned cities and 21.8 percent of the Municipal Corporation provisioned cities have telescopic volumetric tariff.

Among the cities with non- telescopic volumetric tariff, Surat and Indore have the lowest tariff at Rs.2/kl while Amritsar and Ludhiana have the highest tariff at Rs.3.8/kl. In the case of telescopic volumetic tariff, the first slab is known as the lifeline tariff and is supposed to be set at such a rate which is affordable to meet the basic water needs. Among cities with telescopic volumetric tariff, Jodhpur has the first slab at 8 kl at the rate of Rs.7/kl. The cities of Kerala and Jamshedpur have the first slab upto 10 kl at the rate of Rs.4/kl and Rs.5/kl respectively. Raipur has the first slab at 11 kl at the rate of Rs.5/kl. Hyderabad has the first slab upto 15 kl at the rate of Rs.10/kl. Delhi and Nagpur have the first slab at 20 kl with a higher tariff as compared to other cities, at the rate of Rs.4.39/kl and Rs.6.38/kl respectively. Chennai and Chandigarh have the highest lifeline slabs. First slab for Chennai is upto 25 kl till which water is free, after which the tariff is very high at Rs.25/kl. Chandigarh's first slab is at 30 kl at the rate of Rs.2/kl. Metered households in Jaipur have to pay Rs.4/kl for water consumed above 40 kl. Besides the cities which do not have charges for the lifeline slab, the highest percentage increase in tariff from the lifeline slab to the next slab is seen in Delhi with an increase of 400 percent. Jamshedpur and Hyderabad have the lowest increase of only 20 percent.

2.5.5 Cost Recovery

Cost recovery has been very poor for most cities. All the above mentioned initiatives have been taken with the ultimate aim of initiating full cost recovery. Cost recovery is also a function of the cost of producing and distributing the water for consumption. This also depends on the electricity tariff as these days all water works are dependent on pumps for drawing and distributing water. Table 2.34 presents the cities against the water cost recovery percentage.

Table 2.35: Million plus Cities and Water Supply Cost Recovery

S.No	Cost Recovery (Percent)	Cities (No.)
1	Less than 25	3 (Bhopal, Jodhpur, Gwalior)
2	25-50	14 (Vijayawada, Meerut, Rajkot, Kochi,Indore, Jabalpur, Kozhikode, Malappuram,Kannur, Aurangabad,Kollam,Ghaziabad, Thiruvananthapuram, Kota)
3	50-75	9 (Hyderabad, Lucknow, Patna, Nashik, Pune, Jaipur, Thrissur,Vasai virar, Chandigarh)
4	75-100	10 (Vishakhapatnam, Faridabad, Agra, Allahabad, Kanpur, Varanasi, Ahmadabad, Surat, Nagpur,Bangalore
5	More than 100	4 (Kolkata, Jamshedpur, Coimbatore, Greater Mumbai)

Source: :SLB Data Book, 2011

Out of the four cities with more than 100 percent cost recovery,Kolkata and Greater Mumbai have 100 percent cost recovery due to lower production costs while Coimbatore has 100 percent metered connections and Jamshedpur has the lowest Non-revenue water percentage among the million plus cities. At the other end, is Bhopal, Jodhpur and

Gwalior with the poorest cost recovery percentage figures. Both the Madhya Pradesh cities, Bhopal (37 percent) and Gwalior (43 percent) have higher than average percentage of non revenue water and also very low percentage of metered connections. The comparison across the agencies have not been done as the pre-conditions vary for different cities and the type of agency might not be soley responsible for the cost recovery figures.

2.5.6.Safeguards for the Poor in the Tariff Structure

As seen in earlier sections, cities are moving towards telescopic volumetric pricing where difference in tariff is based on volume of water consumed. In most cases the lifeline tariff is kept low to enable the poor households to afford water wherever such households are metered. In addition, there are some cities where a separate provision has been kept for the slum dwellers or Below Poverty Line households. In Hyderabad, the tariff for the slum households has been fixed at 30 percent less tariff than the base tariff. In Vijaywada, the water connection charge for BPL ration card holders has been fixed at Rs.200 compared to Rs.1225 for others.In Greater Mumbai, slum (Rs.3/kl) and non slum households (Rs.4/kl) have to pay different water tariffs. In the case of Nagpur, slum and non slum households pay the same tariff and the tariffs are differentiated on the basis of hutment size. In Vishakhapatnam, 50 percent subsidy is given on the basis of ferrule size. Slum dwellers applying for half inch ferrule connections can avail the subsidy. In Bangalore, the water tariff is based on the size of the plot. Houses with less than 150 sq.feet area are supposed to pay only the meter cost@Rs.550 and the upper ceiling is capped at 650s.ft after which regular rates apply. In Kochi and Kozhikode, there are no charges for households which consume water upto 15kl per month. In Amritsar, houses upto the size of five Marla or 25.2 sq.m/30.2 sq.yards are exempted from paying bills while in Ludhiana, houses with area below 125sq.yards pay a flat rate of Rs.100 as water bill. In Jaipur and Jodhpur, connection charges for BPL households have been kept low at Rs.100 compared to Rs.500 for others.

While there have been attempts to introduce safeguards for the poor in the water tariff structure, households are able to avail it only if they have legal connections. Some cities are making efforts to include the poor into the system but there is still a long way to go. Greater Mumbai has regularised water connections in slums built after 2000 **(BMC to**

regularise water connections in post-2000 slums, 2016). Delhi Jal Board has set a target of December 2017 for connecting all households in the capital to authorised piped water supply **(Every home in slums to get water connection, 2016).**

2.6 SUMMARY

The global history of water supply shows that privatisation of public water supply is not a new concept or practice and water supply in private hands has existed in tandem with public owned water supply. The need of water for public uses like firefighting, public health reasons and welfare has propelled the idea of public water supply being in Government's control. Much difference is seen between the water supply coverage and other parameters among the developed and developing countries. The developed countries have had a long history of public water supply in their cities and their present status is after many trysts with life threatening waterborne diseases and the subsequent improvements. On the other hand, the developing countries after their exploitative colonial rule have undergone urbanisation at much higher rates in a short span of time, thus not able to cope with the demand with their limited resources and capacity. Inequalities not only exist between the developed and the developing countries, but also within these countries themselves. Even though, in most of the countries the public water supply is state controlled, yet instances of unequal distribution of water is rampant with the rural areas and the poor being at the receiving end. Given the general dismal condition of the urban water supply in India, the entities at the economically lower end of the spectrum are the most disadvantaged, be it the less developed states, the smaller towns or the lowest income class. It is a vicious circle with the rich having better access to resources and the poor lagging behind. On the positive side, in the last four decades, the less developed states have shown higher percentage improvement in household access to safe drinking water and are catching up with the developed states. The level of development of the states also has implications for the small towns with the small towns of the developed states faring better than the small towns of the less developed states. Government programmes have also played a role in accentuating the inequality between the cities and the small towns. The disparity between slum and non-slum households in access to treated tap water is lower in the developed states which also implies that the benefits of development is trickling down with respect to basic amenities. The general narrative in the international circles since the late 1990s, for the upliftment of the lower sections and improving household coverage of public water supply, has been to introduce sectoral reforms and to restrict the role of the Government to a facilitator. The emphasis has been on increasing the financial sustainability of the water utilities through full cost recovery. In such a scenario, there needs to be adequate safeguards for the poor so that they do not sink further in the debt trap, in trying to meet just their basic needs. Further, the role of the private sector is also being relooked into, with more active participation of the private sector in the urban water sector. This also might have implications on the poor as the private sector is known to be profit oriented and might neglect the welfare needs of larger and vulnerable section of the society ie. the poor and the underprivileged.

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CHAPTER III

PRIVATE SECTOR PARTICIPATION IN URBAN WATER SUPPLY- POST 1990

3.1 INTRODUCTION

An increased global awareness of scarcity of resources, particularly water, in the 1960s and its interlinkages with society, manifested in one of the most important environment conferences of all times; the UN Conference on the Human Environment, Stockholm, 1972. The conference led to the creation of United Nations Environment Programme (UNEP) and also acted as a driver for countries to frame their own environmental policies. The 1980s witnessed further deteriorating environmental conditions and scarcity of clean water with active reporting from Media. This period also saw a conflict between environment and pro-development lobbies.There was renewed focus on laws, rules and regulations pertaining to natural resources and pollution including drinking water. Further, during this time, the public sector came under much criticism for its inefficiency and inability to meet the water demands of the growing population.There was a clamour for disrupting the vicious circle of crumbling water infrastructure and low water charges. Water came to be accepted as a commodity which could be priced and made profit out of. Privatisation emerged as an important aspect of financial reforms, symbolised by the privatisation of water supply in United Kingdom. The international donor agencies chose to promote privatisation of water services system to put things in order **(Hall & Lobina, 2008).** It was expected that there would be an increase in efficiency,finance for investments and better governance **(Hall & Lobina, 2008).** There was also emphasis on reduction in the provider role of the state to that of a facilitator, paving the way for involvement of the private sector. The Soviet dissolution in early 1990s witnessed several countries in Eastern and Central Europe with collapsing infrastructure. The decade of 1990 also witnessed metropolitanisation of urban population in developing countries with urban population getting concentrated in few cities and water and sanitation becoming critical problems. Achievement of the time bound MDG (1990-2015) also acted as a driver for the developing countries to act upon the deteriorating water and sanitation situation, more so in urban areas.All this further reiterated the focus on access to drinking water for the poor which became an important justification in implementation of the user pay principle and full cost recovery as part of the structural reforms. Although, private players have also existed in the past in the water sector, the post 1990s phase has witnessed the capture of the water sector by a few corporations operating at a global scale.

The present chapter dwells on the private sector involvement in urban public water supply and distribution at both global level and in India. The threshold year has been taken as 1990 as this was a watershed year after which there has been enhanced interest in private sector participation (PSP) varying from full ownership to operation and management contracts. The first section gives a brief prelude to the beginning of the modern era privatisation in the water sector followed by the next section which discusses the global trends in select PSP sectors in the 1990-2015 period highlighting that PSP in the water sector took place simultaneously with other sectors. The section also explores the trends and patterns in the geographical spread of privatisation in the urban water sector, largely, through a selection of such projects. This section also outlines the history of these projects and the type of privatisation that has taken place. Further, the outcomes of the privatisation attempts have been discussed. In the third section, there is focus on the PPP projects in the urban water sector in the Indian context.

3.2 PRIVATE SECTOR PARTICIPATION (PSP) IN URBAN WATER – RECENT GLOBAL TRENDS (1990-2015)

Globally, PSP in water sector is a continuation of similar developments in various other sectors. Certain sectors such as transportation including airports, ports, roads, electricity are favoured by the private sector as the scope of profit generation is higher in these. The magnitude of PSP varies across sector, space and time.

3.2.1 Overview of PSP in Select Sectors at the Global Level: A Brief Overview

The intensity of PSP varies among different sectors and global regions. The intensity has been analysed with the help of number of projects and investment across sectors such as electricity,roads,water and sewerage,telecom, sea ports,natural gas, airports and rail roads and also across regions. The database has been taken from the World Bank repository. The sectors included in the database are the ones which were capital intensive and were traditionally provided by the public sector. The database covered infrastructure projects in low and middle income countries where the private player has at least a 20 percent participation in the project, five percent in case of divestitures. The database includes only projects that have reached a financial or contractual closure.The investment commitment is the one made by the project company as a whole and could be a combination of public and private.

The total number of projects and investment in all the sectors has been shown in figure 3.1 and figure 3.2. Among the various regions, Latin America and the Caribbean are leading in terms of both number of projects and investment. There were 2045 private participation projects in Infrastructure projects in the Latin America and the Caribbean compared to only 170 in the Middle East and North Africa in the period 1990-2015. In terms of investment, Latin America and the Caribbean was way ahead of the other regions with a total investment of 9.6 Lakh US Dollars. The Middle East and Africa had the least amount of PSP investment of 1.1 Lakh US Dollars.

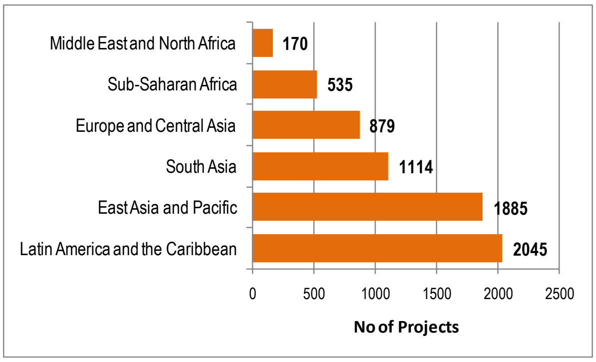


Figure 3.1 :Regions Ranked by Number of Projects (Involvement of Private Sector)- 1990-2015

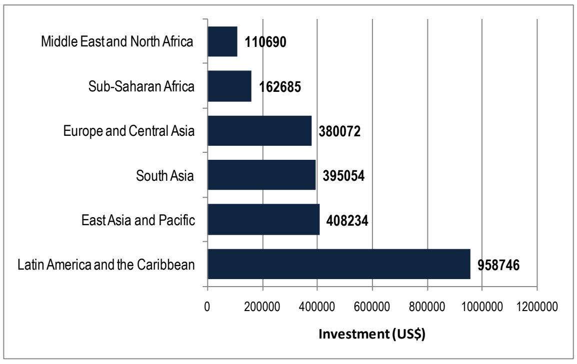
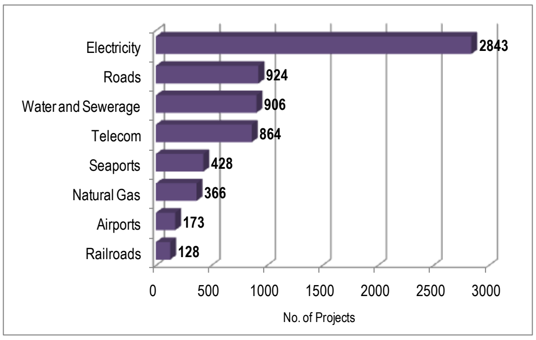


Figure 3.2 :Regions Ranked by Investment (Involvement of Private Sector)- 1990-2015

Source :www.ppi.worldbank.org accessed on 25-01-2016

In terms of sectors,the highest number of projects with financial/contractual closure are in the electricity sector (2843 No.) followed by roads (924 No.) and water and sewerage (906 No.) while in terms of investment, telecom (1.03 Million US Dollars) is ranked first followed by electricity (0.77 Million US Dollars); water and sewerage is ranked fifth (US$79621).



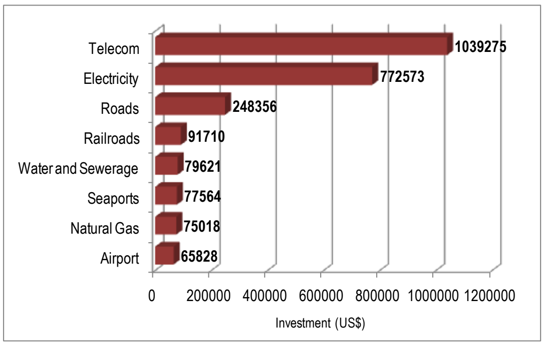
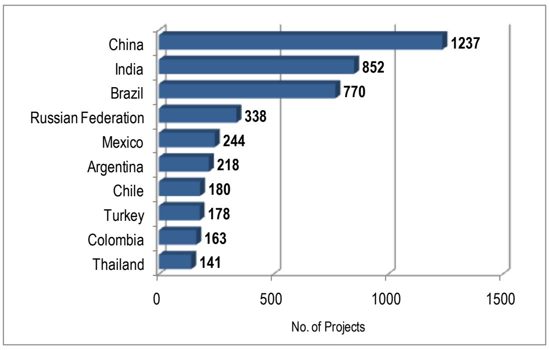


Figure 3.3 :Primary Sectors ranked by Number of Projects- 1990- 2015

Figure 3.4 :Primary Sectors Ranked by Investment- 1990- 2015

Source :www.ppi.worldbank.org accessed on 25-01-2016

Among the select sectors, private participation in the electricity sector is present in the highest number of countries (109 No.) followed by sea ports (67 No.). Surprisingly, private participation in the road sector is present in the least number of countries (36 No.). Latin America and the Caribbean has the highest percentage share of investments in all the sectors with the share being the highest for airports (59 percent). The region also has 49 percent of the total PSP (Private Participation in Infrastructure) investment in water and sewerage. Each sector has a different preference for the type of contracts. With respect to the share of investments, while greenfield projects are the most common in the elecricity, natural gas, rail roads and sea ports sector with 70 percent, 54 percent, 51 percent and 56 percent respectively of the PSP investment concentrated in greenfield projects; concession form is more common in water and sewerage (62 percent), airport (79 percent) and roads (67 percent). Simlarly with respect to share of projects, 79 percent of the projects in the electricity sector, 65 percent in the natural gas sector, 51 percent in the railroads sector and 44 percent in the sea port sector are greenfield projects. With respect to share of projects as concessions, 40 percent of the water and sewerage projects, 51 percent of the airport projects,68 percent of the road projects were concessions. Out of the select sectors, water and sewerage sector (26 percent) has the highest percentage of cancelled projects while airport (2 percent) and sea ports (2 percent) have the lowest.



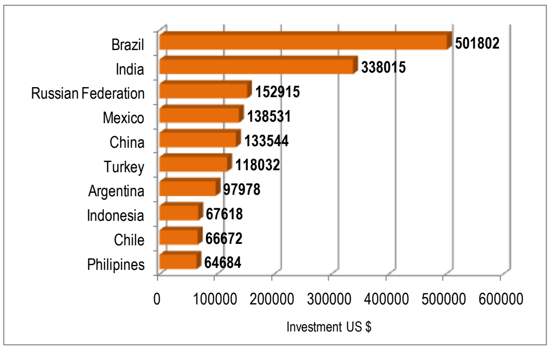


Figure 3.5: Top 10 Countries by Projects- 1990-2015

Figure 3.6 :Top 10 Countries by Investment-1990-2015

Source :www.ppi.worldbank.org accessed on 25-01-2016

With respect to countries, China has the highest number of PSP projects followed by India, while in terms of investment, Brazil has the highest PSP investment again followed by India.

3.2.2 Overview of PSP in Select Sectors in Asia and India: An Insight

PSP has been active in East Asia and Pacific and South Asia in the last few decades. The region is only second to Latin America and the Caribbean in terms of investment and number of projects in private participation projects. India forms a large part of the projects (76.48 percent) and investment (85.5 percent) in PSP in South Asia.

Table 3.1: Details of Private Sector Participation in Asia and India: 1990- 2015

S.No	Component	South Asia	India
1	Number of countries with private participation	8	-
2	Projects reaching financial closure	1114 with total investment of $395,054	852 with total investment of $338,015
3	Sector with largest investment share	Electricity (41%)	Electricity
4	Type of PSP with largest share in investment	Greenfield Project (76%)	Greenfield Project
5	Type of PSP with largest share in Projects	Greenfield Project (64%)	-
6	Projects cancelled or under distress	40 representing 5% of total investment	34 representing 5% of total investment

Source :www.ppi.worldbank.org accessed on 11.07.2016

India's record of cancelled projects or projects under distress is similar to that of South Asia i.e five percent. While the present section delved in the private sector paticipation in select sectors of infrastructure, the ensuing section focusses on the private sector participation in urban water supply.

3.2.3 Private Sector Participation in Urban Water Supply at the Global Level

The present section particularly focusses on private sector participation in urban water supply around the world. Literature review has shown that the major PSP projects in urban water supply are largely restricted to Latin America, South East Asia, Eastern Europe and Africa. Disaggregated data for water supply projects is not available in the public domain thus PSP in both water and sewerage has been taken. An attempt has been made to disaggregate the PSP in water supply and sewerage data into time periods.

Table 3.2: Details of PSP in Water Supply and Sewerage at the Global Level: 1990-2015

Components	**1990-2015**	**1995-2015**	**2000-2015**	**2005-2015**	**2010-2015**
No.of Countries with Private participation	64	63	56	35	19
Region with largest investment share	Latin America and Caribbean (49%)	Latin America and Caribbean (48%)	Latin America and Caribbean (49 %)	Latin America and Caribbean (54%)	Latin America and Caribbean (76%)
Type of PSP with largest share in investments	Concession (62%)	Concession (58%)	Concession (55%)	Concession (45%)	Concession (54%)
Type of PSP with largest share in projects	Concession (40%)	Concession (40%)	Concession (43%)	Concession (50%)	Concession (42%)
Projects cancelled	63	56	23	4	0

Source:Compiled from http://ppi.worldbank.org/snapshots/sector/water-and-sewerage accessed on 11.07.2016

There were 64 countries in the period 1990-2015 which had PSP in water supply and sewerage. Latin America and Caribbean had the largest share of investment (49 percent). Concession (40 percent) was the most popular form of PSP contract. The period 1995-2000 witnessed the highest number of project cancellations. Thirty-three projects were cancelled during this period. This was also the initial period and there was stiff civic resistance and several public protests. There has been the least number of cancelled projects in the latter part of the 1990-2015 period i.e in 2010-2015.

The present section gave an insight into the predominance of country, sector, type of contract in the PSP that is taking place all over the world. It gave a macro view of the global scenario. The next section focuses on the salient features of some of the major private sector projects in the world which have given shape to the present discourse on privatisation.

3.2.4 PSP in Water Supply and Distribution over Time and Space : A Global Perspective

In the 1980s, privatisation came to be seen as the only alternative to poor state of affairs in the government sector. In almost all cases, selling of water utilities to private players or their involvement was part of the bigger picture of liberalising the economy. In 1989, the privatisation of water supply and distribution in England in the regime of the then Prime Minister, Thatcher set the ball rolling and the next decade saw several attempts at privatisation, both succesful and unsuccessful. The 1990s was a decade which witnessed the dissolution of the Soviet Union, more emphasis on market policies and the emergence of International Monetary Fund (IMF) and the World Bank as key agents through conditionality for lending. There is a distinct pattern in the way privatisation of water supply has spread across the world. Privatisation efforts of water across countries also coincides with the state of economy in those countries, more so for the countries of the Global South.

Europe

Many of the European countries have had an on and off experience with private provisioning of water supply and distribution since 1800s. Barcelona, Spain is an example of one of the oldest private water systems having started in 1877. Societe

General Des Eaux de Barcelonne (Agbar) began as a Belgian company, was bought over by Lyonnaise des Eaux which was further bought by Catalan banks in 1920s **(Molina 2003 cit. in Juuti, 2005).** The Dutch water utilities were largely privately owned till the 1920s after which most them were municipalised. While the company owned all the assets, the tariff and the service conditions were fixed by the City Council. In Netherlands, after experimenting with both private and public ownership, water utilities have been publicly owned but run on commercial principles **(Blokland 1999 in Juuti, 2005).** In France, contracting out of water provision service is very common. A municipality or a group of municipalities can contract out the services utilising any of the service production model. Three regimes have been recognised in the water management history of France;the concession period (1848-1900) where the investment and operation was the responsibility of private players with low connection rate, Regie period where the investment and operation was done by Municipalities with the connection rate increasing from 2 percent in 1900 to 65 percent in 1950 and 90 percent in 1970, the affermage period (1970 onwards) **(Pezon 2003 cit. in Juuti, 2005).** The strong presence of private players in the water sector in France is often attributed to a large number of small municipalities in France. More than 500 contracts expire annually, about 20 percent are reconsidered to be re-municipalised but only about one percent are remunicipalised **(Desmars 2003 cit. in Juuti, 2005).** While the mentioned cases were much before 1990, but the French history of private water utilities is important as some of the most important private utilities today are of French origin and the French type of contract is more common in today's world.

The turning point in the history of corporate privatisation of water supply and distribution was the re-privatisation of the water sector in England and Wales.It assumes special significance as with it, began the trend of corporate privatisation in other countries. Originally, the government solely owned the companies, then they were privatised by floating shares **(Juuti & Katko, 2005).** The 1990s witnessed a spurt in the privatisation efforts all over the world. These were largely concentrated in countries which were experiencing economic or political upheaval. Full privatisation or private operation and management of water utilities was a recurrent theme across countries of Central and Eastern Europe through the decade of 1990.These countries witnessed a major paradigm shift after the disintegration of USSR in early 1990s. The water utility of the town of Gdansk, Poland got public private partnership in the form of a 30 year lease contract to SAUR in 1992 **(Allouche & Finger, 2002)**. Water utilities in Szeged and Budapest, Hungary underwent privatisation in 1994 and 1997 respectively preceeded by transfer of state ownership to Municipal in 1992-93 in Budapest. In 1993, the administration of water utilities was tranferred from monopolies to municipal in Czech Republic **(Juuti et al, 2005).** In 1997, a ten year operation and management contract was given to Suez for the city of Antalya **(Cinar 2009 cit. in Harris & Islar, 2014).** Concessions were handed out in Prague and in 23 other cities in 2001 and four cities of Romania in 2000. In 2000, Berlin's water company Berlinwasser gained a 30-year concession in Elbasan, Albania **(Juuti et al, 2005).**

The German cities witnessed privatisation of their water utilities in late 1990s. Berlin's water utility was privatised in 1999 and need for money for budget deficit was cited as the reason for the move **(Juuti, 2005).** The main reasons for the move were to improve services and lack of funding.

In Italy, private sector players, mainly English and French were very active in developing the first water networks from the middle to the end of the 19th century. The municipalisation movement ensured the decline in the share held by the private players to 4-5 percent by the 1980s. Profits were also undermined by anti-inflation policies **(Guffanti, Merelli, 1997 cit. in Juuti, 2005).** Again, there has been an increase in the 21st century. In 1999, the town of Arezzo, Italy awarded a 25 year concession to Suez led consortium. It was renegotiated in 2003. Bologna's (Italy) utility was listed on the stock exchange in 2003. It is partly owned by the private sector.

Africa

In the African continent, the projects were largely awarded in the period 1990-2000. The countries in North Africa, mainly Oran, Annaba, Constantine in Algeria and Rabat, Tangiers-Tetouan (23 municipalities) and Casablanca in Morocco underwent PSP through management contracts in 2005-08 and concessions in 1997-2002 respectively. Central African countries also has had its tryst with PSP in urban water beginning 1989, where Guinea (1989), Central African Republic (1991), Senegal (1996), Gabon (1997) Chad (2000), Congo (2002); have private players supplying water. PSP was initiated in Cape Verde, Mali (2000), Niger (2001), Burkina Faso (2001); i.e the countries of Francophone Western Africa. There was a spurt in the PSP attempts in 1999 with

Dolphin coast (South Africa), Nelspruit (South Africa) Maputo (Mozambique), Motola (Mozambique) undergoing PSP in that year. Sub- Saharan Africa is considered as a high risk area for private investment, thus are unable to attract private companies. Most consumers also cannot pay tariffs high enough for adequate returns **(Budds & McGranahan, 2003).** The African Development Bank has actively pushed for PSP stating that investments from private companies can fill in for the deficit in national budgets and users paying for water is an important way for them to value water **(Is the stage being set for new water wars in Africa, 2010).** It has attracted much criticism in a continent where nearly 2000 children die from diarhea every day **(Is the stage being set for new water wars in Africa, 2010).**

South America

PSP in water supply in cities of South America was introduced in the latter half of the 1990s. Buenos Aires, Argentina (1993); Cochabamba, Bolivia (1999), La Paz (1997), Puerto Rico (1995) and Chile (1998-2005). Each of these projects have charted their own path. Cochabamba, Bolivia project has been one of the most written about PSP projects in the world. Large cities with a substantial middle class has been an attractive factor for private investment **(Budds & McGranahan, 2003).** Besides the presence of the transnational water companies, there is a strong presence of the local companies also **(Budds & McGranahan, 2003).**

South East Asia and China

PSP in the water sector entered South East Asia in the late 1980s. Manila (Philipines), Jakarta (Indonesia) and Kuala Lumpur (Malaysia) led the way in the region. In Malaysia, PSP in the water sector began in 1987. Full privatisation was done for Johor while PSP was introduced in Kedah, Negeri Sembelan, Sabah, Perak and Selangor; the higher urbanised states of Malaysia **(Tan, 2015)** . In Indonesia, although the formal privatisation began in the mid 1990s, the preparations started much earlier.World Bank extended a loan of $92 million to improve the infrastructure of Jakarta PAM Jaya and this opened up the water utilities of Jakarta for entry of private players in 1998. In the same year, US $300 million was appoved by the World Bank to the Indonesian Government. The third tranche of $150 million led to the passing of the New Water Management bill in 2003 **(Siregar, 2004).** Manila’s water works was privatised in 1997.

The Water Crisis Act was passed in 1995 by the Phillipine Congress, after which privatisation was fastened.

China has had a socialist regime characterised by nationalised ownership since 1949. The first development of the private sector took place in the 1970s. This was restricted to non-infrastructure. In the mid-1990s, Government introduced PSP in infrastructure through BOT **(Zhong et al, 2008).**

South Asia

PSP in the urban water sector in South Asia as a region has been limited. Among all the South Asian countries, India has had the highest number of PSP projects in the water sector. PSP was introduced in the Indian water sector in the mid 1990s. Karachi in Pakistan was another city where an attempt was made to introduce PSP by the World Bank in the water sector in the mid 1990s, but was unsuccessful **(Hasan, 2001).**

3.2.4 The Drivers of Private Sector Participation in Urban Water Sector: A Spatial Analysis

The driver for private sector participation in water sector varies across regions mainly due to different socio-political conditions. Although, the main crux of initiating PSP revolves around the incapability of the utilities to further rehabilitate and upgrade the system and thus their inability to improve coverage and quality.

In the Western European countries such as UK and Wales and Germany, where privatisation in the water sector has been implemented in some form, austerity measures and hope for a "slim state" were largely responsible for the initiatives. In England and Wales, during the oil crisis of the 1970s,the Central Government cut down its financing to Regional Water Authorities drastically. At the same time, the Regional Water Authorities were not allowed to borrow for capital projects. This was in tandem with the wave of neoliberalism sweeping the western countries. It could also be argued that it was a part of the larger picture of declining role of the State in utility provision. This was part of the larger government strategy of privatisation of ownership and management of public assets. In both the cases of UK, Wales and Germany, the privatisation efforts were led and driven by political leaders; Margeret Thatcher, the then Prime Minister of UK and Annette Fugmann-Heesing, Head Financial Administrator of the Berlin senate in the case of Berlin. In UK and Wales, during the 1980s, there was restriction on borrowing on public spending. It became a challenge to fund asset improvement and maintenance, while at the same time there was increasing pressure of adhering to the high quality standards set by European Union. In the case of the Berlin, water privatisation as a legal option for enterprenurial action was introduced in 1995 opening the doors for partial privatisation. The utility (Berliner Wasserbetriebe-BWB) was privatised in 1999 with RWE and Vivendi buying 49.9 percent shares of BWB **(Werle, 2004).**

Contrary to the western countries, PSP in urban water supply in the developing countries has been driven by the International Financial Institutions as a part of conditional lending **(Hall, 2008).** African countries with their war torn history and debt ridden economies have been at the receiving end of such conditional loans. The main justification for the structural adjustment programmes has been to introduce poverty reduction initiatives for efficient and effective access to clean drinking water, particularly for the poor in these countries. The World Bank's role in promoting privatisation has been rather direct **(Bakker, 2003).** Private sector participation has become a pre-requisite for loans from the World Bank **(Grusky, 2007).** The African countries provided the ideal conditions for implementation of these reforms as most of the countries were heavily in debt by the 1990s and had weak economic structures. These countries also have a large share of poor people relying largely on informal water suppliers for their daily water. The World Bank or the other IFIs such as DFID, IMF, African Development Bank, European Investment Bank have had a strong presence in promoting PSP in countries such as Dar es Salam, Tanzania, Accra, Ghana;Maputo, Mozambique;Conakry, Guinea; Dakar, Senegal and the cities of Algeria **(Bayliss, 2000; Nellis, 2005; Harris, 2013).**

Other than the role played by the IFIs in promoting PSP, other conditions in Africa also provided a conducive environment for the coming in of private players. In Mozambique, 10 year liberation war followed by 15 year insurgency had left the water supply system in a bad shape. In 1999, concessions were awarded to SAUR for the cities of the country. It was part of the bail out programme of World Bank **(Zandamela, 2001).** Morocco had one of the worst debt in the world at the end of 1970s. A structural adjustment plan was rolled out in 1983 by IMF and WB. In 1989, Morocco adopted a law designating 112 public enterprises for privatisation.Many of the well performing assets were also put up for sale **(Catusse, 2011).** Private players were brought in to improve the service record of all the four cities. Consortium led by Suez was hired, but without any competitive tendering and at the behest of King Hussain. Privatisation in Dakar, Senegal (1993) has been touted as one of the successful privatisation efforts. The water utility was under private ownership in 1960 but was later nationalised. In 1983, SONEES, a supervisory utility was created which had little autonomy. Private sector was brought in to bring in more managerial autonomy to improve efficiency and productivity. International Development Association, an arm of World Bank had been involved in the Senegalese water sector in the past and continued to extend support in this reform as well **(Bayliss, 2008).** In the case of South Africa, the country had just emerged from apartheid when private participation in the water sector was introduced. This period also coincided with reduced spending on capital infrastructure and at the same time, a marked difference in infrastructure status between the white and the non-white areas **(Chetty et al, 2014).**

In Latin America, Bolivia and Chile underwent privatisation after the end of military rule. It was part of the structural reforms and was introduced to prevent economic meltdown **(Kommives**, **2001).** In Puerto Rico, water privatisation was a part of the larger scheme of other public entities getting privatised with a strong narrative of inefficiency of the public sector being dominant **(Hall, 2002).** Argentina was afflicted with a deep economic crisis in the late 1980s coupled with hyperinflation. Privatisation was sold to the people as an anti-inflation tool by the Menem Government **(Loftus, 2001).**

In Eastern Europe, the breakdown of USSR was a major factor in the private companies moving in. The utilities were left financially weak without support from USSR and their inability to raise finance was an important trigger for concessions **(Lipton 1993, Allouche & Finger, 2002).**

In South East Asian countries, the reason largely has been poor financial condition of the utilities restricting their ability to expand and ugrade network. For instance, the Jakarta city government utility, PAM Jaya had been on losses without any enterprise reform and had run up a huge debt. The private companies paid off the debt of $231 million in lieu of private wells being shut down and the residents being forced to buy water from the consortia **(Siregar, 2004).** As a part of the water sector reform program under the World Bank, PT Pam Lyonnaise Jaya and PT Thames Pam Jaya have been operating the water supply since 1998. In the case of Manila, Phillipines, the Metropolitan Waterworks and Sewerage System (MWSS) had very high water losses to the tune of 60 percent, much more than the major cities of the other South East Asian countries. The utility was heavily under debt in loans from ADB, World Bank and Japan Bank for International Cooperation. The privatisation effort were driven by the then President Fidel Ramos under the garb of a water crisis **(Dumol, 2000).** In Malaysia, water privatisation began in 1987 and was promoted as a solution for low efficiency, escalating costs and low tariffs **(Tan, 2012).** The role of IFIs in South East Asia has been very strong. Introduction of PSP in the urban water sector of China was in tandem with the privatisation taking place in other sectors. The rapid economic development, following the embracing of private ownership in some key sectors, has put pressure on the country's water resources. Inefficient management, advanced technology, lack of capital have been cited as the reasons for bringing in PSP in the water sector **(Globalisation Monitor, 2011).** Again, China has been one of the largest recipients of World Bank loans in the water sector **(Lee, 2006).**

On the basis of the review of history of water privatisation in various regions and countries, the major reasons for bringing in private players into the water sector can be summarised as:

- The countries being in debt and the IFIs giving conditional loans based on the promise to introduce and implement structural reforms to bail out these countries.
- Countries emerging from strife or political instability and wanting to join back the civil mainstream.
- A few of the privatisation initiatives were taken because of the belief of the ruling party and was often driven by a leader.
- Reduction in government spending and introduction of austerity measures was a reason in many of the western countries to get private players in the water sector.

3.2.5 Dominance of Type of Private Sector Participation

There are various management structures in the urban water supply. It primarily refers to the kind of contract between the private player and the Government.

Management Structures in the Urban Water Supply

a) State owned and operated -The State has full control and ownership on the distribution, operation and management of the water supply system.

b) Short Term Service Contract – The State has full control over the management of the utility but contracts out certain functions like meter replacement, laying water pipes etc to private companies on a non-regular basis.

c) Long Term Service Contract- The State has full control over the management of the utility but contracts out certain functions like regular supply of chemicals, maintenance or repair of water pipes etc to private companies on a regular basis.

d) Public Private Partnership (PPP) means an arrangement between a government / statutory entity / government owned entity on one side and a private sector entity on the other, for the provision of public assets and/or public services, through investments being made and/or management being undertaken by the private sector entity, for a specified period of time, where there is well defined allocation of risk between the private sector and the public entity and the private entity receives performance linked payments that conform (or are benchmarked) to specified and pre-determined performance standards, measurable by the public entity or its representative.

Common Forms of PPP

Build-Operate-Transfer (BOT) - The BOT model is the most common form of PPP in India accounting for two-third of the PPP projects. Two common BOT models are: a) User-fee based BOT model- Commonly used in medium- to large-scale PPPs for the energy and transport sub-sectors (road, ports and airports) and b) annuity-based BOT model; commonly used in sectors/projects not meant for cost recovery through user charges such as rural, urban, health and education sector.

Modified design-build (turnkey) contracts- In traditional Design-Build (DB) contract, private contractor is engaged for a fixed-fee payment on completion. The primary benefits of DB contracts include time and cost savings, efficient risk-sharing and improved quality. Government may consider a Turnkey DB approach with the payments linked to achievement of tangible intermediate construction milestones (instead of lump-sum payment on completion) and short period maintenance / repair responsibilities

Performance Based Management/ Maintenance contracts -In an environment of constrained economic resources, PPP that improves efficiency will be all the more relevant. PPP models such as performance based management/maintenance contracts are encouraged. Sectors amenable for such models include water supply, sanitation, solid waste management, road maintenance etc.

e) Privately owned and operated- Control and ownership of the water supply system is under a private company.

In the urban water sector, irrespective of the region, concessions are the most popular form of contract with two prominent cases of divestiture in UK and Chile. Africa has a mix of different type of private-public sector contracts. Johannesburg and Nelspruit in South Africa and Accra in Ghana, Nairobi, Algeria and Chad had management contracts. Dolphin Coast (South Africa), Mali, Mozambique, Morocco had concession agreements. Queenstown,Stutterheim, Fort Beufort all cities on the Eastern Cape of South Africa along with Tanzania, Guinea, Central African Republic and Niger had lease agreements. The management structures are also determined by the type of service rendered by the private player. Mostly, concessions and lease are reserved for long term water supply and distribution projects while BOT and its variants are reserved for only bulk water supply. Operation and Management contracts are preferred in countries with high risk of currency instability and payment default by customers as this involves the least degree of participation from the private player, on the other hand concessions involve high risk. To minimise losses, there is is a trend towards waste water contracts rather than water contracts as the latter are more politically charged. The private companies are also focussing on key areas and withdrawing from others **(OECD, 2007)**

3.2.6 Outcomes of Water Privatisation

The broad outcomes of water privatisation has been categorised into two sections- positive and negative represented through some important examples. One single project might have had both positive and negative results.

a)Positive Outcomes

In most of the cases, the positive outcome is related to the financial health in the form of increase in metering, reduction in unaccounted for water and improved billing and fee collection, improvement in customer response and in some cases improvement in coverage.

Some of the African cities such as Nelspruit; South Africa and Conakry;Guinea experienced substantial increase in metering with the latter reporting percentage of metered households as 5 percent before privatisation to 98 percent after **(Penelope & Smith, 2001).** Many cities also reported a considerable decline in non-revenue water such as Rabat, Morocco in which NRW reduced from 25 percent to 19 percent in six years after privatisation **(Marin, 2009)** and Dakar, Senegal in which it reduced from 31 percent to 22 percent. In a study comprising two cities with privatised services (La Paz and El Alto) and two with public services Santa Cruz and Cochabamba), the findings revealed that cities with private systems performed better with respect to coverage and percentage of income being spent by households on water **(Cox, 2013)**

b)Negative Outcomes

The negative outcomes have largely been of the following type:a) tariff increase b) disconnection due to non-payment c) issue with meters d) Neglect of the low income areas e) absence of competitive tendering thus higher chances of corruption f) alteration of contracts after finalisation and g) delay or cancellation of the promised investment by the private player. Many of the projects have had two or more of these issues.

While tariff increase has been a common thread among all the private projects across the world, there have been other issues as well. South African cities represent some of the worst instances of water privatisation results. In Johannesburg, pre-paid meters were introduced to deal with payment defaults by poor customers. The connection would be cut after the 6 kl of water allocation per month per household would get over unless more water credit was purchased. This 6 kl per month per household was not enough for the poor households **(Bond & Dugard, 2008).** Many poor households started using unclean water, there was a cholera epidemic in the year 2000-2001 **(McDonald, 2006).** In the other South African cities such as Nelspruit, Dolphin coast and Stutterheim, there was an increase in tariff of 400 percent, 15 percent and 200 percent respectively. In Conakry, Guinea; along with tariff rise, connections were also cut if bill was unpaid for more than three months. Focus was only on improved billing and not on reducing non-revenue water or increasing connections. In Nelspruit, South Africa, meters were such that they would start recording, the moment the tap was turned on with or without water flow **(Cox, 2013).** Some cities such as Nairobi in Kenya, Rabat in Morocco faced low levels of expansion in the low income areas which mainly implied inequity in access to water based on ability to pay. Jakarta, Indonesia faced a 40 percent price hike without any improvement in service. Projects without competitive bidding has also been an issue in some of the cities such as Jakarta and Kuala Lumpur, Malaysia. In the case of Puerto Rico and Buenos Aires, Argentina; the contracts were re-negotiated in favour of the private player after their finalisation. In some cities such as Buenos Aires, investment agreed upon by the Government and private player were cancelled.

3.2.8 Trend of Remunicipalisation of Water Utilities

Remunicipalisation is a process is which the responsibility and charge of supplying and distributing water goes back to a public utility after a stint with privatisation. There has been a growing trend of remunicipalisation of water utilities. While in some cases, contracts have been terminated, in others they have not been renewed. From 2000 to 2014, there have been 180 cases of remunicipalisation; 136 from high income countries and 44 cases from low and middle income countries **(Hall & Lobina, 2008) .**Major cities that have remunicipalised include Berlin (Germany), Accra (Ghana), Buenos Aires (Argentina), Budapest (Hungary), Maputo (Mozambique), Kuala Lumpur *(*Malaysia*)*, La Paz (Bolivia), and Paris (France).

The past experience in several countries involving high tariff increase such that water, which is a lifeline good, went out of reach of the poor and the vulnerable section of the society, private players not honouring contracts, low investments in infrastructure by private companies, workforce reduction etc contributed to the remunicipalisation efforts. Many cities also have also experienced large scale public protests to discontinue these projects. On the other hand, the remunicipalisation efforts are often discouraged by the international donor agencies **(Pigeon et al, 2012).**

3.2.9 Best Practices in the Public Sector Water Utilties: A Perspective of the Global South through Case Studies

A review of the global literature has shown that there are problems with both privatised and public system of water supply. In the developing countries of the world where privatisation in the water sector has been pursued with much zeal and enthusiasm, the services rendered by the public water utilities have been much below par. Yet, there are some cities in the developing world which have shown that certain practices can make even the public sector utilities perform well. The present section seeks to review two such case studies and understand the nature of components which are capable of turning around a public utility.

Pnom Penh, Cambodia

Pnom Penh presents an example of bringing in full cost recovery to turnaround the level of service provided by a public water utility. It is also an example of how corporatisaion of public sector utilities can bring in the same results as expected from private companies. Financial and institutional reforms were implemented to improve the services of Pnom Penh Water Supply Authority (PPWSA) in 1993. Several steps were taken to streamline the services such as enforcement of bill payment, regularisation of illegal connections, introduction of metering, reduction of UFW, greater autonomy of the utility in personnel and financial matters. By 2004, the coverage had increased to 90 percent from 25 percent in 1993, supply had become continuous from intermittent supply at good pressure. While the tariff was increased, it was calcuated to cover the total expenditure of PPSWA. The poor benefited as they got piped water at lower costs than what they were paying to private vendors. With reduced UFW, there was an increase in efficiency in billing of water from 30 percent in 1993 to 90 percent in 2005. In 1995, a fully updated database of customers was established eliminating corruption. To enable the poor to access water, infrastructure was upgraded and pipelines laid in the low income areas. Subsidies were also provided on the connection fee with the help of International Development Institutions.

Singapore

Singapore has one of the most successful public water utilities; namely the Public Utility Board (PUB) in the world. Once dependent on Malaysia for water, it produces most of its water now through various methods such as desalination, water reuse, building dams etc. It has also been seen as a national security issue after once, Malaysia threatened to cut off water supply if Singapore's foreign policy was against Malaysia's interest. In 1965, Singapore had only three reservoirs to meet 20 percent of its water demand. It has come a long way since then, extending water and sanitation to its entire population. The entire water system is metered right from the beginning to the consumer.The percentage share of unaccounted for water is one of the lowest in the world i.e only five percent (2004). Monthly bill efficiency is also extremely high at 99 percent. Singapore is also one of the countries which extensively uses the services of private players through service contracts.

3.3 A BACKGROUND TO PRIVATE SECTOR PARTICIPATION IN THE INFRASTRUCTURE SECTOR IN INDIA

Post-independence, India followed the socialist model of development with a top down welfare approach. International aid and loans were an important driver of the development agenda. For several years after independence dams remained the panacea for solving water problem. The 1970's decade witnessed the rise of environmentalism which also influenced the way policies shaped up in India.

With the dissolution of USSR in 1991, the socialist ideology also suffered a setback. The neoliberal ideology became even stronger and this period saw the rise of International Funding agencies such as the IMF and World Bank.This was also the time when many of the developing countries including India were running into high debt and the lending agencies had started pushing for structural reforms. As a continuation of these reforms, the World Bank advocated for reduction of the role of government from being a provider to that of a facilitator and regulator. The failure on the part of the Governments to adequately deal with the challenges of water provisioning forced a change in the Banks' approach from a supply driven to a demand driven approach. Full cost recovery along with the poor willing to pay for better services became an important part of the narrative. The argument revolved around the poor benefiting from piped water supply at home in the form of more free time which could be used productively and lower expenditure on water than paying to private vendors. With India becoming a part of the globalised economy in 1992, divestiture of public sector units and active involvement of the private players, in sectors which were earlier the prerogative of the Government, got firmly established.The concept of unbundling was introduced in order to introduce competition in the otherwise monopolistic sector like electricity and water.

The increased participation of private sector is endorsed by the important decision making bodies such as the Planning Commission, Ministry of Water Rsources and Ministry of Urban Development. In the Ninth Five Year Plan (1997-2002), Drinking water and sanitation was accorded importance for "Health for All" through provision of basic infrastructural faciltiies. BOO-BOOT-BOT was to be encouraged in infrastructure development and the concept of recovery of full cost was also brought into the Plan. The Plan also laid emphasis on the active shift of Government from provider to enabler reflecting the global economic scenario of that time. Again, in the 11th Five Year Plan (2007-2012), there was renewed focus on private sector participation in the infrastructure sector. The Ministry of Urban Development launched Jawaharlal Nehru Urban Renewal Mission (JNNURM) in 2005, where again private public partnerships were given great importance for projects related to drinking water, sanitation etc. The World Bank and ADB had dealt directly with the state government in giving loans for projects which also involved structural adjustment programmes. The Bank noted that the move to focus large-scale integrated investment packages on the few states willing to undertake public sector expenditure reform gave the bank much leverage than it had before **(Asthana, 2009).**

3.4 PRIVATE SECTOR PARTICIPATION IN SELECT INFRASTRUCTURE SECTORS IN INDIA

Before embarking on the analysis for private sector participation in the urban water sector, it is important to understand how PSP has played out in the different states of India for all the sectors. A total of 2599 projects comprising government infrastructure projects (PPP) and private sector infrastructure projects has been taken for this analysis. They have been listed on the government website for infrastructure database in India. These projects mainly comprise government infrastructure projects (PPP) of above 5 Crore INR and private sector infrastructure projects above 50 crore. Though, many projects would not be a part of this list, this is the best available database in public domain. The PPP projects are the ones that were either in pre-construction stage or under construction stage or operation and maintenance stage and completed as on April 2011 or awarded thereafter till February 2017. The private sector projects refer to projects under construction as on April 1,2012 or awarded thereafter.

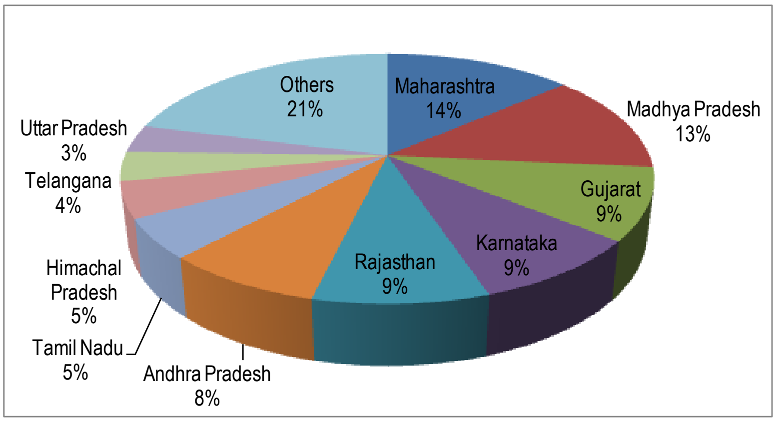


Figure 3.7: Share of PSP Projects (Number) by State : All Sectors (2017)

Source: https://infrastructureindia.gov.in

In terms of the number of projects, Maharashtra (14 percent) followed by Madhya Pradesh (13 percent), Gujarat (9 percent) ,Karnataka (9 percent), Rajasthan (9 percent) and Andhra Pradesh (8 percent) are the foremost in terms of the percentage share of the total projects.

Analysis of the state wise number of projects through PPP and private sector as a percentage share of total projects revealed that the figures for Himachal Pradesh (66.9 percent) followed by Punjab (53.5 percent) and Sikkim (51.4 percent) were the highest while the figures for Bihar (7.7 Percent), Assam (8.7 percent) and Jharkhand (9.5 percent) were the lowest implying that private investment avoids the less developed states. Madhya Pradesh and Rajasthan are anomalies in this with both of them having high share of Indian PPP projects despite being less developed states. In the case of Rajasthan, PPP is being promoted from the top by the State Government **(Jain, 2015)** and both these states have taken initiatives to promote PPP based high development **(FICCI & E&Y, 2012).**

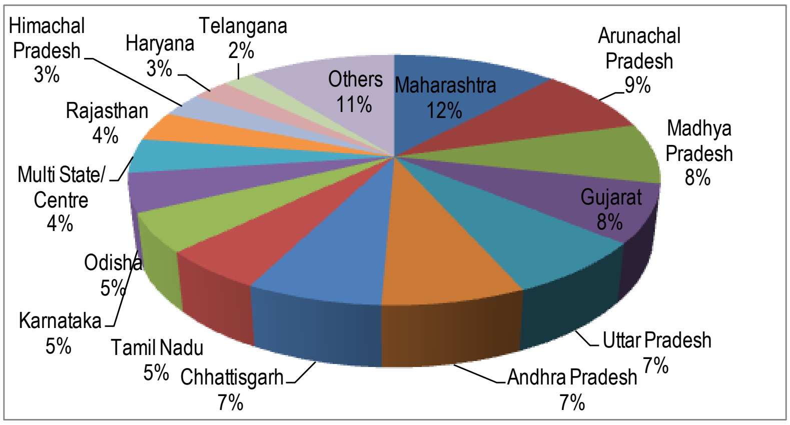


Figure 3.8: Share of PSP Projects (Project cost) by State : All Sectors (2017)

Source: https://infrastructureindia.gov.in

The total project cost of all the projects is INR 17,59,153.82 Crores. Among the states, Maharashtra has the largest share followed by Arunachal Pradesh (9 percent), Madhya Pradesh (8 percent) and Gujarat (8 percent). Arunachal Pradesh is a surprise element here but can be explained by the type of projects in the state. Out of the 20 projects in Arunachal Pradesh, 17 are hydro-electric projects which involve high costs as compared to the other sectors.

Looking at the state wise cost of projects through PPP and private sector as a percentage share of cost of total projects, Arunachal Pradesh (91.51 percent) and Chhattisgarh (63.02 percent) lead the way while Assam (4.24 percent), Bihar (11.79 percent) and Meghalaya (9.44 percent) have the lowest figures. Nearly 85 percent of the projects in both Arunachal Pradesh and Chhattisgarh are energy based. The difference being that in the former, they are hydroelectricity projects while in the latter they are thermal power plant projects.

An analysis of the share of projects in each of the infrastructure sectors in terms of number of projects and project cost is given figure 3.9 and figure 3.10 respectively.

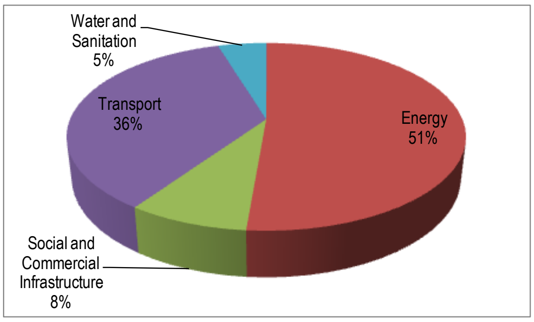


Figure 3.9: Share of Infrastructure Sectors : Number of Projects (2017)

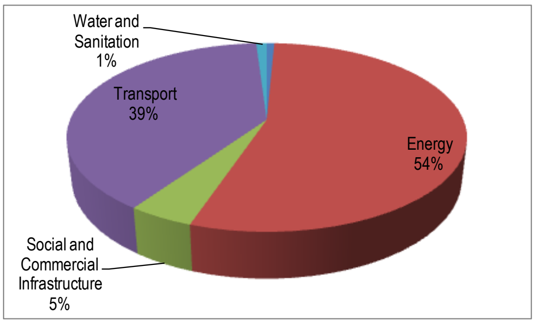


Figure 3.10: Share of Infrastructure Sectors : Project Cost (2017)

Source: https://infrastructureindia.gov.in

With respect to both number of projects and the project cost, the share of water and sanitation projects is very less as compared to the other sectors as seen in figure 3.9 and figure 3.10. While, in the macro-scenario, water and sanitation might be of miniscule importance, it assumes gigantic proportions given the criticality of the sector in ensuring basic human right, dignity and health.

3.5 TRENDS AND PATTERN IN PSP IN PUBLIC URBAN WATER SUPPLY IN INDIA

PSP in urban water in India is still at a nascent stage, as a result, there is very little literature or data available for this sector. To understand the developments in this sector, a sample of projects were taken, information for which was available in the public domain. All efforts were made to include as many projects as possible. Mainly bulk supply and water distribution projects were selected.Projects which involved operation and management of the entire bulk water or distribution network system were only taken for the exercise, thus purely Engineering Procurement Construction (EPC) Projects were excluded. Projects which were formally awarded and had reached financial closure have been included. By default, the projects in the urban water sector are PPP projects. Eventually, analysis was done for 39 projects spanning 15 years (2000 – 2015). (Refer Appendix 3.1). The status of these projects has been updated till 04.03.2017. These 15 years have been divided into three phases; 2000-2005, 2006-2009, 2010-2015. The year of 2005 can be considered a watershed year in the history of infrastructure financing with Jawaharal Nehru National Urban Mission (JNNURM) being launched in December in that year. Although, some projects such as in Pune,Hyderabad, Goa and Bangalore were mooted in the mid-1990s, they were scrapped before being awarded. The reasons being high unaffordable bulk water tariff and the subsequent political opposition and civil protests.

An analysis of the selected projects (31 no.) revealed that the period 2006-2010 and 2011-2015 witnessed the highest number of the PPP (Public Sector Participation) projects getting awarded in the urban water sector. This can also be attributed to the launch of JNNURM in 2005 which pushed for PPP in the infrastructure sector with an aim to improve service delivery. The PPP bent continues in AMRUT (Atal Mission for Rejuvenation and Urban Transformation). The number of projects remained high in 2011-2015 as the tempo of PPP in urban water supply picked up.

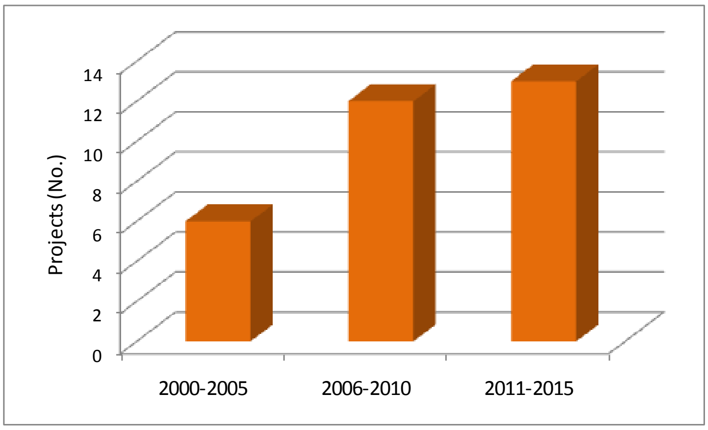


Figure 3.11: Trend in PPP in Public Water Supply: 2000 – 2015

Source: Official websites of private companies, World Bank (2011)

3.5.1 Regional Variation of PPP in Urban Water Sector in India

States of India show much variation in the award of PPP projects in water supply and distribution. States such as Maharashtra and Karnataka show a comparatively higher level of PPP while there are others which have had no experience in PPP in the water sector at all. The geographical spread of PPP in water supply and distribution is similar to that exhibited by all sectors, except that PPP in the water sector was introduced and has taken more time for getting accepted as compared to energy and road sectors.

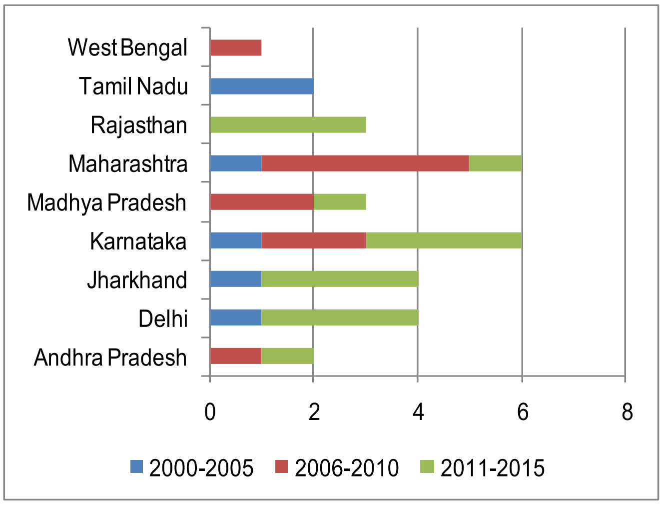


Figure 3.12: State wise Projects (PPP) in the Water Sector: 2000-2015

Source: Official websites of private companies, World Bank (2011)

The spatio-temporal pattern of PPP projects in the water sector is presented in figure 3.12. In 2000-2005, projects were awarded in Tamil Nadu, Maharashtra, Karnataka, Delhi and Jharkhand. The sole project in Jharkhand is in Jamshedpur but it is not a new project. Tata Steel Ltd. has been responsible for water supply and distribution in the Tata Township since 1909 in Jamshedpur. Jamshedpur Utilities and Service Company Limited (JUSCO) was created in 2004 as a sole water utility. The next phase (2006-2010) witnessed a spurt in PPP projects in water supply and distribution sector. With focus on private sector participation in JNNURM, a number of projects were awarded in states such as Jharkhand, Rajasthan, Madhya Pradesh, and West Bengal. Many of the projects awarded during this phase ran into trouble, probably implying that projects were hastily awarded without much ground work to avail the JNNURM funds. This phase also witnessed civil society protests against PPP in the water sector. The next phase (2011-2015) could be called a more mature phase with more stability in the award of projects and less number of projects running aground.

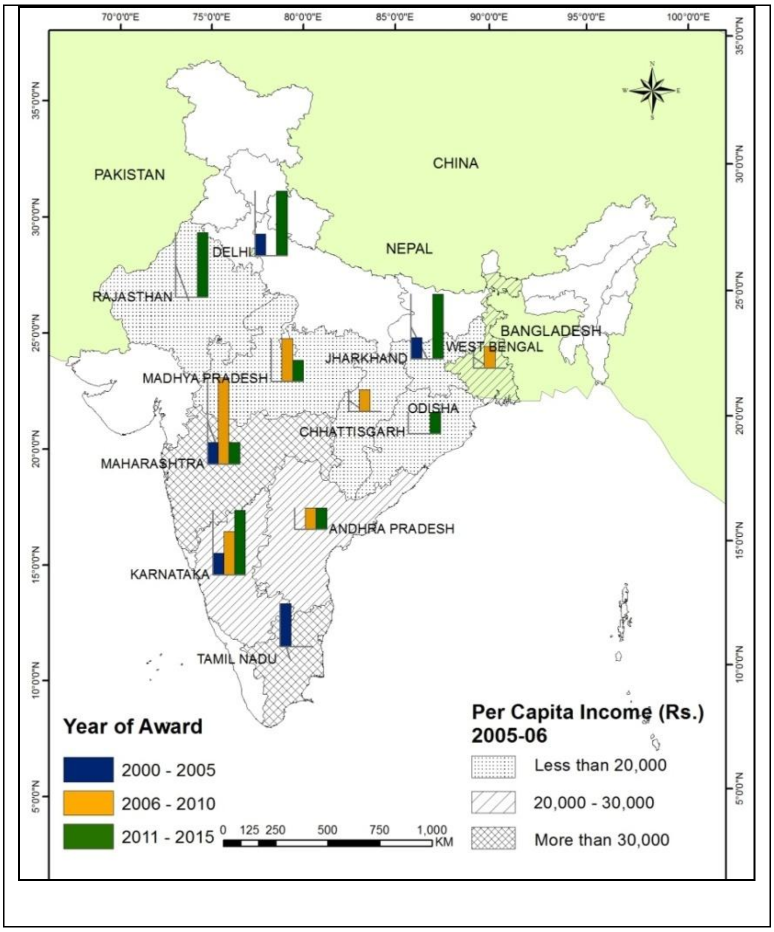
3.5.2 Factors Influencing Spatio-Temporal Variation in PPP in Urban Water Sector in India

Although PSP has been promoted in India through PPP embedded in various programmes, yet it shows a distinct pattern of geographical preference. The reasons which attract private investment to a state is complex and an interplay of several factors. Private companies look to invest in areas with low risk and high profits, which means that they would prefer to invest in states with better institutional and financial capacity to see the project through. Besides, simultaneously, there has been a reduction in budgetary allocation for water infrastructure and financial and institutional reforms have been introduced to improve the condition of the ailing utilities. There is a distinct pattern in the way PPP projects in the urban water sector have been introduced in the various states. An attempt has been made to explore and unravel the probable factors which played a role in initiation of PPP through understanding the conditions prevailing in the states where PPP has been introduced.

3.5.2.1 Per Capita Income of States

Per capita income and its association with various aspects of development is well documented in literature. Per capita income also has a two way association with infrastructure development. The contribution of physical infrastructure to economic growth and development comes through facilitating increase in investment, employment, output, and income in a chain of 'cumulative causation' **(Ghosh & De, 1998; Calderon et al, 2004).** Regional imbalance in infrastructure was found to be responsible for rising income disparity among states **(Ghosh & De, 1998).** On the other hand, states with higher per capita income invest more in infrastructure. In India, Maharashtra, Gujarat and Tamil Nadu have had high per capita income due to their industrial development while Punjab and Haryana have high per capita income because of their high agricultural output **(Nath, 2011).**

In map 3.1, the per capita income of the state (2005-06 at current prices) has been juxtaposed with the year of award to bring clarity into the phasing of PPP awards in the water sector. The per capita income for 2005-06 has been taken as it is the mid-point of the beginning year of the selected time periods (2000-2011) taken into consideration. Initially till 2005, development in the PPP water sector took place in the states with higher per capita income such as Delhi, Maharashtra and Tamil Nadu. PPP in the water sector was introduced in states with less per capita income mostly after 2006.



Map 3.1: Per Capita Income of the State (2005-06) and Year of Award of PPP Projects

Source: Official websites of private companies, World Bank (2011)

3.5.2.2 Budgetary Allocation for Public Water Supply

Deteriorating state finances along with limited capacity of ULBs to generate finances for investing in infrastructure has been one of the primary reasons for moving towards PPP **(Hoque, 2012).** The budgeted capital expenditure of some of the selected states is presented in table 3.3.to give clearer understanding of the trends in budget outlay for water and sanitation.

Table 3.3: Capital Expenditure for Water and Sanitation as Percentage Share of Total Development Outlay: Select States

S.No	States	2001-02 (Percent)	2005-06 (Percent)	2011-2012 (Percent)	2015-16 (Percent)
1	Andhra Pradesh	10.36	1.06	1.42	0.56
2	Bihar	5.82	11.73	3.93	5.09
3	Chhattisgarh	0.13	0.59	0.44	18.64
4	Gujarat	7.26	13.82	3.43	7.79
5	Haryana	16.10	9.80	22.27	18.64
6	Jharkhand	13.47	7.47	4.87	3.39
7	Karnataka	4.97	9.98	7.69	2.37
8	Kerala	-	-	0.94	1.49
9	Madhya Pradesh	0.13	4.20	7.20	7.35
10	Maharashtra	0.03	0.01	1.70	2.07
11	Odisha	4.34	10.17	3.64	2.92
12	Punjab	-	10.48	6.52	7.79
13	Rajasthan	28.32	23.52	17.18	23.18
14	Tamil Nadu	25.08	13.13	10.09	7.60
15	UP	-	1.89	2.52	4.74
16	West Bengal	0.64	11.14	-	1.55
17	INDIA (All states)	7.29	7.51	5.57	6.20

Source: State Finances: A Study of Budgets downloaded from https://rbidocs.rbi.org.in

Developmental outlay comprises social services and economic services. Water supply and sanitation is a part of the social services. Some of the states (Andhra Pradesh, Jharkhand, Tamil Nadu and Karnataka) have shown a disturbing trend of the percentage share declining over the years. On the contrary, the percentage share has increased in Maharashtra and Madhya Pradesh. In some states (Chhattisgarh, Punjab and Rajasthan), the percentage share declined till 2011-12 and increased again in 2015-16. In this context, the period of 2000-2005 is important as this was the time during which the narrative of State inefficiency in managing urban infrastructure was being built. The percentage share of capital expenditure for water and sanitation was dismal in some of the states such as Maharashtra (0.03 percent), Madhya Pradesh (0.13 percent), West Bengal (0.64 percent), Chhattisgarh (0.13 percent), Odisha (4.34 percent) and Karnataka (4.97 percent) in 2001-02.

3.5.2.3 Presence of International Financial Institutions in the States

Reflecting the global scenario, the presence of international donor agencies has also played an important role in the spatio-temporal pattern of award of projects in India. Out of the 31 projects considered, five have been directly funded by IFIs mainly the World Bank, JICA, ADB and USAID. Out of these five projects, three are in Karnataka (KUWASIP, Ilkal, TK Halli and Extension), one in Madhya Pradesh (Gwalior) and one in Tamil Nadu (Tiruppur).While the KUWASIP and Tiruppur were awarded prior to 2005, the rest were awarded afterwards. Although, the total number of projects funded by IFIs is only 16 percent of the total projects, it is clear that the IFIs have had a large hand at promoting PPP. Some of the earliest PPP attempts in the water sector were promoted by IFIs. The Government of India has also been working very closely with IFIs in the preparation of policies related to infrastructure and PPP.

Funds for projects may come from four sources: user pay charges, Government budget, private participation and loans or grants from donor agencies. Post 1990s, donor agencies have been giving conditional loans to promote private participation in infrastructure development. In India, among the various donor agencies, Asian Development Bank (ADB), World Bank, Japan International Cooperation Agency (JICA), Germany have a large footprint in the infrastructure sector. ADB has commitment to fund connectivity for six lagging states **(World Bank, 2010).** In 2014, a net total of USD 2984 Million was given as Official Development Assistance (ODA) to India. Among the ODA from OECD countries, International Development Agency (IDA); part of World Bank (32.5 percent), Japan (29.4 percent), Germany (16.02 percent), United Kingdom (9.8 percent) and France (3.10 percent) are the top donors. In 2014, Economic infrastructure (56.4 percent), of which water supply infrastructure is a part, had the largest share among all the sectors followed by the social sector (28.4 percent) **(OECD, 2014).**

There is a pattern in the cities and states which have received external funding from agencies like the World Bank and Asian Development Bank in the 10 years preceding the launch of JNNURM (1995-2005). While there are other multilateral agencies as well like JICA, DFID; WB and ADB have been the most active in the decade in consideration. In 1980, Municipal accounting reforms were initiated by the World Bank. The actual work started in 1990 in Gujarat. Thereon, external assistance in India seems to be skewed in favour of some states. Disbursement to states like Bihar, the north-eastern and special category states are negligible. In terms of disbursement, Andhra Pradesh, Maharashtra, West Bengal, UP and Tamil Nadu made up for nearly 34 percent of the total assistance in 1997-98. Andhra Pradesh, Uttar Pradesh, Gujarat, Tamil Nadu and West Bengal made up for 43.4 percent of the total disbursements in 2000-2001. In 2005-06, West Bengal, Gujarat, Karnataka, Andhra Pradesh, Rajasthan and Madhya Pradesh together comprised 31 percent of the disbursements **(Department of Economic Affairs, 2008).** Select states like Karnataka, Tamil Nadu, Gujarat, Rajasthan and Madhya Pradesh have implemented projects or undergone capacity building funded mainly by the World Bank and Asian Development Bank. Thus, the presence of donor agencies in the state seems to have bearings on the phasing of the award of the PPP projects in the water sector.

There has been a decline in the direct involvement of IFIs in the urban water sector at the project stage over the years. An argument could be that private sector involvement in the urban water sector along with other sectors has become an intrinsic part of India's national policies eliminating the need for direct involvement of IFIs. Initially, the conditional loans from IFIs were based on getting in private players, but now that has become the natural course of action allowing the IFIs to retreat.

3.5.2.4 Institutional Capacity to Implement PPP

Entry of the private player in the urban water sector has been preceded by implementation of institutional reforms. Among the states, there is variation in the implementation of institutional reforms. Some of the states such as Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Andhra Pradesh and Uttar Pradesh have been aggressively pushing for structural reforms in the water sector **(Warghade & Wagle, 2011).** Maharashtra was the first state to prepare a white paper on the drinking water supply programme and take initiatives for institutional reforms to improve its ULBs **(Pangare et al, n.d)**.

Parastatal organisations had been formulated as part of institutional reforms, to bring in more autonomy. Nearly 39 percent of the projects awarded have parastatal organisations as their implementing agency.

Table 3.4: Type of Implementing Agency of PPP Projects in the Indian Urban Water Sector

Type of Agency	2000-2005 (No.)	2006-2010 (No.)	2011-2015 (No.)	Total (No.)
Parastatal Organisation	3	4	5	12
ULB	1	6	3	10
Parastatal and ULB	1	1	-	2
PHED	-	1	4	5
Private	1	-	-	1
Institutional	-	-	1	1
Total	6	12	13	31

Source: Official websites of private companies, World Bank (2011)

Parastatal organisations led the way in awarding the first set of PPP projects in the urban water sector. Before the launch of JNNURM, nearly 50 percent of the projects were being implemented by parastatal organisations of Delhi, Karnataka and Tamil Nadu. The rest were divided between ULB (Chandrapur, Maharashtra), parastatal and ULB (Tiruppur, Tamil Nadu) and private (Jamshedpur, Jharkhand). The other agencies have caught up in the next two time periods. ULBs were the implementing agencies in 50 percent of the projects in 2006-2010.

3.5.2.5 Readiness for PPP: Policy Framework

A policy framework for PPP is part of the two way process in which a policy might be framed as a result of increase in PPP projects and thus to further facilitate the projects or as an initial action to convey to private actors that the state is ready for PPP projects. Although, PPP in various sectors is being driven by the various organisations of the Central Government such as Planning Commission, Committee on Infrastructure and the PPP unit of the Department of Economic Affairs, there is an absence of a final PPP policy at the Central level. A draft National Public Private Partnership Policy (2011) has been prepared and is under discussion. The various states have their own policies. Besides, many of the sectors where PPP is being initiated is in the State List such as public health, city roads, water and sanitation and irrigation. The year in which these policies were drafted also give an idea about the status of conducive nature of environment for PPP in these states. Gujarat, Andhra Pradesh and Punjab are some of the states which drafted policies as early as 1999, 2001 and 2002 to facilitate PPP in the infrastructure sector. Rajasthan, although, drafted its PPP policy in 2008, its first policy to facilitate PPP (BOT projects in the road sector) was formulated in 1994. States such as

Bihar and Orissa formulated their PPP policies after JNNURM was initiated in 2006 and 2007 respectively. Among the major states, West Bengal was one of the last states to formulate PPP policy in 2012 highlighting the initial resistance to PPP. The two anomalies which need special mention are Karnataka and Maharashtra. Both have been very pro-active in the PPP scene yet Karnataka does not have a separate PPP policy and Maharashtra started discussions on drafting its policy as late as 2010 after facing many issues with the concessionaires and is yet to finalise it. Although, Karnataka does not have a separate PPP policy, its Infrastructure Policy (2007) covers the PPP aspect.

3.5.2.6 Water as a Special Sector: An Ideological Perspective

PPP projects in the water sector form a miniscule part of the total PPP projects. Some of the states such as Gujarat, Rajasthan and Madhya Pradesh which have engaged with PPP in other sectors have only recently started introducing PPP in public water supply and distribution. PPP has been associated with privatisation of water in the past and several of the projects have also been abandoned due to civil society protests. Besides, water supply and distribution is a sector with one of the least amount of clarity in terms of infrastructure status and had initially experimented with various models which did not work out. Now, one of the simpler models of operation and management is popular in this sector and has been reasonably successful. The sector has recently started to mature and more PPP projects in the water sector might be expected in other states as well.

3.5.3 Hierarchical Position of Urban Centres with PSP Projects in the Water sector

An attempt has been made to understand the association between the type of urban centres, in terms of their hierarchical position (population), and award of PPP projects. The class of that centre in the year of award has been taken into account.

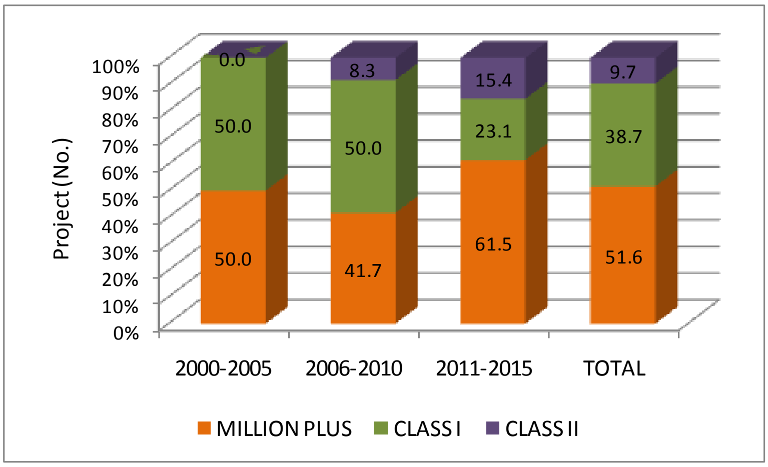


Figure 3.13: Hierarchical Position of Urban Centres (Population) with PPP Projects in the Water sector

Source: Official websites of private companies, World Bank (2011)

Out of the selected projects, a large share of PPP projects have been awarded in large cities with Million Plus and class I cities comprising nearly 90 percent of the total share. While the Million Plus cities have single projects, in case of Class II towns, a group of towns is clustered together. The Class II town projects are also largely funded by either UIDSSMT or an IFI. Among the states, Rajasthan has a unique feature i.e the projects are usually at a regional scale covering many villages and a few important urban centres.

There has also been a shift in the trend of award of projects to urban centres on the basis of class size over the selected time periods as well. While in the initial period (2000-2015), the projects were concentrated in million plus and class I cities, the share of class II cities have increased in the next two time periods to 8.3 percent in 2006-10 and 15.4 percent in 2011-2015. This trend of Class II cities getting PPP projects in the urban water sector might continue to increase with these towns getting further impetus under AMRUT. This could have double ramifications; first, the smaller cities might not have the financial and institutional capacity to implement the project successfully, second, if the project is overseen by the state level authority that could mean compromising the autonomy of the urban local body.

3.5.4 Implementing Agency of PPP Projects

Despite the 74th Constitutional Amendment, 1993, wherein the water supply functions had to be passed on to the Urban Local Bodies, water supply is still managed by the parastatal organisations in several states. Till 2008, only Andhra Pradesh, Bihar, Chandigarh, Chattisgarh, Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Tamil Nadu and West Bengal had transferred the water supply function to their respective ULBs **(TISS, 2008).** This reflects in the distribution of implementing agency for PPP in the urban water sector in the states. There are broadly three types of institutions in the urban water sector: a) State Boards b) PHEDs (State level) and c) ULBs

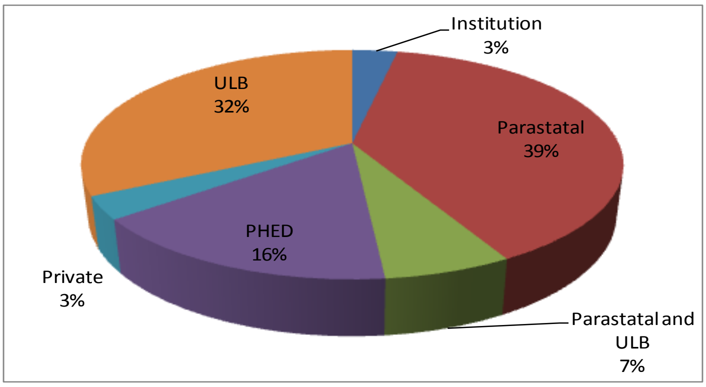


Figure 3.14: Implementing Agency of PPP Projects in the Urban Water Sector

Source: Official websites of private companies, World Bank (2011)

Figure 3.14 presents the type of implementing agencies of the PPPs initiated in the urban water sector. Projects implemented by parastatal organisations (39 percent) are the most common followed by ULBs (32 percent). Prima facie, parastatal organisations appear to be in a better position to implement PPP than ULBs. To a large extent, ULBs do not have the authority to raise tariff which is a setback for PPPs as cost recovery is an important element of PPPs **(MoUD & MoUEPA , n.d).**

States such as Rajasthan, Delhi, West Bengal, Odisha in which the contract is only between the parastatal organisation and the private operator are more in number than the states in which some of the projects have been implemented by parastatal organisations and some by ULBs. The skewed figures are also due to the incomplete transfer of powers as per the 74th Constitutional Amendment from State bodies to the ULB, especially in revenues and funds. Even in some projects like in Karnataka, Tamil Nadu, Jharkhand, Chhattisgarh and Andhra Pradesh where Municipal bodies are involved in the water supply and distribution, the PPPs have been introduced under a state programme and is managed by the Water Boards of the states. For instance, the PPP project in Ilkal, Karnataka is one of the projects prepared as a part of North Karnataka Urban Sector Investment Programme by KUIDFC under ADB assistance. In Maharashtra, ULBs or Maharashtra Jeevan Pradhikaran is responsible for planning, implementation and mobilisation of funds. The implementation of the 74th Constitutional Amendment has been more successful in Maharashtra than in other states, as a result of which the WSS functions are with the ULBs in large cities. **World Bank (2012)** placed Maharashtra in a better situation regarding the implementation of reforms, compared to other states and proposed ring fencing and corporatisation of ULBs in its business plan. That might explain the strong presence of ULBs in these public-private associations. Similarly, Madhya Pradesh, another state where the ULBs are the implementing agencies of the respective cities, has been pro-active in decentralisation of power. More research also needs to be directed towards understanding whether the PPP projects which are being executed by the State level agencies are enabling the ULBs of smaller cities through transfer of knowledge and expertise.

3.5.5 Dominance of Companies in PPP Projects in Water Supply in India

The Indian scenario is similar to the global situation whereby a few “water barons” dominate the private water supply scene. Degremont/Suez, Veolia, Tahal, Nihon, L&T are the major foreign players while SPML, Vishwaraj, JUSCO are the major Indian companies in this field. Degremont/Suez and Veolia are partners or sole concessionaires in nearly half of the select PPP projects followed by SPML Infra Ltd (23 percent).

3.5.6 Components of PPP Projects in the Urban Water Sector

The focus has been mainly on projects involving distribution of water supply (41.94 percent), both bulk water and water distribution (25.81 percent) followed by sole supply of bulk water (32.26 percent). Over the years, there has been a change in focus.

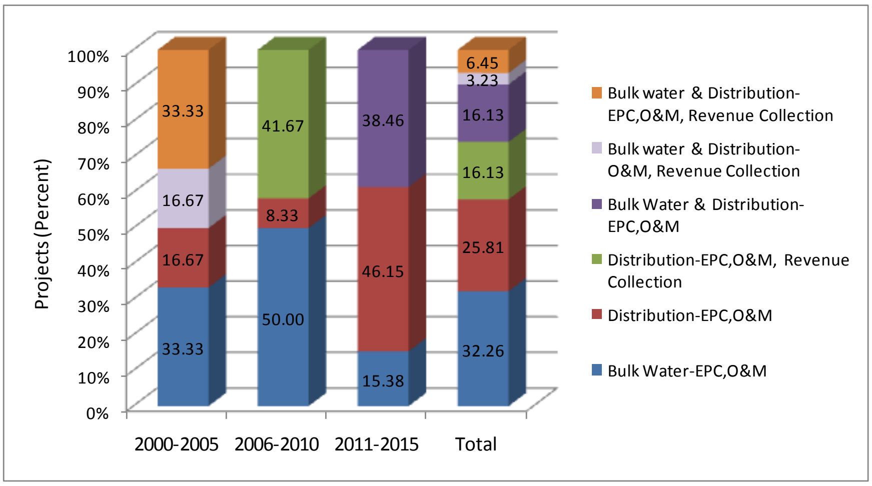


Figure 3.15: Components of PPP Projects in the Water Sector-2000-2015

Source: Official websites of private companies, World Bank (2011)

The trend in change in preferred components of PPP projects is presented in figure 3.15. In the period 2000-2005, there was a focus on bulk water supply. This was the time when Sonia Vihar Water treatment plant and Chennai Chembarambakam were launched. During this period, an equally high number of projects were awarded to combined bulk water and distribution projects. These projects included EPC, O&M and revenue collection as well. In the next time period, 2006-2010, there was a renewed focus on solo bulk water supply with 50 percent of the projects during this time being solo bulk water projects. This was followed by water distribution projects comprising EPC, O&M and revenue collection (41.67 percent). There was a turnaround in the share of type of projects in the third period of 2011-2015. The projects during this time were restricted to only EPC and O&M in both bulk water supply and water distribution, revenue collection was not a part of any of the projects. Revenue collection as a responsibility of the private operator might have been eliminated as a response to the public protests which has associated billing, inflated increase in tariff with involvement of private sector in the water sector.

3.5.7 Change in Pattern of Funding of PPP Projects

Most of the projects have multiple sources of funds besides itself, the major ones being the grants from Government schemes such as JNNURM/UIDSSMT,loans from IFIs and private investments. Initially, one of the justification for bringing in private players was that they would infuse the capital intensive water sector with much needed funds. In the Indian context, this has only been partially true. The projects launched in the 1990s, besides being capital intensive, involved heavy private investment **(MoUD, n.d).** They were largely unsuccessful. There has been a change in the pattern of funding over the years.

Overall, one-fourth of the projects had private investment, though in various degrees. While the Aurangabad project had 50 percent private investment, Shivpuri and Khandwa had 10 percent. The highest share of projects (50 percent) with private investment was in the period 2011-2015. A pattern is also seen whereby all the projects which had the private operator responsible for direct revenue collection through tariff also had private investments. The involvement of IFIs in project implementation is a natural course of action with many of them, particularly World Bank, being actively involved in preparation of feasibility study of need for PPP projects such as in Delhi and Mumbai (K-East).

The IFIs have largely focussed on the Class I cities and class II towns barring Gwalior which was already a million plus city when the project was awarded. This could also imply that IFIs were looking at smaller, more manageable towns for these projects. Nearly 16 percent of the total projects were being funded by IFIs.Out of these,40 percent of the projects were awarded in 2000-2005 and 2011-2015 each. No particular temporal trend is seen with respect to IFI funding. In the period till 2005, World Bank funded projects were dominant.ADB and JICA also emerged as important donor agencies in the water sector in the late 2000s.

JNNURM/UIDSSMT have played a very strong role in the funding of PPP projects. Nearly 45 percent of the selected projects were funded by either JNNURM or UIDSSMT. Out of the total projects awarded with funding from JNNURM/UIDSSMT, 64.2 percent were awarded immediately in the years after the launch of JNNURM while the rest were awarded in 2011-2015. AMRUT is expected to take this further. Water supply and sewerage projects were launched by 115 cities under AMRUT at a cost of Rs.6346 Crores **(PIB, Ministry of Urban Development, 2016)**. Some of these will be accessing funds through PPP, like Vijaywada Municipal Corporation which has proposed to contract out the pipeline laying and household connection to a private company which will eventually recover the capital costs through water charges.One of the main trigger for this was the fear of diversion of the states government's share of funds if it did not implement the project **(VMC moots water supply project under AMRUT, 2016)**

3.5.8 Emerging Patterns in Continuation of PPP Projects in the Urban Water Sector in India

All the projects are at different stages of implementation. While some have already entered the operation and management stage, others have got delayed at the rehabilitation stage itself due to reasons like unavailability of land, lack of consensus between multiple authorities, civil society protest etc. There are also some projects which have not progressed beyond the initial discussion or award.

Past studies have identified inadequate stakeholder support, weak financial capacity of implementing agencies and low technical understanding of the government agencies to implement PPPs as the major reasons for the discontinuation of PPP projects in urban water sector **(Swarup, 2011).** In the present study, the continuation of PPP projects has been cross tabulated with the year of project initiation, agency or scheme involved in the implementation, political support and civil society opposition. The analysis includes 39 projects, more than the previous exercise as it also includes projects which were not awarded but had nearly reached the bidding stage. Archival newspaper reports were referred for assessing the political consensus and civil society opposition for each project. Report of political consensus and civil society opposition in the national media was considered for each project. Besides media reports, World Bank reports and other Govermnent of India reports were also referred.

Table 3.5:Year of Initiation and Status of Project

Project Status	Before 2000	2000-2005	2006-2010	2011-2015	Total
Operational	0	20.7	37.9	41.4	100 (29)
Stalled	45.5	36.36	9.09	9.09	100 (10)

Fischer's Exact test-14.49; p<0.01

Source: Official websites of private companies, World Bank (2011)

It is seen in table 3.5 that there has been a decline in the percentage of projects being stalled or abandoned with time. Nearly 45.5 percent of the projects stalled were before 2000 compared to only 9.09 percent after 2011.This could be because of maturing of the PPP market and different types of contract and investments being tried out. There has been a shift from the more risky concession and lease contracts involving heavy private investment to operation and management contracts with less or no private investment. In the earlier stages (pre-2000), the utilities focussed on getting in private investment, pursued models inconsistent with their financial and institutional capacity **(World Bank, 2011).**

The terms and conditions in the PPP have been made more suitable for private players. The focus has been on mnimising the revenue risk of private companies. While earlier, the stake and risk was higher for the private companies in terms of investment, the present model of operation and management is more popular. In some cases such as Khandwa, in case of default of payment of charges from consumers, 50 percent of the connection charge collected from the consumer was to be given to the private company and the private operators were also allowed to disconnect defaulting connections **(World Bank, 2011).** KUWASIP, one of the first successful PPP project in the Indian urba space, was an O&M project with minimal revenue risk to the operator. In this context, public funding from Government schemes has played an important role in the award of PPP projects. Out of the 29 ongoing projects selected for the study, 44.83 percent have been either been funded by JNNURM or UIDSSMT (Refer section 3.5.7). The availability of Government grants has enabled a scenario in which the PPP projects ca be executed without investment from private operators.

Stakeholder support has been an important factor in the continuation of projects. Political consensus for the projects has been a critical factor in the continuation of the project. In many of the earlier high profile projects such as Pune bulk water project, Goa project, Bengaluru project and Sangli project, the projects were abandoned after opposition was raised by the political parties. The opposition was largely centred around high bulk water tariff proposed by the private operators **(Tiwari & Nair, 2011).** Civil society protests have also delayed and in many cases prevented the projects from getting awarded.

Table 3.6: Civil Society Opposition and Status of Project

Project Status	Yes	No	Total
Operational	37.93	62.07	29(100)
Stalled	80.0	20.0	10(100)

Pearson's Chi Square-10.917; p<0.001

Source: Media Reports, World Bank (2011)

The entry of private players in the Indian urban water space has met with much opposition from various elements of civil society such as NGOs and RWAs. As seen in table 3.6, 80 percent of projects which were stalled had also faced civil society opposition compared to 37.93 percent of the operational projects. The 21 zone Delhi water distribution project is one of the strongest instances of civil society opposition derailing private player entry despite political support.

Another interesting aspect has emerged whereby projects which faced protest in the initial years (before 2005) of PPP initiation were prone to being called off while many of those introduced in the later years (post 2005) such as Delhi- three pilot projects, Nagpur, Khandwa, Mysore etc have continued. This also shows that the influence of protests on the award of PPP projects in the urban sector might have declined over time demonstrating that PPP in urban water supply has become more entrenched.

3.5.9 Case Studies of PPP Projects in the Urban Water Sector in India

Five Indian case studies have been taken to illustrate the different kind of benefits and issues that have emerged in the projects involving private sector. Jameshedpur showcases the oldest private water supply case for a city, the KUWASIP project in Karnataka touted as the most successful PPP in the urban water sector, the only full city PPP in Nagpur, first project to be rolled back in Latur and PPP project with contract renegotiation in Mysore.

Jamshedpur

Jamshedpur is the home to the first private iron and steel plant of India. The city has a population of 1.3 million **(Census of India, 2011).** Before 2004, municipal services were provided by Tata Steel's town division unit. However, in the 1990s, the unit faced financial and human resource crunch and technological challenges. At the same time, the population of Jamshedpur was rapidly increasing and the city was expanding, compelling the Town division to scale up its operations. A tie up- was forged between Tata Steel Ltd. and Veolia Water for two year for management and technical consultancy to Tata Steel Ltd. Finally, the Town Division unit was corporatised and JUSCO, a wholly owned subsidiary of Tata Steel, was created on August 25, 2003. A partnership between TATA steel and JUSCO was formalised with pre-defined performance standards. JUSCO provides both water and wastewater management in Jamshedpur. It had about 40,000 household connection with half of it being of Tata employees **(World Bank, 2011).** Before 2007, the employees did not have to pay for water and for others, it was a flat rate of Rs.140 per month. In areas, where continous water was being supplied, customers comprising 350 connections paid Rs.1000-1200 per month for improved services. In 2007, in sync with the prevailing fiscal environment at that time,metered potable water supply and volumetric tariff regime was introduced **(Jamshedpur to become first city in East to get metered water supply, 2007).** Although, JUSCO had been supplying water to a few slums numbering around 20000 connections between 2005 and 2015, Jharkhand High Court gave instructions to JUSCO to supply water to 86 slums in 2015.

The Jamshedpur case exemplifies the transition of water from a public good to a commodity within the same company. Earlier, public water was supplied at nominal rates, not only to make it accessible to the poor, but also as it was considered to be a public good. Despite, Tata Steel Ltd being a private company, it had kept the water charges low as that was also the norm before the 1990s. Keeping pace with the changing fiscal and policy environment, it also reinvented itself into a more competent water utility putting into place the contemporary technological and financial practices of water supply and distribution.

Nagpur

A pilot project for 24x7 water supply was initiated in Dharampeth zone of Nagpur in 2007. The contract was a five year performance based management contract with nine months preparatory work, 15 months for rehabilitation and five years for operation and management. The project covered 15000 house connections including ten slum areas.The key performance indicators were a) reduction in UFW below 30 percent b) 10 percent increase in billed volume over 2008 base c) 24x 7 supply d) admissible water quality and e) customer grievance handling within three days and f) 100 percent metering. Nagpur

Municipal Corporation (NMC) had some experience of handling private players in the WTP,pumping stations, valve operation etc. although it was in the form of service contracts. A review of the pilot project by Academic Staff College of India revealed that the zone experienced improved pressure eliminating the need of household level booster pumps along with 7500 connections getting 24x7 water supply. In the slum areas, 5000 connections were added albeit without 24x7 water supply. Billed water volume increased by 50 percent and NRW decreased from 50 percent to 38 percent. The report found the stakeholder participation lacking. Consumers were not adequately informed about the urgent need to fix internal leakages, as a result of which, due to higher tariff than before and a similar water volume, the water bills were high in several cases. Continuous 24x7 water supply was achieved only in 50 percent of the connections. **(PPP in City wide water supply, n.d).** Before the results of the pilot project could be studied, the full city project was launched.

In 2011, Orange City Water Private Limted, a consortium of Vishwaraj and Veolia was signed up for executing the full city project. It is a 25 year contract further extendable by another 25 years by mutual agreement. The first five years are meant for upgradation and rehabilitation of the network and the next 20 years for operation and management. The remuneration is as per the metered volume billed. The operator is supposed to be financing 30 percent of the project cost (Rs.387.86 crore as per the Detailed Project Report) and 70 percent was to be done by NMC through grants from JNNURM. In 2012, there was a demand for termination of the project by opposition parties and civil society as the financial losses of the water works had increased by 60 crore per annum **(Nair, 2015).**

There has been a delay in the provision of house service connections despite the pipeline rehabilitation following the timeline schedules. The delay is said to have caused an escalation in the project cost from the initial Rs.387 crore to Rs.566 crore. As per NMC data, only 4 percent of the households have been connected to 24x7 water supply, although OCW claims it to be 15 percent, as of January 2017 (two months from the deadline) **(Anparthi, 2017).** The delay has been attributed to protests due to high connection charges and low pressure in existing connections initially and then discontinuation of JNNURM and non-completion of Pench-IV water supply project

(Anparthi, 2017). One of the most important lessons of the project so far, has been to continue to stakeholder engagement in all stages of the project.

While it is too early to comment on the success and failures of the project, certain conclusions can be drawn. One of the criticisms of the project could be the award of project for the full city before a thorough assessment of the pilot project could be undertaken implying the pressure from various quarters to implement PPP projects. The case with so much delay in implementation also shows that getting in private players to do the work of public water utilities will not succeed unless other factors such as inter-institutional collaboration, source of supply, stakeholder engagement is smoothened out. PPPs do not operate in isolation, rather are as much dependent on these external factors as public utilities.

Karnataka Urban Water Supply Improvement Project (KUWASIP)

A water supply service delivery improvement project (KUWASIP) was initiated by the Government of Karnataka with assistance from World Bank in 2005. It was to be implemented through Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC), a nodal agency for externally funded projects in Karnataka. Project aimed at 24/7 water supply was introduced as pilot projects covering 10 percent of the population of the three ULBs namely Hubli- Dharwad, Belgaum and Gulbarga. The project involved rehabilitation and operation and maintenance of the distribution network to be done by the private operator in lieu of a fee. Sixty percent was fixed fee and 40 percent was variable based on the performance in meeting targets.There were financial incentives as well over and above the fees. The maximum permissible bonus was 25 percent of the remuneration. One of the components of the bonus was percentage increase in billed volume to the base volume of the bulk supplied water. An increase of more than 25 percent, would get the private operator 30 percent share of the bonus. The rehabilitation activity largely included replacement of the distribution pipelines, installation of bulk water and consumer meters and setting up of a computerised billing system. The capital expenditure was to be done by World Bank. The estimated project cost was Rs.62 crores and the World Bank loan assistance was Rs.45 crores. The contract was for 3 years and six months.The tariff was set by the ULB in consultation with KUIDFC and KUWSDB. ULBs had the responsibility of bill collection.One of the important features of the project has been the strong stakeholder engagement involving local NGOs **(IDFC, 2009).** The pro-poor policies for the demonstration cities has been termed as a response of the stakeholder engagement **(Walter, 2013).**

On the upside,the situation is reported to have improved after the project intervention. The supply has become 24x7 from 3 hours in 3-7 days.There is 100 percent metering and 10 percent NRW now compared to more than 50 percent NRW earlier. Pro-poor policies were also introduced with respect to lifeline water, tariff and connection charges. On the other hand, to reduce NRW, all of the 433 public fountains had been removed and customers were provided with individual meter connections **(Ministry of Finance, 2011)**. This might have implications for the houseless population and require a more indepth study. There was lack of transparency as well. The waiver of connection charges was not implemented and rather broken down into installments and added to the slum households' water bill every month **(Walter, 2013).** Households which had legalised their connections were also charged the backlog amount of water consumed before the legalisation. These households were not informed of this beforehand **(Walter, 2013).** After the commencement of volumetric pricing, the bills increased to nearly Rs1000 from a flat rate of Rs.90 per month. This was mainly due to connections costs, arears, high consumption of water and technical glitches **(Walter, 2013).**

Mysore

Mysore's water supply and distribution system was modelled to be the finest example of a full city PPP in the urban water sector.JUSCO was contracted by KUWSDB and Mysore City Corporation in 2008 to upgrade the existing network and eventually bring in 24x7 water supply.The contract period was for six years including two years of upgradation and rehabilitation and four years of operation and management. The fees to the operator was to be paid in the form of fixed and performance linked remuneration.The project like most other such projects has faced severe delay. One of the major reasons for this was the data discrepancy in the pipeline coverage provided by the Municipal Corporation and the actual pipeline coverage found during surveys by the private operator. During the signing of the agreement, the pipelines were to be laid over 910 kilometres with 117,000 connections. During the preliminary survey by the private operator , it was found that the actual pipeline length that needed to be upgraded and rehablitated was 1910 kms and the connections were 1.74 lakhs. The project cost shot up much beyond the initial estimated cost and budget **(Yousaf, 2103).** The contract was renegotiated and with the Government not willing to increase the project cost, JUSCO is implementing the project in only half the city.

Discrepancy between the data provided by the public water utility and the information found by the private operator after the initial study has been a sore point in many cities. This has been one of the reasons for delay also as the pipeline layout plans provided by the utilities do not match the ground realities and have to be prepared again by the private operator.Such issues will continue to arise unless adequate stress is given on maintaining up to date data by the prublic utilities. Unless the public utility is completely prepared with the correct data at the time of contracting, delays are bound to happen, negating the seriousness of the project timelines.

Latur

Latur is a city in the water parched marathwada region of Maharashtra with a population of a little less than four lakh. Before the PPP project was initiated, Latur households would get 75 lpcd of water in the non-summer months twice a week, while the situation would deteriorate drastically in the summer months to 40 lpcd with tankers being brought into service. Nearly 70 percent of the population was covered by piped supply. Like most Indian cities, Latur Municipal Corporation's recovery of cost has been dismal ranging between 19-33 percent, not even sufficient to cover O&M cost. The tariff was very low and there were many unauthorised connections. LMC was also not able to raise funds for its share of the water supply augmentation proect. In 2006, Maharashtra Jeevan Pradhikaran (MJP) took over the responsibility of water supply in Latur for 30 years. It was decided that MJP will hire a private operator for operation and management of Latur's water supply.

In 2008, the consortium named Latur Water Management Company (LWMC) comprising SPML Infra Ltd, UPL-Environmental Engineers Limited and Hydro Comp Enterprises was given a management contract for ten years. The contract was a hybrid of a managemnet contract and concession as the private operator had taken more than the usual technical and commercial risk due to the inability of MJP to invest in the project.The private operator was required to operate, maintain and carry out repair of scheme, deploy resident staff, extend full coverage and 100 percent metering, set up customer service centres, reduce NRW and implement 24/7 water supply in two year time. Under the management contract, consortium would pay MJP a fixed monthly sum **(Ministry of Finance, 2011)**. Investment to be made by the private player over the contract period was Rs.139 crores and the amount to be paid to MJP for asset use was Rs.42.9 crore. The operator was expected to generate a revenue of Rs.190 crore for Latur Water Management Company. After the end of the contract, the assets would pass back to MJP without any encumbrances. The new tariff was fixed at Rs.150 per month, an increase of Rs.50 from the earlier Rs.100 per month. There was an additional connection cost of Rs.1700 and meter cost of Rs.2400 **(Nayar, 2013).** Billing concessions were provided for the slums. Group connections were introduced for upto four households and an identified leader would be responsible for bill collection.

The project met with stiff resistance from the public and particularly the political parties. The increase in tariff and the metering policy was unwelcome. A study committee was formed by the District Collector of Latur to review the terms of the management contract which was eventually found to be in favour of the residents of the city.There was renewed agitation resulting in destruction of public property. As a result, LMC could not transfer assets to MJP which further could not transfer assets to LWMC. Politics also played an important role in the opposition. This was a dream project of the then Chief Minister, Vilas Rao Deshmukh. Most political parties supported the opposition agitation, except for Congress. During Corporation and state legislature election, the anti-privatisation drive became a part of the manifesto of the contesting political parties **(Govindpurkar, 2013).** Finally, it was rolled back after three year of continuous opposition.

3.6 SUMMARY

Private sector participation in the urban water sector has been introduced in several countries of the world. The reasons have varied from austerity measures in the developed countries to external pressure from IFIs to bring in PSP in the developing countries. One of the major justifications has been the poor state of water supply under public utilities, low efficiency of public utilities, low coverage and the poor spending an exhorbitant amount of money on informal water. At the global level, the benefits of PSP has been cited as improvement in the financial health and increase in metering, reduction in unaccounted for water and improved billing and fee collection, improvement in customer response and in some cases improvement in coverage.The negative outcomes have largely been tariff increase, disconnection due to non-payment, issue with meters, neglect of the low income area, absence of competitive tendering thus higher chances of corruption, alteration of contracts after finalisation and delay or cancellation of the promised investment by the private player. Many of the PSP projects have been remunicipalised. Civil Society through protest has played an important role in the reversal. The Indian PSP scenario also mirrors the global developing countries' situation to a large extent in terms of the reasons for initiation, benefits and drawbacks. Much spatio-temporal variation is seen among the states with respect to award of PPP projects in the urban water sector. The corresponding factors range from the per capita income of the states, presence of IFIs in the states beforehand, readiness for PPP through policy preparedness and institutional capacity to implement PPP projects. In terms of continuation of PPP projects, projects that were awarded in 2011-2015, were public funded, had political consensus and did not face civil society protest have continued. The civil society protests have been less effective in stopping projects in the later period.

Among all the cases, Delhi has been one such city where PPP was initiated in the mid 2000s but withdrawn due to civil society protest and later introduced again, albeit, at a smaller scale. Delhi also presents an interesting case where there was a pro-privatisation Government when the projects were awarded but now the present Government is against bringing corporate global players in the water sector. The next chapter delves into the water governance of Delhi and the introduction of PSP in the city.

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CHAPTER IV

WATER GOVERNANCE AND PRIVATE SECTOR PARTICIPATION EFFORTS IN PUBLIC WATER SUPPLY IN DELHI: A MACRO ANALYSIS

4.1 INTRODUCTION

Delhi, although located in a water scarce area, has been privileged to have better water availability compared to similar cities and towns due to its status as the capital city of the country. Over the years, there have been attempts by the Central and the State Government to quench the thirst of the burgeoning population by bringing in water from far off places and simultaneously the residents have made their own arrangement by digging deep into the aquifers. While the increasing population plays an important role in determining the water demand,the changing intensity of commercial and industrial activities is also a critical factor. Since the 1990s, the urban scape of Delhi has changed significantly with the commercial spaces being dominated by shopping arcades of gigantic proportions. At the same time, following the Supreme Court order, several industries were closed down in early 2000. Despite Delhi having one of the highest water availability at source among the Indian cities, gross inequalities exist across space owing to physiographic variations and across communities due to socio-economic differences within the city.

In the eternal quest for water, several strategies have been formulated by successive governments. These strategies have also mirrored the on-going global discourse on water management prevalent at that time. An institutional rehauling of the water utility in Delhi in 1998 gave way to shift in focus from supply side to demand side management. Some initiatives were taken in the period to improve the equitable distribution of water in the city, construction of underground reservoirs being one of them. Simultaneously, there was an ongoing debate about the role of the State. A shift in role of the State from a provider to a facilitator was being propagated. The natural progression of this was the introduction of private players in the urban water sector. Given the sensitive nature of water provisioning, the private sector participation was brought into only construction, operation and management of supply and distribution services. Although, private players had always been involved in construction through service contracts, it was the first time that a multinational corporate giant was being contracted for construction, operation and management together in lieu of a management fee. The first attempt was made in 2001 when Sonia Vihar WTP for bulk water supply was contracted out to Degremont for construction and O&M. Again in 2004, two pilot projects in distribution were initiated but they did not materialise and then subsequently a fresh attempt was made in 2012 and now there are three ongoing PPP projects in the water distribution space.

The background factors which led to PPP being introduced in the water sector in Delhi have been explored in the present chapter. An attempt has been made to understand the formal water scenario in Delhi from the demand-supply perspective with focus on the constraints faced by the public utility in catering to the demands of the increasing population of Delhi growing in an unplanned manner. The successive Delhi Governments have been active in pursuing the reforms suggested in the water sector by MoUD and there has been a focus on achievement of the Service Level Benchmarks. PPP in the water sector has not been done in isolation and is a result of the increasing stress on withdrawing of government as the provider and inclusion of the private sector on a larger scale in the infrastructure sector. Thus, a brief description of the privatisation efforts in the electricity and solid waste management sector has also been given in the chapter.

4.2 HISTORY OF WATER SUPPLY IN DELHI

Delhi, although, located in a semi-arid region has had its own mechanisms of water supply and conservation. Historically, Delhi has relied on the dynamism of the landforms and utilised it for its water source. The Aravalli hill outcrops extend into South and West Delhi with Yamuna river in the East. Runoff from the ridge and plains collects in small watersheds which along with the river have supported several of city's historic capitals.

One of the earliest water storage structure, Surajkund was built in the 11th century during the reign of Tomar king Anangapal **(CSE, 2013).** Delhi's waterworks developed further in the 13th century during the reign of Iltutmish (d.1236 CE) in the form of tank (hauz) and stepwell (baoli). In the medieval times, multiple bundhs were constructed, masonry regulatory works were added, water was sometimes channelled into adjacent sub-watersheds as in the case of Hauz Khas complex, Adilabad, Jahapanah **(Wescoat Jr., 2008).** In the year 1320-25, Tughlaqabad was buit and water was brought into it by damming the natural eastward drainage line.Satpula, a 65 metre dam with seven sluice gates, was built by Muhammad Bin Tughlaq (1325-51 AD) to irrigate areas outside the city. With Mughal Emperor Shahjahan establishing his capital Shahajahanabad near Yamuna river, canals were built in the fourteenth century to transfer water from Yamuna river to the city. In addition, most houses had wells. They became the source of water when the canals became dry in the eighteenth century. Besides, there were water carriers (*kahars or mashkis*) who would carry water from the common wells and supply to households.

The British, who had come to occupy it in 1803, viewed the system as impure and inadequate **(Sharan, 2011).** They built a large tank in 1846 for drinking water but the water became brackish within a decade. Drains emptied in western Jumna Canal, the water of which was used by the residents and the military cantonment. In the middle of the 19th century, efforts to source and transport water from cleaner sources began. Delhi waterworks was set up at Chandrawal village at the end of the nineteenth century. To cater to a population of around 173,000, two sets of wells were dug **(Sharan, 2011).**

The walled city, western suburbs and the civil lines houses got preference as far as distribution of water was concerned. A little less than 150 houses had piped water connection by the end of the 19th century; mainly restricted to areas inhabited by the Europeans. The number of private connections increased to 2000 in 1904. It was understood that shifting of the capital to Delhi would lead to an increase in demand of water. Pumping of water from river Yamuna was made the main source of water. Intake works and pumping station were proposed at the village of Wazirabad. Cleanliness of the source of water was given due importance, a bye law was passed which stipulated 50 rupees fine for anyone dirtying the water of wells, municipal public water tanks and the Yamuna river between Majnu ka tila and Metcalfe house.Around 1918, the Government noted that water supply distribution system needed to be expanded and water needed to be treated and thus charged like any other commodity **(Sharan, 2011).**

The issues of contaminated piped water existed even during those times. The memoirs of a city doctor point to the large number of locations where the drinking water pipelines pass through drains and sewers. He referred to reasons for contamination of drinking water as sucking of foul air and water due to intermittent water supply, leaks in drinking water and sewage pipes running together underground, leaky water pipes in polluted subsoil and housewater taps being located close to privies and drains. A poorly laid distribution system was held responsible for rise in Cholera cases in 1928, typhoid in 1930 and enteric fever a few years later **(Sharan, 2011).**

Delhi's fast growth and increasing demand for water highlighted the inadquacies in the current system. In 1925, a joint water board was set up to meet the water requirements of Old and New Delhi, the Cantonment and the Notified areas. It was made responsible for procuring and distributing water in the city. By 1935, water scarcity again raised its ugly head. Along with increasing population, the per capita demand was also increasing. From a projection of 20 gallons per head in 1931, consumption levels had risen to 25.5 gallons per head by 1935 and it was further expected to increase to 30 gallons per person. In the next few years, several new plans for increasing the coverage of distribution system were taken up, but the issue of water contamination continued **(Sharan, 2011).**

Eventually, in 1936, the Board in its defence, put the onus on the authority controlling pipelines and reservoirs through which water runs. It claimed to be responsible for the water quality only till it left the mains and the main reservoir. Following the Jaundice epidemic in 1956, large scale engineering works were mooted. In 1958, Delhi Water Supply and Sewage Disposal Undertaking was constituted under the Delhi Municipal Corporation Act, 1957. Delhi Jal Board (DJB), a parastatal organisation under the Government of NCTD, was constituted in 1998 through an Act of Delhi legislative assembly. The foray of the corporate private companies started in 2002 when a contract was awarded to a private firm (Degremont) on a Design, Build, Operate basis for the Sonia Vihar Water Treatment Plant (WTP). It was designed to serve 35 lakh people and draw raw water from Yamuna and Upper Ganga Canal **(Finally Sonia vihar Springs to Life, 2006).** The plant was commissioned in 2006. In 2005, the World Bank commissioned study "Delhi Water Supply and Sewerage Project Preparation Study" was released which emphasised on reforms. Two zones were identified for privatisation on a pilot basis. The water tariff was also increased seven to ten times **(Asthana, 2009).** The water was to be supplied by the Sonia Vihar WTP. This plan was shelved after protest from the civil society and the Government of NCTD informed Government of India that they will not be availing the loan. Eventually in 2012 and 2013, contracts for EPC and Operation and Management were awarded to three private companies for three separate zones.

To summarise,domestic water supply was the responsibility of the individual households before the British either through private wells or water carriers transporting water from public wells. The British brought with them a centralised, state controlled era of water supply and distribution. The British legacy of water supply continued well into the mid 1990s after which reflecting the neo-liberal times, several institutional changes were made. The responsibility of water supply and distribution shifted from the urban local body to a parastatal organisation in 1998, in contravention to the 74th Constitutional amendment. It could be argued that this was the first step towards the series of institutional and financial reforms which were introduced in Delhi through the first decade of 2000. While small private players have always worked with DJB through service contracts, giant global corporations entered the water scene for the first time with substantial support from the World Bank. Although, the Government has always sent assurances that these are only operation and management projects and the ownership is with the Government, the literature is rife with instances of these big companies arm twisting their way in the developing countries where the regulatory framework is still evolving and weak.

4.3 FACTORS INFLUENCING WATER DEMAND IN DELHI

The water demand for an urban centre is an amalgation of domestic demand,public demand,industrial demand,commercial demand, fire demand and the water lost in transmission. Several factors influence the demand of water such as the size of the city (both population and spatial spread),the presence or the absence of a sewerage network, the climatic zone, the socio-economic zones or the living style of the residents, metering of water supply, quality of water etc **(CPHEEO, 1999).** Some of the factors, in context of Delhi, are discussed in the following sections.

4.3.1. Population and Water Demand

4.3.1.1 Population and Water Demand: A City Level Analysis

The present section mainly focuses on the effect of growth of population on the demand for water. Increase in population has repercussions on the infrastructure requirements emerging out of an increase in water demand. There is great amount of ambiguity in the per capita demand as recommended by various agencies. While MPD-2001 worked out water demand @ 363 lpcd , DJB does so @ 274 lpcd **(City Development Plan, Delhi, 2006)** DDA recommends 80 gpcd or 300 lpcd and IS:1172-1993 suggests 335 lpcd. The estimated water demand vis a vis the population from 1981 to 2011 for various recommendations is presented in Table 4.1.

Table 4.1: Population Change and Estimated Demand of Water

Population/Water Demand	**1981**	**1991**	**2001**	**2011**	**2021***	**2031***
Population	6220406	9420644	13782976	16787941	23373503	32542445
Water Demand (MLD) @274 lpcd	1704.4	2581.3	3776.5	4599.9	6404.3	8916.6
Demand (MLD) @300 lpcd	1866.1	2826.2	4134.9	5036.4	7012.0	9762.7
Demand (MLD) @363 lpcd	2258.0	3419.7	5003.2	6094.0	8484.6	11812.9

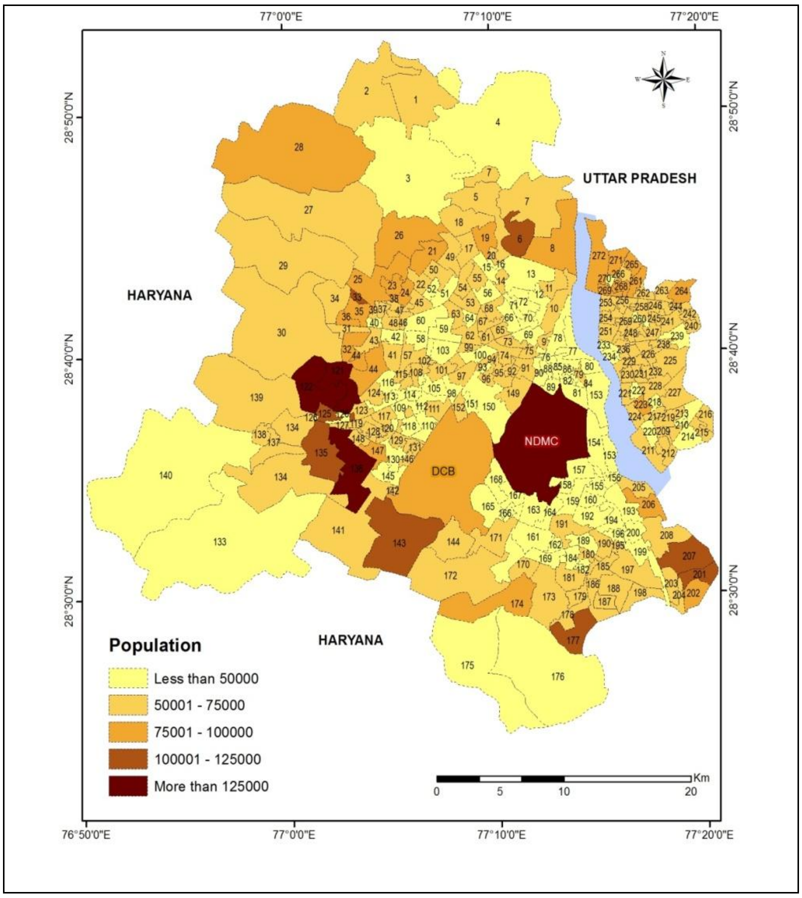
*Projected Population (Calculated on the basis of 2001-2011 CAGR)

Source: Computed by Author on the basis of population from Census of India,1981,1991,2001,2011

The present supply from DJB is around 906 MGD or 4119 MLD, insufficient to meet the present demand (2011) by any of the standards. The demand would far exceed the supply by 2021 and 2031 if supply is not augmented (Table 4.1). This would also mean additional stress on the ground water as households would also meet their demand through adaptation by digging deeper into the aquifers.

4.3.1.2 Population and Domestic Water Demand: A Ward Level Analysis

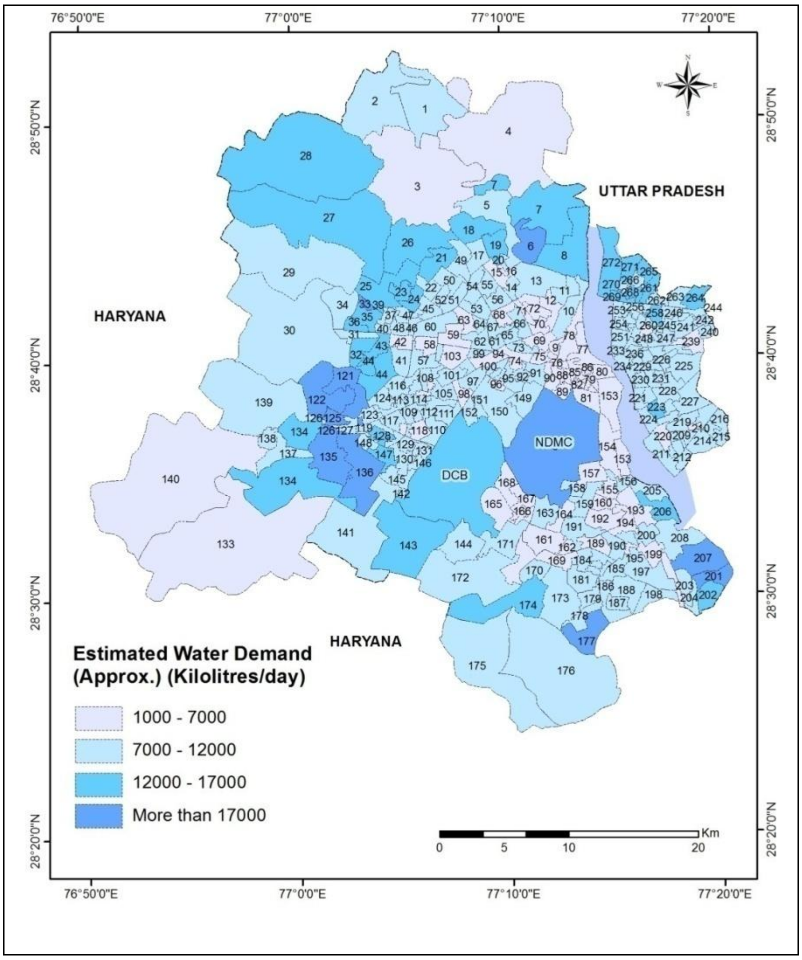
Delhi administrative area is divided into three statutory towns namely New Delhi Municipal Corporation, Delhi Cantonment Board and Municipal Corporation of Delhi. The former two have been considered as two single entities and ward level analysis has not been undertaken. Municipal Corporation of Delhi (MCD) area has 272 wards and the population distribution in these wards has been further analysed. A more detailed look at the ward level throws up a picture with much variation. Ward number 122, comprising Hatsal census town, has the highest population of 1,45,715, more than the population of one lakh cities while ward 166 has the least population of 10467. Ward wise population distribution is shown in map 4.1.



Map 4.1: Distribution of Population by Wards- 2011

Source: Census of India, 2011

Similar to norms for the city, there are various norms to calculate domestic water demand in urban areas, recommended by different agencies. The recommended water supply levels varies according to the status of the urban centres.For towns with piped water supply but without sewerage system, recommended water supply level is 70 lpcd while for cities with piped water supply with sewerage system, the recommended water supply is 135 lpcd. For Metropolitan and megacities, the figure is 150 lpcd. Bureau of Indian Standards, IS:1172-1993 recommends a minimum of 200 lpcd for domestic consumption in cities with full flushing systems and otherwise 135 lpcd. Besides these, most of the water supply utilities have their own norm. As per DJB, the domestic water demand is 172 lpcd for planned colonies, 155 lpcd for urban villages, 50 lpcd for jhuggi jhompdi.



Map 4.2: Estimated Domestic Water Demand by Ward (2011)

Source: Map generated from Census of India, 2011; DJB

It is very difficult to estimate the domestic water demand as the heterogenity in income, water source **(Whittington, 1987 cit. in Nauges & Whittington, 2010),** distance from water source, presence of multiple sources affect the demand. A broad attempt was made to understand the daily domestic water demand in each ward. In the absence of data on ward wise urban village population, the daily domestic water demand by wards was calculated by multiplying the non JJ cluster population by 172 lpcd (norm for planned colonies) and the JJ cluster population by 50 lpcd and then adding both for each ward. (refer map 4.2)

4.3.2 Land Use Change and Water Demand

Land use change can be through spatial expansion of the built up urban area whereby agricultural land is converted into residential areas and in-situ land use conversion with the existing built up urban area. Over the years, the spatial extent of the urban area has grown to accommodate the increasing population while the rural area has declined. Some villages, as a result of their strategic location and historical importance have grown to be classified as census towns. With Master Plan of Delhi-2021 declaring another 276 sq.km of land as urbanisable, new rural land will soon be acquired to pave for further urban expansion.

The change in water demand or consumption resulting due to both spatial expansion and in situ land use is seen in table 4.2.

Table 4.2: Water Consumption by Domestic and Industrial Use: 1981-2011

Year	Domestic consumption (Lakh Kilo Litres)	Industrial consumption (Lakh Kilo Litres)	Total consumption (Lakh Kilo Litres)	Percentage Increase in Total consumption	Percentage Increase in Domestic consumption	Percentage Increase in Population	Per Capita Consumption per day (Gallons/day)
1981	1556	509	2065	-	160.2	51.45	32.24
1991	4049	556	4605	123.0	129.6	47.02	47.66
2001	9296	1640	10936	137.48	37.6	18.05	40.0
2011	12789	1296	14085	28.79	160.2	51.45	50.0

Source: Statistical Abstract of Delhi, 2014, Census of India 1981-2011

The rate of growth of domestic consumption of water has increased at nearly double the rate of growth rate of population except in 2001-2011. The present decade (2001-2011) has witnessed a slowdown in both population growth rate and water consumption growth rate. Globally, the water consumption rate doubles every twenty years, a pace that is double the rate of population growth **(Population and Water, 2010).** There has been a decline in the industrial consumption of water in 2001-2001 probably due to several industries being closed down within the city in 2001 as a result of the Supreme Court order. It is also interesting to note that there has been an increase in the per capita consumption per day over the decades with a decline seen in 1991-2001.

4.3.3 Settlement Categories and Water Demand

Delhi is dotted with different settlement types largely categorised as the planned areas and the unplanned areas. While the areas conforming to the Master Plan provisions and planned and authorised by the civic agencies are termed as the planned areas, urban villages, unauthorised colonies and JJ clusters can be put into the unplanned category. Not only does Delhi Jal Board have a separate water demand estimation for the different settlement categories, archaic policies deprive the unplanned areas of basic amenities such as potable water. The role of socio-political equations is more dominant in areas where water is not supplied through legal channels and is at the mercy of people in power. The various categories of settlements and the demand in terms of the quality and amount of water and is discussed in this section.

4.3.3.1 Planned Areas

The planned colonies also known as approved colonies are built on land as per the Master Plan zoning. Housing planning and design conforms to the norms, at the time of construction. They are fully serviced by water supply and sewerage network before being inhabited.The Planned areas are provided water by DJB through pipelines. The domestic water demand is 172 lpcd as per DJB. They are the most fortunate, in terms of access to potable water.

4.3.3.2 Urban Villlages

There are 135 urban villages in Delhi. In 2015, 39 more villages under South Delhi Municipal Corporation were notified as urban villages **(Kumar,2015).** The urban villages mainly depend on borewell water and in some cases piped water. According to DJB, the domestic water demand is 155 lpcd.

While the villages were always there and over time, have got enveloped by planned development, they have got a raw deal with respect to water supply. While there have been technical constraints in laying pipelines and giving access to each and every household to potable water owing to the narrow and winding lanes of these village, the reason seem to be largely a lack of will. These village households have also relied on well water and then borewell water to meet their needs. With the borewell water becoming brackish and unfit for consumption in many parts of Delhi, the need to supply these villages with treated water has become intense. For instance, Chiragh Dilli village located in Southern Delhi is a good example of how water governance influenced by the changing legal-socio-political scenario has played an important role in providing access to potable water to households. Chiragh Dilli has existed since the 18th century **(DUAC, n.d).** After partition, the khadims of the dargah around which the village was built moved out, and the land came to be occupied by the jats. At present, Chiragh Dilli households get water from various sources. In early 2016, It got about 50,000 gallon water from Sheikh Sarai UGR which sufficed for water for one hour once a day. But, this water was received only if there was an overflow in the UGR, which also meant that during summers the village households were in a worse situation than their planned colony counterparts as the overflow water was much less in summers. One small part of the village was given water from a four inch pipeline going towards Dakshinpuri. Besides, there were sixteen tubewells in the area which supplied ground water to the households. Treated water is at a premium here due to the tubewell water being brackish **(Field Survey, 2016).** Political leaders have taken advantage of this in the past connecting the peripheral houses with the main water pipe through half inch ferrule, insufficent to meet the needs. This also highlights the water vulnerability of the houses as they are at mercy of political leaders for clean, affordable water **(Field Survey, 2016).**. In 2016, a peripheral pipeline was laid from Malviya Nagar UGR to Chiragh Dilli with the intent of supplying potable water to the residents. This also coincided with the coming of Aam Aadmi Party to power (2015). The party has paid special attention to the water sector and is keen on getting all households connected to water irrespective of their legal status. Legal requirements to apply for connections have been eased with indemnity bonds being sufficient instead of property ownership documents. Camps were conducted to convert unauthorised connections to authorised connections in which around 400 households utilised the opportunity. The present MLA of Greater Kailash constituency, the constituency where Chiragh Dilli is situated, is a resident of the village and has been active in pursuing and liasoning between the private player, DJB and the people **(Interview with AAP representative, 2016)**. The tubewells are expected to be phased out once all the households get house service connections from the new pipeline. Thus, without the tubewells, the demand for treated water will go up and add to the total city demand.

4.3.3.3 Unauthorised Colonies

Unauthorised colonies are built in non-conformance of the Master Plan zoning regulations. They are usually built on sub-divided agricultural land, forest land or land under the ownership of a Government organisation such as Archeological Survey of India etc. In 2013, four million people were living in as many as 1639 unauthorised colonies **(Sheikh & Banda, 2014)**. Unauthorised colonies have been regularised from time to time i.e they have been brought under the Municipal wing and been provided infrastructure and services in lieu of taxes and charges. In 1977, a policy for regularisation of unauthorised colonies was framed. Development charges would be taken from these colonies for laying roads, water pipelines and sewerage lines. 567 unauthorised colonies were regularised till 1993. In, 2002, a fresh cut off date for regularisation of unauthorised colonies was issued. But this time, there was a proposal of levying penalty and charging land rates on these colonies. This proposal was opposed by Government of NCTD. Again in 2008, notification for regularisation of unauthorised colonies in Delhi was issued. Out of 1797 unauthorised colonies, 1639 colonies applied for regularisation. After scrutiny, 895 colonies were approved for regularisation, on the basis of their location. Colonies not located on forest and ridge areas, protected areas under the provisions of the Ancient Monuments and Archeological Sites and Remains Act, 1958 and not posing hindrance to provisions of infrastructural facilities under the Master Plan 2021 were approved **(Govt. of NCTD, 2012).** There are several levels in the regularisation process, the major ones are the setting of boundaries which is done by the Delhi Government and finalisaton of the layout plan which is the Corporation's responsibility. As the boundaries sent by the Government did not match the real location, other than 312 colonies which stood on private land, other colonies were not regularised **(Indian Express, 1, April, 2015).** In April 2015, the Delhi Government gave a nod to register properties in these colonies. According to the Deputy chief Minister, the new AAP Government will go ahead with registry even if the plans are not approved by MCD **(Indian Express, 1, April, 2015).**

The residents of these colonies depend on private tankers and borewell water for meeting their demand of water. Under the current government, water pipelines are being laid in all the unauthorised colonies irrespective of the regularisation status. The work is complete in 300 colonies and is expected to cover all the colonies by December 2017 **(NDTV, 26 April, 2016).** This move would greatly increase the demand for potable water to be supplied by DJB.

4.3.3.4 Resettlement Colonies

These colonies are bulit by the Government agencies and provided to the evicted eligible JJ colony residents in lieu of their existing jhuggi. These are supposed to have access to basic services. Residents of Delhi's JJ clusters have faced eviction at least three times since the 1960s.During the first eviction, 18 resettlement colonies were built. The second round of eviction happened in the late 1970s when 26 more such colonies were established. The most recent eviction occurred before the Commonwealth Games (2010) and 11 more resettlement colonies were built. The latest resettlement colonies are on the periphery of the city in Savda Gheda, Holambi Kalan, Papan Kalan, Rohini and Narela. According to estimates, 250,000 households (approximately 1.25 lakh population) reside in these colonies (except the latest 11 colonies) **(Centre for Policy Research, 2015).**

Most of these colonies are yet to get piped water.They depend on DJB and private tankers and borewell water for water. Recently, Delhi Jal Board together with a private firm has set up water ATM in Savda Ghevra and planning to set up more ATMs in these resettlement colonies to meet the demand for potable water.

4.3.3.5 Slums and JJ colonies

In Delhi, in order to be notified slum, a settlement must be notified under the Slum area (Improvement and Clearance) Act, 1956. The entire walled city and its extension is notified as slum. No new slum has been notified since 1994. Slums are eligible for provision of basic services. Jhuggi Jhopdi clusters or squatter settlements are located on public land or others' private land and have occupied and built on without permission.

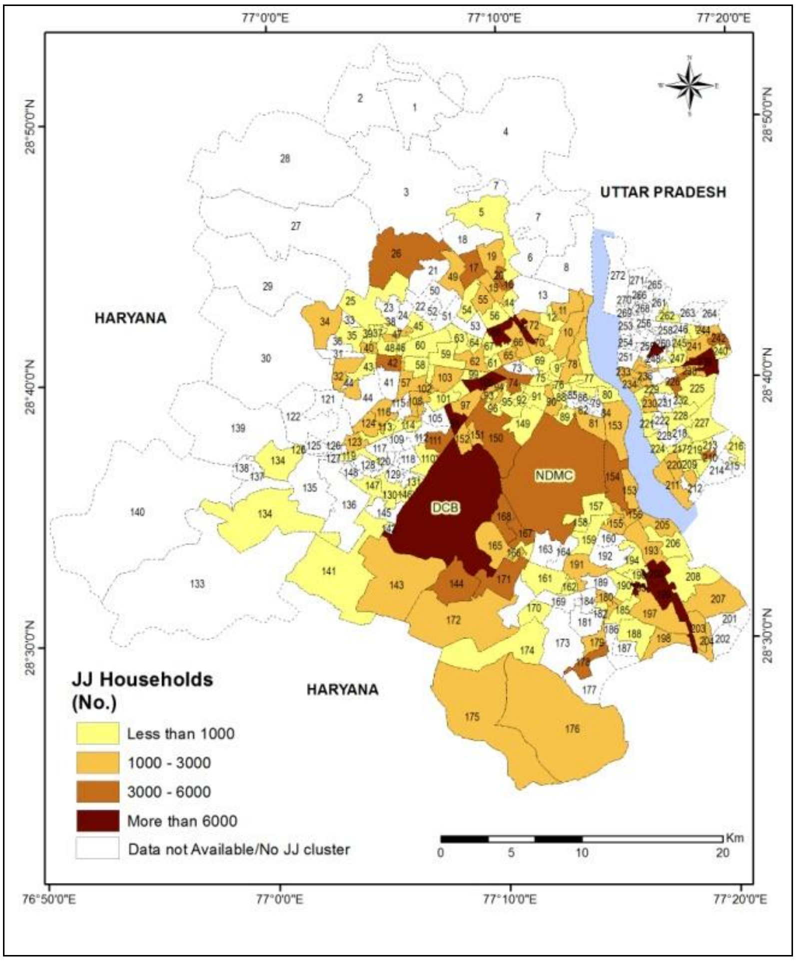
Table 4.3: Trend of JJ Cluster, JJ Households and JJ Population- 1951- 2011

Year	JJ Cluster	JJ HH	JJ Population	Area (ha)
1951	199	12749	63745	21.1
1973	1373	98483	492415	164.1

1983	534	113000	565000	188.3
1990	929	259000	1295000	431.7
1997	1100	600000	3000000	902.1
2001	728	429662	2148310	650.2
2011	675	383609	1785390	-

Source: City Development Plan- Delhi,2006; www.dusib.com *(Delhi Urban Shelter Improvement Board' official website)*

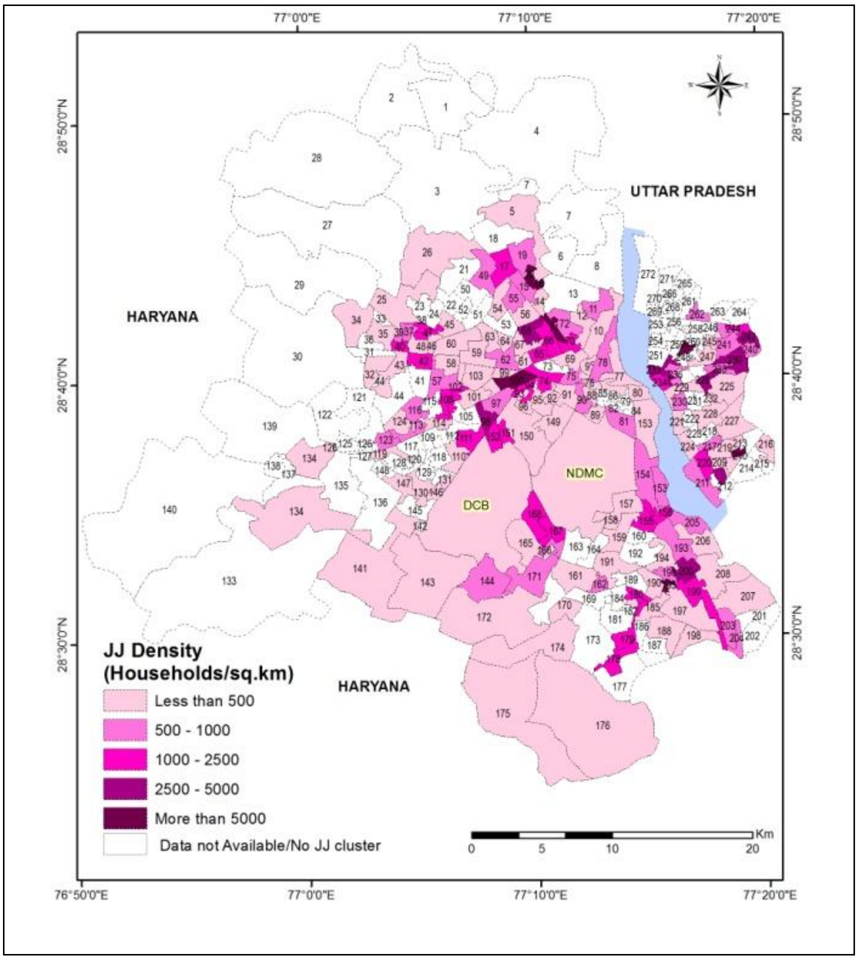
Delhi has a total of 3.8 lakh slum households (Both notified slums and JJ colonies) with a population of 17.85 lakhs as per Census Census of India, 2011 **(Statistical Abstract of Delhi, 2014)** and 3.06 lakh according to Delhi Urban Shelter Improvement Board (2015). Slum households are concentrated in the Delhi Municipal Corporation area with nearly 3.29 lakh (85 percent) households in the area. Both the NDMC (1.2 percent) and Delhi Cantonment (0.72 percent) areas have miniscule share of slums. The remaining 13 percent of the slums are in the Census towns **(Census, 2011)**. The distribution of JJ households is presented in map 4.3and the density of the JJ households is shown in map 4.4.



Map 4.3 : Distribution of JJ Households by Wards (2015)

Source: Map generated from www.dusib.com *(Delhi Urban Shelter Improvement Board' official website)*

Besides Delhi Cantonment Board area (7398 No.) which has a high number of JJ households, ward numbers 100 (15109 No) and 200 (10832 No.) have the highest number of JJ households among all the wards. One of the most populated JJ clusters of Delhi is situated in ward no. 100 (JJ Camp, Rakhi Market, Zakhira- 12716 households). Ward no. 200 has large number of JJ clusters with an average household size of 250. These are located in Okhla industrial area.



Map 4.4: JJ Household Density (2015)

Source: Map generated from www.dusib.com *(Delhi Urban Shelter Improvement Board' official website)*

The household density has been calculated by dividing the number of housholds in each ward by the area of that ward calculated in ArcGIS. Wards with highest concentration of JJ population is in East Delhi and North Delhi. Ward no 71 and ward no.100, located in North Delhi, have one of the highest JJ household densities in Delhi.

JJ clusters which are located near planned colonies and have arterial water pipelines passing from near the premises are officially provided water from public standpipes but in reality most of the slum households have connected water pipelines in an unauthorised manner from the main water pipelines and have installed "gali taps". On the other hand, JJ clusters which are located in areas without access to main water pipelines depend on DJB or private tankers.

4.3.3.6 Rural villages

Nearly 4.19 lakh (2.5 percent) of Delhi's population resides in 112 rural villages (Census of India, 2011). The share of rural population has increased in the 1980 decade and then has been declining over the years with more areas getting urbanised.

Table 4.4: Decadal Change in Number of Rural Villages and Population

Year	No. of Villages	Population	Decadal Population Growth Rate (%)
1981	231	452206	-
1991	209	949019	109.86
2001	165	944727	-0.45
2011	112	419042	-55.64

Source: Statistical Abstract of Delhi, 2014

Largely, the villages depend on ground water for both agricultural and domestic use. Delhi Jal Board also sends tankers to these areas.

The demand for water and factors which influence its distribution across Delhi, relevant to the present study were taken up in this section, but the analysis would be incomplete without understanding the situation from the supply point of view. Thus, the next section delves into the water supply scenario and subsequently the constraints which are faced by the public utility, DJB in meeting the water demands of the various sections of the population of Delhi.

4.4 WATER SUPPLY REGIME IN DELHI

Delhi has both formal and informal water supply. Formal water supply is the responsibility of Delhi Jal Board, a parastatal organisation under the state government. Delhi Jal Board was constituted under the Delhi Water Board Act, 1998. Prior to that, Delhi Water Supply and Sewage Disposal Undertaking (DWS&SDU), constituted in 1958, existed as a part of Municipal Corporation of Delhi. Till 1958, sewage disposal and water supply and distribution was the responsibility of Delhi Joint Water and Sewage Board. In 1996, DWS & SDU was transferred to the State Government from MCD. Informal water supply is dependent on several sources such as private water tankers, private borewells and tubewells, illegally tapped water from DJB pipelines.

4.4.1 Formal Water Supply : Delhi

Delhi Jal Board is responsible for production and distribution of drinking water and collection, treatment, and disposal of domestic sewage in the Capital. Its services include supplying potable water through pipelines and tankers,supply of packaged water “Jal” in jars through Jal Suvidha Kendra, treatment and disposal of sewage, supply of biogas/sludge manure/treated waste water and testing of water samples.

4.4.1.1 Production System of DJB

Delhi Jal Board (DJB) is the sole body officially responsible for supplying water to the 167 lakh population of Delhi. Yamuna river, Ganga river and Bhakra storage are the main sources of surface water while ground water comprises nearly 14 percent of the total water supply. Water sources of DJB are presented in Table 4.5. The installed capacity has been augmented by 39 percent in the last 10 years from 650 MGD in 2006 to 906 MGD in 2015 **(Economic Survey of Delhi, 2014-15).** Water production during summers was 835 MGD in 2015 **(www.delhi.gov.in).**

Table 4.5 : Water Resources of Delhi Jal Board- Installed Treatment Capacity

S.No	Source	Peak Production Quantity (MGD)
1	Yamuna river	540
A	Chandrawal	90
B	Wazirabad	120
C	Haiderpur	200
D	Nangloi	40
E	Okhla	20
F	Bawana	20
G	Dwarka	50
2	Ganga river	240
A	Bhagirathi	100
B	Sonia Vihar	140
C	Commonwealth village	01
3	Recycling/Waste Water plants	45
4	Ranney wells and Tube wells	80
5	Total	906

Source: Economic survey of Delhi, 2014-15

In March, 2014, DJB was operating 3961 functional tubewells and 14 ranney wells. The increasing depth of groundwater has emerged as a serious concern. In the past, the focus had always been on increasing the production through incorporating new sources in the water production system, thus there was a rush to build dams even if it meant getting water from large distances. Now, although there has been a shift towards improved management of water to reduces water losses, the rush to get water from far off sources has continued. In the wake of lowering ground water levels, several households which depended solely on borewell or tubewell water earlier are in the process of being supplied tapwater. This would also add to the overall consumption. It is clear from table 4.6 that the water demand has exceeded the net water supply in the past and will continue to do so till 2021. The deficit is met largely from the private borewells and tankers.

Table 4.6: A Comparison of Water Demand and Water Availablity : 2005-2021

Demand/Supply	2005	2011	2021
Water Demand (MLD)	3763	5181	6272
Net Water Supply (MLD)	2362	3573	5259

Source: Economic Survey of Delhi, 2014-15

In water scarce areas, water consumption might lag behind water demand as water demand is calculated according to established standards while consumption is the water actually used and is dependent on the availability of water. Prior to the drafting of 1962 Master Plan, total supply of filtered water was 60 MGD. The Master plan envisaged addition of 160 MGD during the period 1961-1981.In reality, 193 MGD was added during that period (Master Plan of Delhi-2001). Further,the Master Plan of Delhi -2001 envisaged a need for additional water supply to the extent of 671 million gallons per day by the year 2001 to meet the demand of estimated 128 lakh population in 2001. This was expected from Tehri dam from Uttar Pradesh, Kishan and Lakhwar and Giri dams in Himachal Pradesh. Enhancement of the existing four treatment plants and construction of one more treatment plant was suggested. The estimated population of Delhi fell short by nearly 10 lakhs as the actual population grew to 138.5 lakhs by 2001. Master Plan of Delhi 2021 recognised not only the increasing demand of water but also acknowledged the inequitable distribution of water supply in the city. It also emphasised on the importance of water conservation which was missing in earlier Plans. Unlike the previous plans, MPD-2021 emphasised on the need for institutional capacity building, user pay approach and public private partnership.The plan suggested a minimum of 172 lpcd of water after taking into account 15 percent losses. It was understood that this proposed water supply would have to be sourced from the then proposed dams in UP,Uttaranchal and Himachal Pradesh, Satluj-Yamuna link canal and Sharda Yamuna link canal. Ground water and recycled water were also seen as important sources. The existing capacity was 650 MGD in 2001 which was envisaged to be increased to 919 MGD in 2021 for an estimated population of 230 lakhs in 2021. But at the same time, DJB and DDA anticipated that the demand would be 1380 MGD@60 gpcd and 1840 MGD@80 gpcd respectively in 2021.

4.4.1.2 Transmission and Distribution System

Delhi Jal board supplies water to the area under the jurisdiction of MCD and supplies bulk water to NDMC and Dehi Cantonment Board for distribution in their areas. The MCD area has been divided into 21 zones for the purpose of operation and management. Water is supplied through pipelines, otherwise through tankers in non-networked areas. The water supply distribution was very inequitable in the past, efforts have been made to improve the distribution by constructing underground reservoirs, now 105 in number and booster pumping stations. Household access to treated tap water within premises may be taken as an indicator for showing the extent of coverage as treated tap water in India is provided by the water utility only. In 2011, 66.51 percent of the households had treated tap water within the premises. In the absence of data for treated tapwater in 2001, household access to tapwater has been taken for comparing the 2001 and 2011 figures (Table 4.7).

Table 4.7: Household Access to Tap Water in Delhi

Location of Tap	2001 (Percent)	2011 (Percent)
Within Premises	61.56	69.18
Near Premises	10.57	9.44
Away from Premises	3.20	2.70
Total	75.33	81.32

Source: Census of India, 2001 and 2011

There has been an overall improvement in the household access to tap water in Delhi in the period 2001-2011. Compared to 61.56 percent households having access to tap water within premises in 2001, 69.18 percent had access in 2011.

In areas not connected by distribution pipelines, Delhi Jal Board provides water through tankers. Among the divisions, North- West II comprising Narela, Bawana, Rohini and Rithala areas has the highest per capita availability of water while South III comprising Greater Kailash, Deoli and Sangam Vihar has the lowest per capita availability of water.

Table 4.8: Per Capita Availability of Water (DJB Tankers) in Non-Networked Areas (2013)

S.No	Division	2009-10	2010-11	2011-12
1	Central II	2.94	4.30	5.95
2	North West I	3.85	3.63	3.82
3	North West II	25.0	25.0	25.0
4	North West III	1.26	1.31	1.42
5	North East I	6.58	6.41	6.65
6	North East II	11.0	10.66	10.75
7	North East III	1.85	1.69	1.52
8	East I	2.90	2.91	2.90
9	East II	2.56	2.33	2.39
10	South I	2.83	2.42	3.24
11	South III	0.68	0.86	0.93
12	South IV	3.23	3.23	3.23
13	South West I	4.15	4.15	4.60
14	West III	6.19	6.19	6.19
15	North	0.11	1.27	1.21
16	Average	3.42	3.40	3.82

Source: CAG Audit Report, Report No.2 of the year 2013

The non-networked areas in South III followed by North West III division have the lowest availability of water through DJB tankers. South III comprises parts of the Greater Kailash, Sangam Vihar and Deoli constituency. The North West division comprises parts of Shalimar Bagh, Shakurbasti, Trinagar and Wazirpur assembly constituencies.

4.4.2 Alternate Informal Water Supply

Informal water supply in Delhi plays a critical role in filling up the gap created by unreliable and inequitable formal water supply. These have emerged as lifelines in the underserved areas. Service providers may be categorised into the following:a) private water tankers b) private pipeline water providers c)push cart operators and d) bottled water. The source of water for all these are private tubewells and public standpost for push cart operators.

Private water vendors have existed for along time but have recently emerged as a symbol of municipal failure to provide water to households. They have come into focus due to the many studies on wllingness to pay in recent times **(Kjellen & McGranahan, 2006)**. The legal status of the water providers is not a concern for the residents as these meet their demand for water at their doorstep and help them in leading regular lives **(Bansal, 2012).** Estimates for private tankers point to nearly 2000 tankers in Delhi **("Groundwater half of Supply", 2012 cit. in Bansal, 2012).** The private tankers usually fill up water from borewells largely located on the outskirts of the city, but given the preferred demand for soft water, these have also been found to fill water from DJB booster stations in connivance with ground level staff **("Official, tanker mafia nexus worsen Delhi's water crisis", 2012).** Although the present Government has banned private tankers unless authorised by DJB, private tankers continue to thrive.In times of acute crisis, private tankers are easier to contact than DJB tankers and also fill up tanks on higher floors with booster pumps **("Private Tankers keep Delhi Going, 2016).** Bottled water belongs to both the organised sectors like the ones from reputed companies and the unorganised sectors. The bottles water industry is required to adhere to the BIS standards set by the Government. Bottled water (for household consumption) in the organised sector is priced at Rs.70 for 20 litres compared to Rs.20-40 for 20 litres bottled water in the unorganised sector. The demand for cheaper water among low income household has also fuelled the demand for bottled water from the unorganised sector. Issues have emerged regarding the source of water. Instances have been there when water from taps, without any further treatment, were found to be filled in these bottles **("Delhi's Worst Bottled Secret is Out", 2013).** The low income households are the most vulnerable to bottled water from the unorganised sector.

4.5 CONSTRAINTS IN PUBLIC WATER SUPPLY AND CASE FOR REFORMS AND PRIVATE PLAYER ENTRY

4.5.1 Allocation of Water and Sanitation in the State Budget

Reflecting the overall trend of reduction in the share of plan outlay for water and sanitation, Delhi's budgetary allocation for water and sanitation as percentage share of total budget has also declined.

Table 4.9: Share of Plan Outlay of Water and Sanitation (2005- 2016)

Year	Approved Plan Outlay –Water and Sanitation (Rs. Crore)	Expenditure (Percent)	Share of Total Plan Outlay (Percent)	Sector with Highest Share (Percent)
2005-06	714.90	75.9	14.2	Transport (23.3)
2006-07	833.55	100	14.3	Transport (16.2)

2007-08	1268.00	99.6	14.0	Transport (25.8)
2008-09	1507.00	98.11	15.0	Transport (29.3)
2009-10	1365.65	99.9	13.6	Transport (30.6)
2010-11	1500	97.41	13.0	Transport (37.6)
2011-12	1850	99.97	13.0	Transport (24.9)
2012-13	1800	98.14	12.0	Transport (22.4)
2013-14	1665	99.04	10.4	Transport (24.2)
2014-15	2000	89.45	12.9	Transport (23.76)
2015-16	1468	-	8.0	Education (24)
2016-17	1976	-	9.6	-
2017-18	2108	-	4.3	Education (23.5)

Source: www.delhi.gov.in

Although, the absolute plan outlay for water and sanitation has fluctuated over the years, the share of water and sanitation has been declining since 2008-09, with a slight increase in 2014-15 (12.9 percent).

4.5.2 Capital Investment

Water delivery infrastructure is capital intensive in nature. One of the primary reasons for advocating private player entry has been that they are in a position to infuse capital in upgrading and rehabilitating decaying infrastructure. The Government utilities, in the absence of financial self-reliance, have traditionally survived on grants from either the state or the Central government. In 2002, 5000 crores was the estimated expenditure for system rehablitation for both water supply and sewerage **(PWC et al, 2004)**. In 2016-17, for the capital investments, budget provision for receipt was made for Rs.381 Crore in the water sector alone. Out of this, Rs.316 Crore came as grant and Rs.65 Crore as loans. A separate provision was also made for water for unauthorised colonies and JJ clusters amounting to Rs.679 Crores (100 percent grant) with 99.5 percent being allocated to unauthorised colonies. The 2016-17 budget witnessed a substantial increase in the budget allocated for infrastructure expansion in the underserved areas such as the unauthorised colonies and JJ clusters compared to the previous year when it was Rs.277 Crore. Thus, the total plan outlay for water infrastructure was Rs.1060 Crore in 2016-17, an increase of 62.3 percent from the previous year. It is clear that all the money budgeted for capital costs is done through loans and grants.Like many other utilities in the country, DJB is also unable to generate funds for expansion of infrastructure and has to depend on grants and loans from the Government or external financial institutions.

4.5.3 Household Coverage

One of the most commonly cited reason for private sector entry into public water supply is the lack of capital to expand coverage of water supply network. This includes, expansion into both peri urban areas and underserved areas within the city limits. In Delhi, the underserved areas mainly comprise the urban villages,unauthorised colonies, resettlement colonies and JJ clusters.

There has been an increase in the length of the water mains in the period 2001 (8363 kms) **(CDP Delhi, 2006)** and 2016-2017 (14000 kms) implying that new water pipelines have been laid to expand the network **(Economic Survey of Delhi, 2016-17).** As per Census 2001; there were 25.54 lakh census houses in Delhi while the number of water connections in 2001 were 13.33 lakh i.e 52.19 percent of the census houses had an authorised water connection.In 2011, there were 33.40 lakh census houses, while the number of authorised water connections in 2013-14 were 20.65 lakh in number i.e 61.82 percent of the total census houses. While there has been an improvement in the percentage of households with access to authorised connections, but there is still a large percentage of households without authorised water connections. These households cope through unauthorised connections, water tankers (both Delhi Jal Board and private tankers) and private borewells.

Table 4.10: Details of Water Transmission and Distribution Components – 2001 and 2013-14

S.No	Component	2001	2013-14
1	Length of water mains (kms)	8363	11350
2	No. of water connections	13.33 lakh	20.65 lakh
3	No. of metered connections	10.32 lakh*	17.7 lakh
4	No. of water stand posts	11,533	-
5	No. of water tankers	493	-
6	No. of private tubewells	200000 (estimated)	-
7	Capacity of existing underground reservoirs	175 MG	-

*Source: CDP,2005, * PWC et al 2004,,Economic Survey of Delhi,2016-17*

4.5.4 Quality of water

There are three aspects of quality of water; physical, chemical and microbiological. Physical characteristics of water comprise temperature, colour, taste and odour and turbidity. Chemical characteristics refers to the hardness, Total Dissolved Solids (TDS), conductivity and sodium adsorption ratio. With respect to micro-biological characteristiics, usually the presence of coliform is taken as an indicator. Contamination of water is one of the leading causes of water borne diseases such as typhoid, diarhoea, cholera, enteric fever etc.

According to a survey by Municipal Corporation of Delhi (2012), 70 percent (81 out of 116 samples) of the water supplied was found to be contaminated **(Singh, 2012)**. There seems to have been improvement since then. In January 2016, 10691 water samples were collected and analysed by South Delhi Municipal Corporation, East Delhi Municipal Corporation and North Delhi Municipal Corporation. Out of these, 170 (1.56 percent) failed to clear the test. South Delhi fared the worst with 2.9 percent of the samples being contaminated while East Delhi received the best quality water with none of the samples failing the test. Ironically, the agencies which conducted the test did not accept the report **(Bhushan, 2016).** Delhi Jal Board claims to test 300 samples each day taken from the distribution system for ensuring potability as per BIS drinking water specifications 10500-1993 **(MoUD, n.d).**

4.5.5 Inequality in Water Supply

The inequality of water supply across Delhi has been an issue for long. The inequality exists over geographical space, between urban and rural and across socio-economic groups. This section discusses the inequality in water supply over geographical space. River Yamuna, the main source of water supply flows through the Eastern side, as a result, the water treatment plants are also located on the Eastern side. The areas situated in Western part of Delhi often fall at the tail end of the distribution system, receiving less water than the rest. Diagram 4.1 presents a sketch which has been one of the most cited maps for inequality in water supply in Delhi since it was published in an NCRPB report in 1999. It shows the high levels of inequality prevalent in water supply across Delhi at that time.

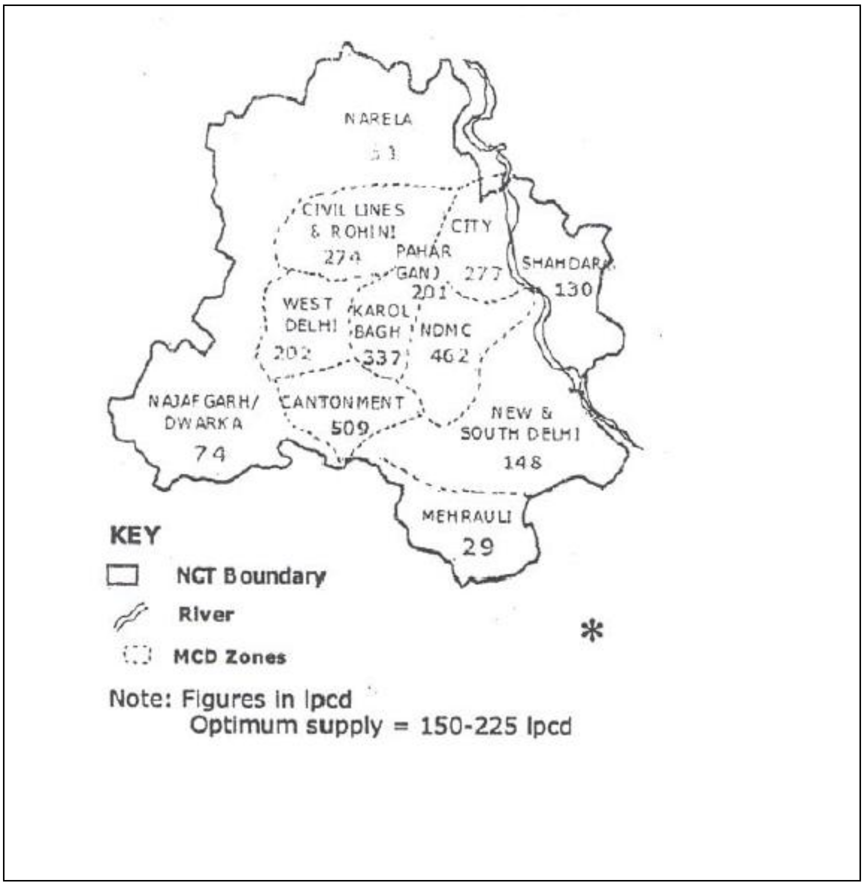


Diagram 4.1: Spatial Inequality in Water Supply in Delhi

Source: City Development Plan of Delhi, 2006

Much improvement in infrastructure has taken place since the time this map was published and this might not hold true as of today. DJB has identified inequitable distribution of water as one of the important issues and has taken measures to address it. While Sonia Vihar WTP started in 2006 and has reduced the water shortage in South Delhi to a large extent ,Nangloi WTP is in the process of getting upgraded and would be addressing the needs of outer Delhi.. DJB is in the process of constructing 107 UGRs spread across the city so that the WTPs feed into the UGR first and then further distribution is done through pumping from UGRs. This will to an extent, address the water availability at the tail end areas. District Metered Areas have also been created in order to do water accounting more efficiently.

While these measures might not suffice to eradicate the inequalities arising out of socio-economic disparities, it might address the inequality arising out of geographic advantage.

4.5.6 Reliability of Water Supply

Intermittent supply, insufficient pressure and seasonal disruptions are some of the major problems which plague Delhi's water supply. The frequency and duration of water supply is highly variable in Delhi. Water supply for 24x7 is still a distant dream in Delhi. The cost of unreliability of water borne by households is substantial as illustrated by **Zerah (2000)** who estimated that each household in Delhi spent about 2000 Rupees annually for coping with unreliable water supply. They did so through long term investment in storage tanks, tubewells or borewells. One of the important selling points of the PPP project has been provisioning of 24x7 water supply. A 24x7 water supply not only eliminates the need for storage tanks, but also reduces secondary contamination. Most of the households fulfill their demand of 24x7 water by storing water in tanks. The duration and frequency of water supply varies across the city. While in the NDMC areas, it is close to 18 hours in a day, the duration is limited to two hours in a day in other parts of the city.

4.5.7 Revenue Management

Revenue management, with focus on recovering operation and maintenance cost, at the least has been at the centre of the structural reforms in the water sector. In this section, the analysis is focussed on the revenue being generated from the retail customers. Prior to that, a brief background has been given on the break up of the revenue and expenditure of the operation and maintenance part of DJB (table 4.11) The operating expenses which largely include salary, electricity costs, repair and maintenance and property tax are met through water charges from retail customers, NDMC and MES (Delhi Cantt.), infrastructure charges and other miscellaneous receipts.

Table 4.11: DJB Budget for Operation and Maintenance -2014-15, 2015-16 and 2016-17

S.No	Item	2014-15 (Rs.Crore)	2015-16 (Rs.Crore)	2016-17 (Rs.Crore)
A	Revenue Income			
1	Revenue Generation	1941.43	2251.49	2382.90
2	Income from LPSC	19.75	95.50	839.95
3	Total income	1961.19	2346.99	3222.85
B	Expenditure			
1	Actual Expenditure	1891.21	2173.57	2577.42
2	Interest on Loan	2858.44	2973.86	3060.26
3	Depreciation	464.63	465.60	465.60

4	Rebate on arrear to Consumers	0	161.81	1553.32
5	Rebate on LPSC to consumers	19.76	95.50	839.95
6	Total Expenditure	5234.04	5870.34	8496.55
	Deficit	-3272.85	-3523.35	-5273.70

Source : DJB Budget, 2016-17

Revenue from retail water to MCD area comprises 76 percent (Rs.1801 Crore) of the total revenue receipt. Among the actual estimated expenditure, payment to staff forms 61 percent of the total expenditure followed by expenditure on power (8 percent) and repair and maintenance (8 percent). The operation and maintenance budget deficit has increased over the past three years, although the income has been more than the actual expenditure in 2016-17. The deficit in 2016-17 has been largely due to the rebates given to the consumers.

The focus has largely been on full cost recovery through 100 percent metering, reducing NRW, improving revenue collection, eliminating unauthorised water connections etc. In 2010, Tata Consultancy Services (TCS) was contracted to introduce an integrated system for bill generation and payment, GIS mapping of water connections to reduce theft and leakages etc. It was 53 crore project for five years with 21 crore as the capital expenditure. Digitised metering, billing and bill collection were an important part of the project **(Gupta, 2010).**

DJB has been planning several initiatives to increase its revenue such as increasing commercial water connections, putting advertisements on tankers and selling by-products of the sewage treatment plants **(Vatsa, 2015**). There has been an increase of Rs.178 crore of revenue in 2015 vis-a-vis 2014 **(Nath, 2016).** Revenue collection through water charges is one of the main areas of revenue collection for DJB. The revenue target is fixed according to the number of households in that zone and the estimated water consumption@135 lpcd. The target includes both the current demand and the arrears **(Interview with DJB official, April 2016).** Table 4.12 shows the division wise status of the achievement of revenue target (water charges).

Table 4.12: Division wise Revenue Collection Efficiency (2014-2015)

S.No	Division	Revenue Target (Rs.Crore)	Revenue (Rs.Crore)	Percentage Achieved of target	20 kl Rebate Amount (Percent)
1	Central II	118.96	50.83	42.73	0.13
2	North West I	23.52	22.08	93.88	0.28
3	North West II	48.23	51.05	105.85	0.20

4	North West III	36.53	47.35	129.62	0.37
5	North East I	58.80	59.35	100.94	0.36
6	North East II	18.23	16.53	90.67	0.31
7	North East III	28.61	29.24	102.20	0.25
8	East I	66.66	58.75	88.13	0.32
9	East II	38.28	40.38	105.49	0.32
10	South I	29.09	39.95	137.33	0.02
11	South II	77.19	64.61	83.70	0.10
12	South III	41.06	41.21	100.37	0.08
13	South IV	26.17	23.33	89.15	0.05
14	South West I	29.30	23.04	78.63	0.32
15	South West II	25.55	16.60	64.97	0.10
16	South West III	49.52	42.47	85.76	0.07
17	West I	74.71	65.45	87.61	0.29
18	West II	111.7	80.99	72.51	0.13
19	West III	10.98	10.25	93.35	0.09
20	North II	15.58	15.63	100.32	0.36
21	PPP MNWS	35.39	37.79	106.78	0.15
22	PPP MVV	10.96	8.43	76.92	0.08
23	PPP NANGLOI	38.39	22.32	58.14	0.01
24	Average	1425	1218.06	85.48	0.43

Source: DJB, Personal Communication, 2016

Overall, DJB has a water charge collection efficiency of 85.48 percent. Central II division comprising the low income of Deputy Ganj, Paharganj, Model basti and middle income areas of Shastri Nagar,Karol Bagh and Dev Nagar area has the poorest revenue collection efficiency (42 percent) while South I division comprising Vasant Kunj, Ambedkar Nagar and Chhattarpur has the highest (137.3 percent). Among the PPP projects, only MNWS Pvt Ltd has generated a more than 100 percent collection efficiency. The other two PPP projects have below average collection efficiency.

4.5.8 Non-Revenue Water

Non-Revenue water refers to the water which is unbilled and does not draw revenue for the Water department. It may be due to leakages in the distribution system or due to unauthorised drawing of water from the pipelines. As per past studies, one of the major flaws in the existing transmission and distribution system is a high percentage of non-revenue water **(PWC et al, 2004).** In 2001, 49 percent of the water supplied was non-revenue water **(CDP-Delhi, 2006)** Non-metered supplies by tankers and standposts accounted for 8 percent of the total water produced implying that the water losses may be attributed to transmission and distribution losses **(PWC et al, 2004)** with nearly 42 percent of the network being more than 20 years old and 6 percent being more than 40 years old. In the absence of bulk metering, it is not clear how NRW has been calculated and there is ambiguity regarding the quantification of non-revenue water.

Table 4.13: Non-Revenue Water in Delhi- 2009-2012

S.No	Year	NRW (Percent)
1	2009-10	66.97
2	2010-11	64.80
3	2011-12	62.59

Source: CAG Audit Report, Report No.2 of the year 2013

Unauthorised connections result in higher NRW than just losses due to transmission and distribution. While there are no absolute figures for the number of unauthorised water connections in Delhi, the fact that there are 50 lakh electricity connections and only 19 lakh water connections give an idea about the number of unauthorised connections that could be there **(Delhi: DJB utility promises water conections for everyone with valid ID proof, 2016).**

4.5.9 Metering of Water Supply

Metered connections are another component, in the absence of which, volumetric bills cannot be generated.The share of metered connections is presented in table 4.14. There has been an abrupt rise in the number of unmetered connections in the 1981-1991 decade, specifically in 1988-89. There has been an increase in the number of metered connections over the two decades in consideration,the percentage share of metered connections has also increased from 76.19 percent in 2001 to 79.39 percent in 2011. The total number of metered connections was 21.61 lakh in April 2016 **(DJB, 2016).**

Table 4.14: Metered Connections as a Share of Registered Connections (1981-2011)

S.No	Year	Metered Connections (No.)	Unmetered Connections (No.)	Percentage of Metered Connections (Percent)
1	1981	3,86,167	12,620	99.07
2	1991	7,00,923	2,45,451	74.06
3	2001	10,02,326	3,13,112	76.19
4	2011	15,40,968	3,99,930	79.39

Source: Economic Survey of Delhi, 2014-15

Attempts at introducing the new air flow water meters have met with a lot of household resistance. The main concern was regarding the meters moving fast. In 2014, AAP had taken up the case of meter acquisition with the anti corruption branch. In 2015, DJB allowed customers to buy and install their own meters **(Consumers can install own meters, says DJB, 2015).**

4.5.10 Pricing of Water

Water is a politically sensitive subject in India and the pricing of water is privy to this. The tariffs have always been kept low and there has been a lot of political pressure to do so. The scenario is slowly undergoing a change with added stress on full cost recovery. Comparing Delhi to other cities with respect to telescopic volumetric water tariff, Delhi is second to Chandigarh (30 kl) with respect to lifeline water volume at 20kl. The most common lifeline water volume is 10 kl (Jamshedpur, Kochi, Kannur, Kozhikode, Thrissur, Malappuram and Kollam). Delhi also has the second highest lifeline tariff, preceded by Hyderabad (Rs.10/kl for the first 15 kl of water). The water pricing has substantially changed in the past two decades, reflecting the changes taking place at the policy level. It has been argued that the abrupt increase in 2005 and then the incremental increase in tariff since 2010 has been to make PPP more viable.

The amount in the bill generated by DJB is dependent on the per unit tariff and the volume of water consumed. The tariff has undergone much change since 1998 when DJB was formed, the beginning of the reforms. In the period 1998 to 2004, for domestic water connections, the rates for the first 10,000 litres in a month were Rs.0.35+50 percent per 1000 litres. For volume above 10,000 litres and below 20,000 litres, the rates were Re.1+50 percent per 1000 litres. Further, for volume above 20,000 litres and below 30,000 litres, the rates were Re.1.50+50 percent per 1000 litres and above 30000 litres, the rates doubled to Rs.3+50 percent per 1000 litres. The minimum charges and for resettlement colonies, the rates were Rs.20+50 percent per month per connection. In 2004-2005, Rs.40 per month was added as service charge to the prevailing rates. Rs.120 per month was added to the bill of residential properties having built up more than 200 sq.m. This was the first time that some distinction was made between high income group areas and other areas with respect to billing. In 2005, further changes were brought about in the criteria for billing. There were no charges till 6 kl/month. The charges were Rs.2/kl for 7-20 kl/month, Rs.7/kl for 21-30kl/month, and for above 30kl/l, the charges were Rs.10/kl. From 2010 onwards, there has been an annual incremental increase in the charges by 10 percent. In addition 60 percent of the volumetric charge was also added as sewerage charge. In 2010, the rates for the first 10 kl were Rs.2.10/kl with Rs.50 as the service charge. For the next 10 kl, service charge was increased to Rs.100 and the tariff increased to Rs.3/kl. For the next 10kl, the service charge increased to Rs.150 and the tariff increased to Rs.15/kl. For more than 30kl, the tariff was Rs.25/kl with service charge as Rs.200. In August 2015, the charges were revised and the present tariff is Rs.4.31/kl and Rs.146.41 as service charge for the first 20 kl. From 20-30 kl, the volumetric charge jumped to Rs.21.97/kl with Rs.219.62 as service charge. For volumes above 30 kl, the charge is Rs.36.61/kl with an additional Rs.292.82. The additional 60 percent of volumetric charge as sewer maintenance charge remained **(DJB, n.d)**. DJB also has separate charges for households not having implemented rainwater harvesting. As per the provisions of Delhi Water and Sewer (Tariff and Metering) Regulation, 2012, rainwater harvesting is mandatory for property of 500 sq.m or more. Domestic properties were give a time period of three years for installing rainwater harvesting systems which was further extended to August 2016. The non-compliant customers are penalised with 1.5 times the tariff for water volumetric charge, sewerage charge and service charge **(Circular No.DJB/DOR/Tariff/2016/6/8 dated 08.02.2016, DJB, 2016)**

The above mentioned factors have been largely responsible for the changing discourse on self sufficency of utilities. DJB also has self sufficiency as one of its mandates and has embraced institutional and financial reforms. The present Government, though against PPP in the water sector, has put special focus on the water sector and is trying to improve the water distribution situation in Delhi through expansion of water pipelines to all areas, reduction of NRW and free water in the lifeline category. The initiatives are commendable but the safeguards for the low income households are not enough and is at the mercy of the political will. While 100 percent metering is being advocated and implemented, problems with these air flow meters have surfaced again and again.

4.7 Private Sector Participation in Water Sector in Delhi

4.7.1 History of Private Sector Participation in Utilities in Delhi

Among the utilities, electricity distribution (whole Delhi) and water supply and distribution (in some areas) have private sector participation. The model for both is very different, although both were preceeded by unbundling of functions. In the case of electricity, the DisComs were bought by the private companies while in the case of water supply and distribution, Delhi Jal Board remains the owner of the assets and the private players would be responsible for operation and management. Private players have also been brought into municipal waste management with waste collection, segregation and transportation to landfill sites outsourced to the concessionaires.

4.7.2 Privatisation of the Electricity Utility (Delhi Vidyut Board)

Since 1957, Delhi Electricity Supply Undertaking (DESU), a wing of MCD was responsible for generation, transmission and distribution of electricity. In 1997, Delhi Vidyut Board was created as a separate parastatal agency. Reforms were brought into the Power sector in the late 1990s that eventually led to unbundling of DVB and privatisation of distribution from 2002. The major reasons cited for privatisation were continuing poor commercial performance especially the high transmission and distribution losses.

As seen in the case of water supply and distribution PSP, legal Acts were brought into force in tandem with the discussions at that time. In this case, the strategy paper on power was brought out by the Government in 1999 followed by the Delhi Electricity Reforms Ordinance (October 2000) and Electricity Reform bill being passed in November,2000. The Delhi Electricity Reform Act, 2001 formally opened up the electricity sector to private players. The Act consolidated all the past laws pertaining to electricity generation,transmission, distribution,trading and use. The Act also laid the grounds for rationalisation of tariff, constitution of Central Electricity Authority and Regulatory Commisions. Even before the Act was passed, DVB was unbundled and six shell companies – one holding company, a generating company, a transmission company and three distribution companies were registered in July 2001. Subsequently, BSES and TATA Power were appointed for Central and East, south and West and North and North-West circles respectively.

One of the major reasons cited for privatisation was to reign in the Aggregate technical and Commercial (AT &C) losses. The losses had reduced from 56 percent in 2002-03 to 38 percent in 2007-08. Various issues related to tariff have surfaced. The CAG Report, 2015 outlined buying costly power, inflating costs, suppressing revenue, dealing with other private companies without tender and giving undue favour to group companies. **(Iqbal, 2015)**. Despite the negative outcomes, some positive outcomes have also emerged such as improvement in quality of electricity and savings for the State Government. The state government had saved Rs.50 billion per year (17 percent) of the State Budget as reported in a report on power sector by SBI Cap Securities **(Ramachandran, 2012).**

4.7.3 Water Supply and Distribution- Public Private Partnership

The presence of PPP in the water sector in Delhi is strong with companies operating and managing water supply and distribution in the city. Delhi has nine Water Treatment Plants, out of which two are operated and managed by Private companies, namely Nangloi WTP and Sonia Vihar WTP. For Sonia Vihar Water Plant, Suez-Ondeo Degremont has been contracted by Delhi Jal Board to build and operate a water treatment facility at Sonia Vihar, Delhi. It is a 140 MGD capacity plant with source of water from Upper Ganga Canal and River Yamuna. The contract is for ten years. Three PPP projects have been initiated in Delhi for distribution of water. Nangloi water distribution services which comprises improvement and revamping of the existing water supply system, Malviya Nagar water distribution services comprising efficient water distribution in Malviya Nagar UGR command area and Mehrauli and Vasant Vihar water distribution services for improving water distribution in the area are the three projects. A brief description of each of the projects is given below.

Malviya Nagar Water Distribution Improvement Project

Malviya Nagar Water Services Private Limited, a consortium of Suez and SPML is responsible for operation and management of water distribution in the selected area under Malviya Nagar Underground reservoir. Adchini, Chirag Dilli, Hauz Rani, Kalu Sarai, Khirki village and extension, Lado Sarai, Nav Jeevan Vihar, Panchsheel Park, Sadhana Enclave, Saket, Sarvodaya Enclave, Sheikh Sarai Phase I, Shivalik, Begumpur, Geetanjali, IGNOU road, Katwaria Sarai, Khirki DDA flats, Malviya Nagar, Neb Sarai, Qutab Institutional area, Saiyad ul Ajab, Sarvapriya Vihar, Savitri Nagar,Sheikh Sarai Phase II and Soami Nagar are covered by this scheme . The contract was awarded in 2012 and the duration is for 2+10 years.

The project area has a population of 3 lakhs and about 32000 registered connections. The performance indicators comprise coverage of water supply, per capita supply of water, continuity of supply, extent of metering of water connections, extent of NRW, redressal of consumer complaints, quality of water, collection efficiency, the targets are the service level benchmarks by MoUD.

Table 4.15: Status of Service Levels in Malviya Nagar Water Improvement Project at the Time of Award

S.No	Service Level Benchmark	Existing Status	Benchmark as per MoUD	Targeted Performance
1	Coverage of Water Supply	84%	100%	24 Months
2	Per Capita Water Supply	286 LPCD	135 LPCD	60 Months
3	Continuity of Supply	3-8 hours	24 hrs	36 Months
4	Extent of Metering	41%	100%	24 Months
5	Extent of NRW	65-70%	15%	36 Months
6	Efficiency in Redressal of Consumer complaints in 24 hours	-	80%	36 Months
7	Quality of water	Mix Supply	100%	48 months
8	Collection Efficiency	81%	90%	60 months

Source: http://www.delhi.gov.in/

The investment plan was estimated to be Rs.141 Crores including 65 crores for road restoration. Thirty percent of the Capital expenditure (except road restoration) will be borne by the private operator.

Mehrauli and Vasant Vihar Water Distribution Improvement Project

MVV Water Utility Pvt Ltd is a consortium of SPML Infra, Tahal Consulting Engineers and Israel's largest water company Hagihon Jerusalem Water and Wastewater Works formed to undertake the improvement in service level for Water Supply in Mehrauli and Vasant Vihar project area. Scope of the project includes improving water supply/availability, improving the existing water distribution system in order to minimize leakage and wastage of water , revamping of service connections in the project area, rehabilitation & augmentation works for pumping stations, immediate road restoration after laying the pipelines during project implementation and 24x7 consumer complaint center. The areas covered under this project are Vasant Vihar, Vasant Enclave, Shanti Niketan, Anand Niketan and Westend.

Table 4.16: Status of Service Levels for Vasant Vihar and Neighbouring Areas Water Supply Improvement Project at the Time of Award

S.No	Service Level Benchmark	Existing Status	Benchmark as per MoUD	Targeted Performance
1	Coverage of Water Supply	98%	100%	24 Months
2	Continuity of Supply	2.5 hours	24 hrs	36 Months
3	Extent of Metering	85%	100%	24 Months
4	Extent of NRW	32%	15%	36 Months
5	Efficiency in Redressal of Consumer complaints in 24 hours	NA	80%	80% in 12 months, 95% in 4 months
6	Quality of water	Mix Supply	100%	36 months
7	Collection Efficiency	64%	90%	24 months

Source: http://www.delhi.gov.in/

The fees comprises two components of fixed fee and performance fee. The fixed fee (60 percent) has to be paid on equated quarterly instalments and the performance fee (40 percent) would be paid half yearly on achievement of performance targets.

Table 4.17: Target Achievement Schedule for Vasant Vihar and Neighbouring areas (In Months)

S.No	Performance Parameter	In Months							
		24	**30**	**36**	**42**	**48**	**54**	**60**	**60-120**
1	Continuity	50	75	100	100	100	100	100	100
2	Billed Volume	75	75	80	80	80	80	80	80
3	Resolution of Complaints	95	95	95	95	95	95	95	95
4	Revenue Collection efficiency	90	90	90	90	90	90	90	90

Source: http://www.delhi.gov.in/

The NRW performance targets fixed for the entire three PPP project areas were based on estimates as there was no bulk metering in these areas at the time of the inception of the projects. With the call for structural reforms strengthening, there has been a shift from the notion of unaccounted for water to non-revenue water which itself captures the commodification of water. Non-revenue water is a more narrow term and includes any water which is not billed. Not only does this include transmission and distribution losses but also includes water which is supplied through standposts in JJ clusters. It is not very clear, on what basis where the NRW targets fixed in the absence of any existing figures. It has been suggested in the literature that the NRW estimates are kept high during contract stage to give the private companies an advantage as the target achievement for NRW is built into the contracts.

Nangloi Water Distribution

Nangloi Water Services India Private Limited formed out of Veolia Water Services and SWACH is responsible for civil construction, operation and management and rehabilitation of Bawana raw water feeder, automation of WTP etc in Nangloi, Najafgarh, Mohan Garden, Mundka (450 colonies and 23 villages). The contract was awarded in 2013 and the duration is for 15 years.

The Nangloi WTP command area is of 65 sq.km with a population of 1.07 million (excluding Ujwa and Daulatpur) (2011). At the time of the award of the project, there were 80724 connections. The length of the transmission system was 31 km and the distribution system was 1127 km. The per capita supply was 150 lpcd within the areas with network coverage. The NRW at the time of the award was estimated to be 78 percent. The key performance indicators are coverage of water supply connections, per capita supply of water, extent of metering connections, continuity of water supply, efficiency in redressal of customer complaints, cost recovery in water supply services, Water charges and collection efficiency. Service Level Benchmarking by MoUD were taken as the target.

DJB is bearing 50 percent of the project cost while the operator will bear the remaining 50 percent of the cost. All the assets will remain with DJB.

4.7.4 Non-Networked Water (Water ATMs)

Non-networked water has been touted by many scholars as the way forward for cities of the Global south, in order to bridge the growing gap between everyday needs and large infrastructure practices **(Allen, 2017).** Like many other cities, there are several areas in Delhi which are not supplied water through pipelines and depend on tankers for their water requirement, especially in the peri urban areas. Delhi Government has contracted private companies to set up water dispensing units at nominal price in these areas to meet the daily potable water need of the residents.

Water ATMs were set up by Sarvajal, a brand of Piramal Water Private Ltd. in Savda Ghevra resettlement colony in 2013 as a pilot project. 850 out of the 7500 families are said to be using the ATMs installed there. The ATMs use ground water which is purified through reverse osmosis and then is being provided to residents through 15 kiosks (ATMs) at 30 paise per litre. The residents can avail this water through pre-paid cards. At a time, 20 litres of water can be withdrawn. 280 more such water ATMs have been proposed by DJB in different parts of Delhi. **(Draw water from ATMs for 30 paise under Delhi Jal Board's new initiative, 2014**).

4.7.5 Solid Waste Management

In 2005, Municipal Corporation of Delhi entered into a PPP arrangement with three private companies for municipal waste collection, segregation and transportation to landfill sites. Delhi Waste Management Pvt. Ltd. (SPML) was given the contract for South, Central and City zones, Ag Enviro Infra Projects (P) Ltd, for Karol Bagh and Sadar Paharganj zones and Metro Waste Handling Pvt. Ltd. for West zone. As per contract, the performance is to be evaluated and monitored by an independent engineer **(Three Private Companies to Collect Garbage, 2005).** Timarpur Okhla Waste Management Company Pvt.Ltd (subsidiary of JITF Urban Infrastructure Ltd.) is at the helm of a waste to energy plant

4.8 SUMMARY

Delhi has carried forward the British legacy of state centric water supply development. Physiographic variation and socio-economic inequalities in the city are reflected in the differential access to water across areas, settlements and communities. Not only is the availability of water different for the various settlement categories but the norms for water provisioning are also starkly different, institutionalising the differential access. The ever increasing thirst of the city is being quenched by getting water from as far as the Himalayas. The present and the future demand outstrips the supply. The demand for potable water will further increase tremendously with lowering ground water tables and borewell water getting more brackish. The past decade has seen an active engagement with structural reforms in the water sector, considered by many as an influence of the multilateral financial institutions. There has also been an increased focus on improving revenue collection efficiency along with 100 percent metering and reduction of NRW. Some positive initiatives such as constructing UGRs across the city to enable equitable distribution of water and introducing piped water supply in all categories of settlements irrespective of the tenure status have also been undertaken, giving a fair chance to all households to access water. In the past decade, private sector participation has been marketed as the panacea for all water issues globally and Delhi is not untouched. PPP in water distribution was introduced in 2011-2012 and presently there are three ongoing projects. Although, the present Government is anti-privatisation but it is going ahead with maximising revenues through extending metering to all households of Delhi. It has also introduced 20 kilolitres of water free per month for each household as a sop for taking authorised connections. While this strategy appears to be a financially sound one which would help in improving the health of DJB, the effect of these initiatives on the various socio-economic groups and settlement categories need to be explored.

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CHAPTER V

INEQUALITIES IN NETWORKED WATER SUPPLY: A MICRO STUDY

5.1 INTRODUCTION

There has been a fierce debate surrounding the implications of PSP in the urban water sector, especially on the marginalised sections of the society. The debate has largely centred on the affordability aspect as cases around the world show that water tariffs have increased tremendously and often gone against the interests of the low income group households. In some cases, the poor households have been left out of service provisioning by the private players due to their inability to pay. The upper and middle class get the best of services as a result of unequal purchase capacity. Race, class and ethnicity are central to the questions of who gets what and how much of natural resources and urban space is distributed **(Swyngedouw et al 2005 cit. in Delgado-Ramos, 2015).** Urban deprivation and disempowerment is embedded in the exclusionary practices through which urban water supply is organised (**Swyngedouw, 2004 cit. in Radonic, 2015).**

The presence of both private and public management in Delhi has created a unique situation in which the tariff rate is the same for both since the ownership and the power to decide on the tariff is vested with DJB. Delhi, as discussed in the previous chapter, is home to various settlement typologies. While the planned colonies represent households which have access to authorised networked water from DJB, the urban villages represent households which are fully entitled to piped water but have inadequate infrastructure provisioning due to years of neglect. The unauthorised colonies represent households, which till 2016, were not legally entitled to formal piped water, unless regularised and thus relied on borewell water and unauthorised tapping into the DJB pipes. The JJ clusters comprise households which are at the bottom of the hierarchy and are provided water through public standposts. As of 2017, all households in Delhi are entitled to receive piped water irrespective of the settlement typology, but the historical neglect driven by discriminatory policies has put the last three settlement typologies at a great disadvantage and much behind the planned colonies.

The understanding of the distribution of benefits and externalities arising out of privatised water management at the end user level has been sought in the present chapter. The intention is not to look into comparing the service levels in the private and the public managed areas; rather focus on the prevailing inequalities between the various settlement categories in both these areas. Introduction of the chapter forms the first section of the chapter while the second section comprises the socio-economic background of the respondents. This is followed by a discussion on the service levels in each of the settlement category under both private management and public management. These service levels have implications on the households in terms of the adoption of coping strategies. These coping strategies have been discussed separately for each of the settlement categories. The cost of water incurred by the households has been at the centre of the public-private debate. While the IFIs have used cost of informal water as a justification for introducing PSP in water supply, the high tariff imposed by private companies has been a burning issue. Cost implications of water on households in the selected settlement categories have been discussed in the next section. Although the coping strategies and the overall cost arises from the service levels, it is imperative to discuss the former two, to get an overall picture of the water scenario in the study areas. Customer orientation has been one of the great selling points of PSP, also driven by the state apathy to consumers and the lack of transparency. Customer orientation of the private companies and the public utility as perceived by the households has been discussed in the sixth section. A household water vulnerability index has been calculated on the basis of some selected parameters already discussed in the previous sections. A summary of the present chapter has been provided in the last section.

5.2 PROFILE OF RESPONDENTS IN THE STUDY AREAS WITH NETWORKED WATER

5.2.1 Average Household Size

The average household size in Delhi is 4.06, while urban Delhi has an average household size of 4.07 **(NSS, 69th round, 2012).** The average household size in each of the settlement categories in the study area is higher than that of whole of urban Delhi. Household size has implications on the water consumption as higher number of members implies higher water consumption assuming similar lifestyle choices.

Table 5.1: Average Household Size in Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management	DJB
1	Planned Colonies	4.4	4.3
2	Urban Village	5.5	6.4
3	Unauthorised Colonies	5.0	4.3
4	JJ Cluster	5.3	5.9

Source: Computed from Field survey, February- April, 2016

With respect to the study area, the average household size is similar in both the private and public management areas. The household size is the highest in the urban villages mainly because of the joint family system still being prevalent in these villages. The household size was also seen to be more in the households in the A and B categories of planned colonies as the houses were ancestral properties inhabited by two to three generations and were large enough to accommodate the growing family.

5.2.2 Sex Distribution of the Respondents

The initial intention was to include more number of women as respondents since women are the key stakeholders in domestic water use but this was not possible in the urban villages and unauthorised colonies. The sex distribution of the respondents is heavily skewed towards males in urban villages and unauthorised colonies as in these settlement categories, very few women had or were willing to share information about the financial aspect of water. In many of these households, the women were sent inside by their husbands, the moment they were seen talking to the interviewer. On the contrary, the situation was better in JJ colonies where women were more forthcoming with their problems including the financial aspect, also probably because of the absence of the husbands during the interview. Therefore, a higher percentage of females could be surveyed in the JJ clusters.

Table 5.2: Sex Distribution of Respondents in Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)			DJB (Percent)		
		M	F	Total	M	F	Total
1	Planned	38.33	61.67	100 (60)	22.50	77.50	100 (40)
2	Urban Village	86.67	13.33	100 (60)	57.50	42.50	100 (40)
3	Unauthorised Colonies	26.67	73.33	100 (60)	65.00	35.00	100 (40)
4	JJ Cluster	8.33	91.67	100 (60)	12.50	87.50	100(40)

Note: M: Male; F: Female
Source: Computed from Field survey, February- April, 2016

The above mentioned characteristic is captured in table 5.2 where the planned colonies and the JJ clusters had a higher share of female respondents as compared to the urban villages and unauthorised colonies.

5.2.3 Age Distribution of the Respondents

Respondents of more than 18 years were selected as some of the questions in the survey pertain to financial knowledge. Majority of the respondents were between 30 years and 59 years.

Table 5.3: Age Distribution in Study Area with Networked Water, Delhi 2016

S.No	Settlement Category	Private Management (Percent)					DJB (Percent)				
		18-29	30-39	40-59	More than 60	Total	18-29	30-39	40-59	More than 60	Total
1	Planned Colonies	0.00	30.00	65.00	5.00	100 (60)	0.0	37.50	52.50	10.00	100 (40)
2	Urban Village	5.00	16.67	61.67	16.67	100 (60)	0.0	2.50	67.50	30.00	100 (40)
3	Unauthorised Colonies	6.67	38.33	53.33	1.67	100 (60)	2.50	12.50	77.50	7.50	100 (40)
4	JJ Cluster	10.00	13.33	73.33	3.33	100 (60)	10.00	30.00	47.50	12.50	100 (40)

Source: Computed from Field survey, February- April, 2016

In both the areas, the respondents were largely from the 40-59 years age group followed by the 30-39 years age group. For both males (70 percent) and females (57.2 percent), the largest percentage of respondents was from the age group 40-59 years of age. Among females, respondents from this age group were available at home at the time of the survey (morning till early evening) as they were largely home makers. For the males who were the predominant respondents in the unauthorised colonies and urban villages, some of them owned and managed shops (grocery, real estate etc.) from their property premises while others were unemployed and mainly depended on house rent as the source of income.

5.2.4 Marital Status of the Respondents

In both areas of management, majority of the respondents were married, largely because of the age group that had been selected. In both the groups, the highest percentage of unmarried respondents were in the JJ cluster settlement typology.

Table 5.4: Marital status of Respondents in Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				Public Management (Percent)			
		M	U	W	Total	M	U	W	Total
1	Planned Colonies	100	0	0	100 (60)	97.50	2.50	-	100 (40)
2	Urban Village	98.33	1.67	0	100 (60)	100	0	-	100 (40)
3	Unauthorised Colonies	100	0	0	100 (60)	97.50	2.50	-	100 (40)
4	JJ Cluster	88.33	6.67	5.00	100 (60)	92.50	7.50	-	100(40)

Source: Computed from Field survey, February- April, 2016
Note: M -Married
U – Unmarried
W-Widow/Widower

5.2.5 Educational Attainment Profile of the Respondents

In both the areas, there is a stark difference between the educational profile of the respondents living in the planned colonies and the JJ colonies. The level of education declined among the respondents with decline in the income levels categories.

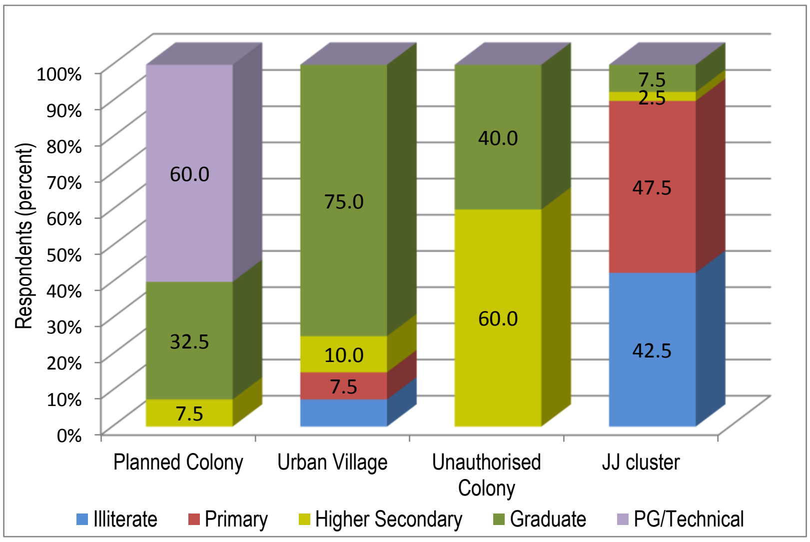

Figure 5.1: Educational Profile of Respondents in Study Area with Networked Water –Area Managed by Public Sector, 2016

Source: Computed from Field survey, February- April, 2016

With respect to JJ colonies, the respondents in the areas serviced by DJB seem to be better in terms of educational qualification with 7.5 percent of the respondents being graduates compared to none in the areas serviced by the private companies.

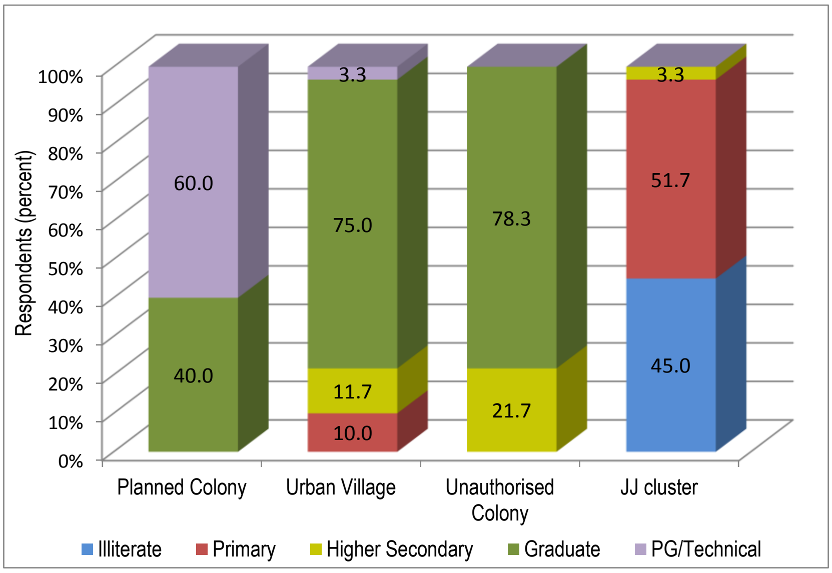

Figure 5.2: Educational Profile of Respondents in Study Area with Networked Water –Area Managed by Private Sector, 2016

Source: Computed from Field survey, February- April, 2016

The difference in education level among the respondents in various settlement categories is also a function of the gender of the respondent. There were more male respondents in the urban villages and the unauthorised colonies, thus the general education level might be higher than if there were only female respondents.

Since water use is at the household level, the educational profile of the household head has also been taken for both the areas. The educational level of the head of the households who were primarily males was found to be higher than the respondents, especially in JJ cluster and planned colonies where a higher percentage of respondents were females.

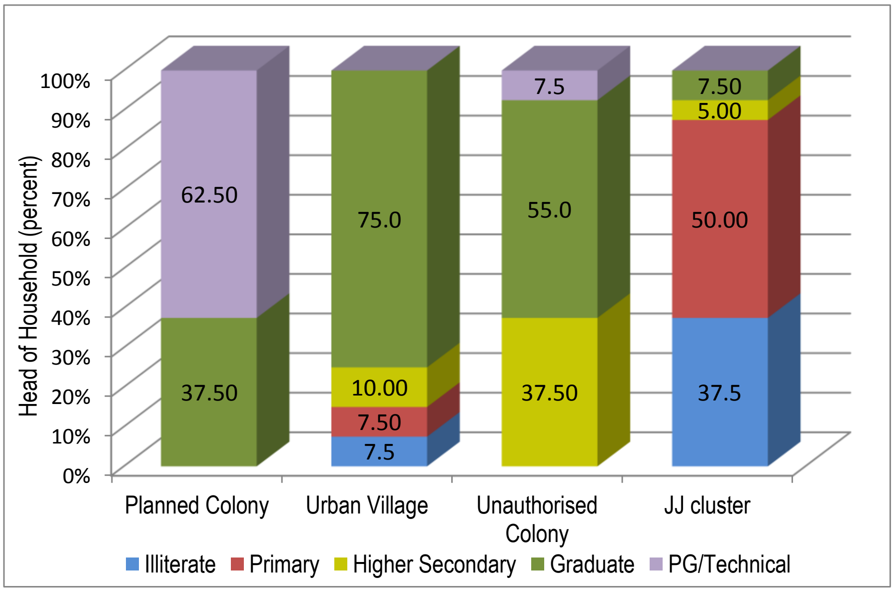

Figure 5.3: Educational Profile of Head of Household in Study Area with Networked Water Managed by Public Sector, 2016

Source: Computed from Field survey, February- April, 2016

On considering the educational profile of the head of the household, higher level educational attainment is more apparent as the head of the families were found to be males in nearly all the cases, reiterating the gender bias that exists in the society.

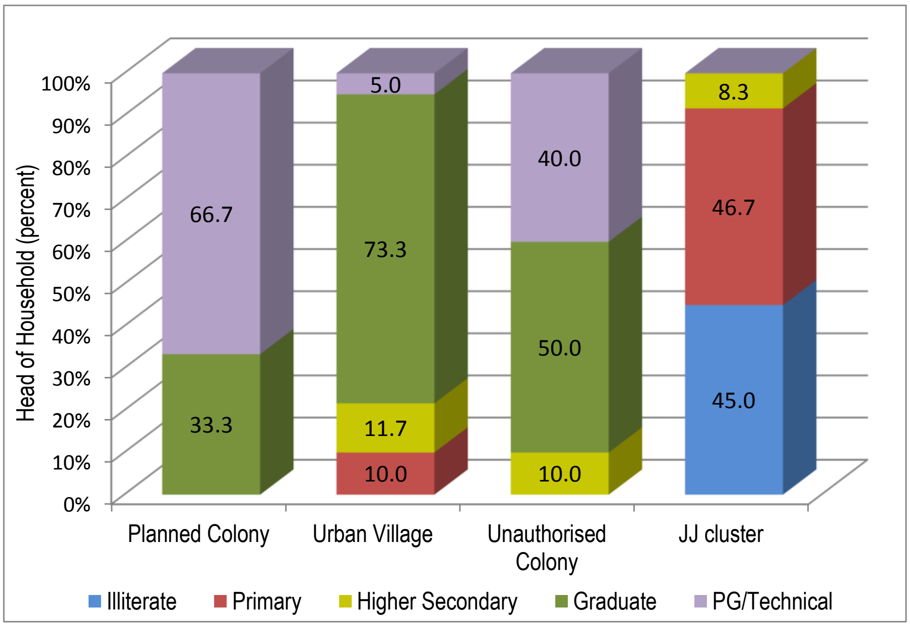

Figure 5.4: Educational Profile of Head of Household in Study Area with Networked Water Area -Managed by Private Sector, 2016

Source: Computed from Field survey, February- April, 2016

5.2.6 Occupational Profile of Earning Members of the Household

Occupational profile of the respondents varies according to the settlement category. Planned colonies, urban villages and unauthorised colonies had a lower percentage of earning members of the households engaged in casual occupations such as mason, domestic help, driver, painter etc while the JJ clusters largely had households with members who were involved in such occupations. The casual nature of the occupations makes these households vulnerable due to the absence of a fixed and timely income. The most vulnerable are the households whose earning members are engaged in occupations that involve daily wage earning or are project based where the activities are seasonal or sporadic such as mason, painter etc. Some households were also found to have no members engaged in any occupation and were found to depend only on rental income, mainly in the urban villages.

Table 5.5: Occupational Profile of Earning Members of the Household, Study Area with Networked Water, Delhi, 2016

S. No	Settlement Category	Private Management (Percent)					DJB (Percent)				
		Casual	Self Employed	Regular	Retired	Total	Casual	Self Employed	Regular	Retired	Total
1	Planned Colonies	0.0	38.75	57.50	3.75	100 (80)	0	39.53	44.19	16.28	100 (43)
2	Urban Village	26.87	64.18	5.97	2.99	100 (67)	22.58	77.42	19.44	0.	100 (31)
3	Unauthorised Colonies	0.00	38.33	61.67	0.00	100 (60)	0	36.67	63.33	0.00	100 (30)
4	JJ Cluster	82.93	9.76	6.10	1.22	100 (82)	69.81	15.09	15.09	0.00	100 (53)

Source: Computed from Field survey, February- April, 2016

In the private management area, the 240 surveyed households had 289 earning members. The urban villages (64.18 percent) and unauthorised colonies (38.33 percent) had the highest percentage of self-employed earning members while the planned colonies (57.50 percent) had the highest percentage of earning members engaged in salaried occupations and the JJ clusters (82.93 percent) had the highest percentage of earning members engaged in casual occupations. A majority of respondents living in JJ colonies were engaged in casual occupation such as domestic help, driver, mason, plumber etc. Those engaged in occupations with monthly wages such as driver, domestic help etc had a more predictable and stable income flow than those engaged in daily wage occupations such as mason, plumber etc.

In the DJB areas, a similar pattern was seen regarding all the settlement typologies other than unauthorised colonies. In the 160 households that there were surveyed, there were 157 earning members. A little less than half of the total respondents residing in the planned colonies (44.19 percent) and 63.33 percent of the unauthorised colony respondents were reported to be engaged in regular occupations. Nearly 69.81 percent of the earning members in the JJ clusters were engaged in casual work.

Rental income emerged as an important source of income especially in the urban villages. Nearly 46.6 percent of the households in urban villages in the private management area and 87.5 percent in the DJB areas reported rental income. Nearly 22 percent of the households in the urban villages in the DJB area reported only rental income as their source of income.

It is also imperative to understand that how many households have more than one earning member as that serves as a cushion against financial ups and downs, more so in the lower income groups. It also reduces the number of dependent household members. Table 5.6 presents the percentage of households with only one earning member and percentage of dependent (non-working) household members to understand the level of financial burden in the households in each of the settlement category.

Table 5.6: Households with Only One Earning Member, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)	DJB (Percent)
1	Planned Colonies	66.67	92.50
2	Urban Village	81.67	77.50
3	Unauthorised	100.0	75.00
4	JJ Cluster	60.0	74.00

Source: Computed from Field survey, February- April, 2016

In both the areas, JJ clusters have the lowest percentage of households with single earning members followed by planned colonies in private management areas and unauthorised colonies in DJB area. The need for more than one earning member in the JJ households is largely because of low income or the temporary nature of job of one earning member, also the second member was found to be engaged in domestic work demanding about half day as a result of which they could devote time to their household duties in the afternoon.

5.2.7 Average Household Income

Household income is often misreported, not only by the low income households but also by the high income ones. Many of the low income households did not have a steady income and the monthly income varied, as a result of which they gave an approximate income figure. On the other hand, the higher income households reported their income only from salaries and business and excluded income from rent or other sources.

In areas with private management, the respondents living in the planned colonies have the highest average income followed by the respondents living in urban villages, unauthorised colonies and JJ colonies. In areas with DJB management, again the respondents living in the planned colonies have the highest average income followed by respondents living in the unauthorised colonies, urban villages and JJ colonies. Income, a sensitive subject, was asked to be reported in terms of categories instead of an absolute value.

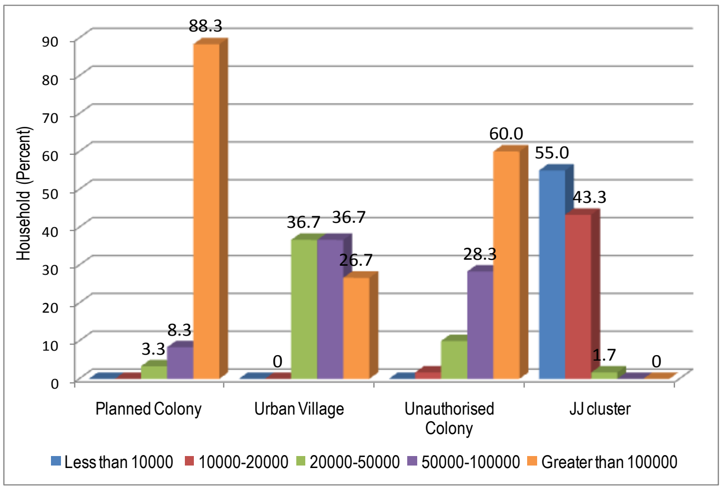

Figure 5.5: Percentage of Households in Various Monthly Income Categories in Study Area with Networked Water : Private Management Areas, 2016

Source: Computed from Field survey, February- April, 2016

The difference among the settlement typologies is stark. On one hand, 88 percent of the respondent households reported monthly household income above Rs.One lakh in the planned colonies and on the other hand, 55 percent of the respondent households reported monthly household income less than Rs.10,000 in the JJ clusters. Urban villages and unauthorised colonies had less variation in monthly income across households.

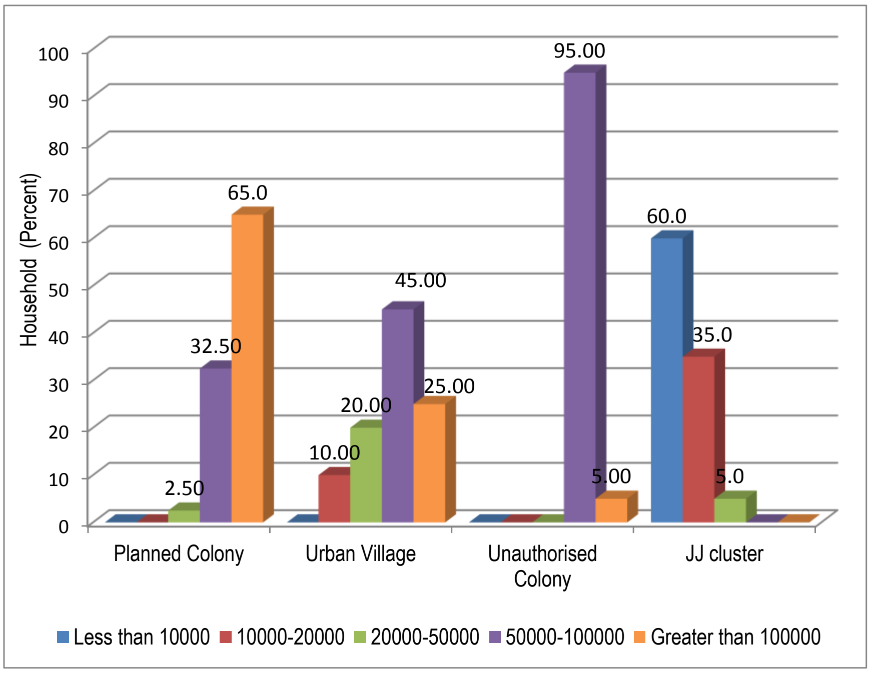

Figure 5.6: Percentage of Households in Various Income Categories in Study Area with Networked Water: Public Management Areas, 2016

Source: Computed from Field survey, February- April, 2016

In the planned colonies, on one hand, 65 percent of the respondent households were in the monthly household income category of above Rs.One lakh, on the other hand, 60 percent households in the JJ clusters had monthly household income below Rs.10000. Urban villages had a mix of all income categories other than less than Rs.10000 category while unauthorised colonies (95 percent) had respondent households heavily skewed in favour of the category Rs.50,000 to Rs.One lakh.

5.3 WATER SUPPLY: HOUSEHOLD COVERAGE, QUANTITY AND QUALITY ACROSS SURVEYED SETTLEMENTS

5.3.1 Household Coverage

There has been limited increase in household coverage since the beginning of the private project due to several impediments related to multi-agency responsibilities and clearances. There are new areas (unauthorised colonies) where water pipelines have been laid and new water connections have been provided. At the same time, progress is being made in the DJB managed areas. New areas, primarily the unauthorised colonies are being brought into the fold of network distribution. The increase in household coverage is primarily a function of the change in policy of the Delhi government whereby a decision has been taken that whole of Delhi irrespective of the tenure status will be brought under water network and each household will have a water connection by 2017. There were 32148 house service connections in the Malviya Nagar Project area till March, 2010 before MNWS Pvt.Ltd was brought on board for managing the water distribution (Detailed Project Report, 2011). The HSCs increased to 39911 in 2015-16 (DJB, 2016) registering an increase of 24.14 percent. The Vasant Vihar project area had 6847 connections in 2011 before MVV Pvt Ltd took over which increased to 7831 in 2015-2016 clocking an increase of 14.37 percent. DJB for overall Delhi (excludes the Malviya Nagar and Vasant Vihar project areas), in the same period, witnessed an increase of 8.8 percent from 19,42,005 connections in 2011 to 21,14,131 in 2015-16. Data seems to suggest that the percentage increase in the household connection is higher in the selected PPP areas than in the DJB areas.

While the above analysis gives an insight into the increase in household service connections in a certain time period, the ground reality is far more complex with various kinds of arrangement existing for accessing water. An attempt has been made to estimate the percentage of households with access to tap water in both the private and public areas on the basis of the primary survey. The main source of water in terms of the distribution point has been analysed in this section. The three main distribution points have been taken as house connection which may or may not have been installed by the service provider, shared connection which is usually found in the JJ colonies and have been arranged for by the residents themselves and standpost which have been provided by the Government for a large group of JJ colony households.

It is interesting to see the differences in access to water through household connections, shared connections and standpost among the households in the four settlement categories. Table 5.7 illustrates the disparity among the settlement categories in access to tap connection inside house.

Table 5.7: Percentage Household Access to Sources of Water by Settlement Categories in Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				DJB (Percent)			
		Connection inside House	Shared Connection	Standpost	Total	Connection inside House	Shared Connection	Standpost	Total
1	Planned Colony	100	-	-	100 (60)	100	-	-	100 (40)
2	Urban	100	-	-	100	100	-	-	100
3	Unauthorised Colony	100	-	-	100 (60)	100	-	-	100 (40)
4	JJ Cluster	30.0	70.0	-	100	0	57.50	42.50	100
	Pearson's Chi Square Test =152.727 $p<0.01$					Pearson's Chi Square Test =160.00 $p<0.01$			

Source: Computed from Field survey, February- April, 2016

All the settlement categories other than JJ colonies have taps inside the houses. In areas of private management, 30 percent of the respondents in the JJ colonies had taps inside the house and 70 percent shared their connection with 3-4 households. In areas of DJB management, none of the respondent JJ households had taps inside the house, 57.5 percent had shared connection and 42.5 percent drew water from public standposts.

The taps inside the houses and the shared connections in the JJ colonies cannot be taken as indicators for utility efficiency in providing coverage to poor localities as these have been arranged for by the households themselves or by an arrangement with the local political representative. But it is interesting to see that these are more prevalent in the privatised management areas, although they have existed since prior to privatisation. So far, privatisation of management services has had no repercussions on these unauthorised connections which shows that there have been no disconnections. This was reiterated by the MNWS Pvt Ltd official as well **(Interview with MNWS Pvt. Ltd. official, 2016)**. Water wastage has also been curbed in the private management areas with tap head being fitted in the shared connection which is an initiative of the private company along with the local MLA. No such initiative was observed in the public utility areas.

Further investigation showed that areas from where surface water pipelines pass are also the areas where JJ cluster households have taken connections from these pipelines and created *gali taps* or shared connections. Thus, one critical factor for creation of *gali taps* is the existence of water pipelines in the immediate vicinity which also implies that poor households have benefited with respect to access to water even when they have not been targeted for development. Further, households find it worth the effort and money to lay pipelines which involves several costs including laying of pipelines, bribing the administrative officials etc. only for soft water. A description of the efforts is captured in the case study below*:*

Bhoomiheen Camp, Govindpuri (DJB managed area), 02.03.2016: *Asha has been living in this JJ colony since the past 20 years, since her marriage. Her family had a water tap inside their house back in the village. When she joined her husband here, only borewell water was available which had to be brought from across the main road. She told him that she won't be able to walk so much to get water and wanted a tap inside or at least near the house. Her husband mobilised around ten households who eventually bore the cost of around Rs.10000 per household, for laying the pipelines and installing the tap. Now they have a shared connection right outside their house. They have their individual water pumps which they attach to the pipe and fill their buckets. They sometimes give water to other households who are in desperate need but usually avoid doing so as the pump operation adds to the electricity cost.*

Besides convenience, many households were also seen to invest in such an arrangement so that the women of the house do not have to go far from the house for water. While in some cases, households have laid pipelines with their own capital and labour, in other cases, the pipelines have been extended into the lanes with money from Member of Parliament Local Area Development (MPLAD) funds.

Jagdamba Camp, Sheikh Sarai (Private company managed area), 08.02.2016 *The local AAP representative stated that the MLA had been approached to solve the water problem in their slum when they saw pipelines being laid in Sheikh Sarai. Ten more taps were installed inside the JJ cluster at a distance of 50-60 metres from each other. Unlike earlier, where the pressure would drop considerably at the end of the pipe and there would be fights over water, the residents found the situation to be much better now.*

5.3.2 Type of Water: Soft or Hard Water

In the study area, there are mainly two sources of water; surface water which is derived mainly from the rivers Ganga and Yamuna and ground water which is withdrawn through borewells. Both suffer from their own set of problems. While surface water is more prone to having pathogens and mud, ground water may be hard water with an unpalatable taste and poor washing ability. The dismal ground water situation in southern part of Delhi puts all those households at a disadvantage which are being supplied with ground water only since it is hard water. In some cases, the households might be receiving surface water with a lower share of ground water mixed into it, but the overall quality is that of soft water. There were some households, largely in the urban villages, unauthorised colonies and JJ clusters which were receiving both soft water and hard water at different times of the day. They have been included in the category 'households receiving both'.

Table 5.8: Type of Water: Soft or Hard Water by Settlement Categories in Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				DJB (Percent)			
		Soft Water	Hard Water	Both	Total	Soft Water	Hard Water	Both	Total
1	Planned Colony	96.67	3.33	-	100 (60)	100	-	-	100 (40)
2	Urban Village	23.33	6.67	70.0	100 (60)	45.0	12.5	42.5	100 (40)
3	Unauthorised Colony	18.33	26.67	55.0	100 (60)	0	0	100	100 (40)
4	JJ Cluster	73.33	-	26.67	100 (60)	45.0	27.5	27.5	100(40)
	Pearson's Chi Square Test = 123.755 p<0.01					Pearson's Chi Square Test =109.504 p<0.01			

Source: Computed from Field survey, February- April, 2016

Majority of the planned colonies receive soft water in both the public and private management areas with 96.67 percent of the planned households in the private management areas and all the households in the public utility areas receiving soft water. The 3.33 percent of the planned colony households receiving borewell water was present in the MVV Pvt Ltd. area in the D category Junta flats of the upscale Vasant Vihar. Despite being located in an area which primarily gets soft water, only these blocks of apartments receive borewell water, although they are supposed to get both soft and borewell water. The households depend on borewell water as the water pressure of soft water is very low. The RWA President provided this information:

> Junta Flats, Vasant Vihar, 04.04.2016 (Private company managed area): *The RWA President complained of the dismal water situation in their area. Although the flats are adjoining the posh D block, the contrast in the conditions was found to be stark. The apartments are at the tail end of the water pipeline. The block is being supplied water from the borewell and DJB surface water. The DJB surface water is negligible as not much water is left after serving the other Vasant Vihar blocks and the residents have to rely mainly on groundwater which is of poor quality. They have complained many times to the MLA but nothing has been done. New meters have been installed in the houses which give a much higher meter reading than before. The President questioned the rationale in paying at the same rate for poor quality ground water. He also said that though the private company has also laid down pipelines but the supply has not started yet. He complained of delay and lack of communication from the private company's end.*

Among the urban village households, 70 percent households received both ground and surface water in the private management areas. In the public utility areas, 42.5 percent received water in such a manner. The urban villages got formal water supply from the water utilities for few hours and not at very good pressure, the surface water supplied is usually supplemented by the borewell water from within the village itself. In addition, village households often have their own boring systems from where they withdraw water. In the case of unauthorised colonies, a majority of the households were getting both soft and hard water in DJB (100 percent) and private managed areas (55 percent). Soft water is a prized good, capable of bringing out deep rooted conflicts, as illustrated by the following case study.

> Basant Gaon, Vasant Vihar, 16.03.2016 (DJB managed area): *A resident of Prajapat Mohalla complained that Prajapat Mohalla was the only mohalla in Basant Gaon which did not receive soft water from DJB. The households received borewell water which is hard water. While those who can afford, drink bottled water or use RO, others drink that water itself. He believed that the water pipeline passed through the pundit mohalla and they had diverted water for their own use. He also said that while the whole Basant gaon was a Congress stronghold and is now an AAP votebank, Prajapat Mohalla has always been a Janta Dal votebank. He believed that it could be a reason for leaving Prajapat*

Mohalla out of the development of the village The truth of this could not be verified but similar sentiments were expressed by others in the Prajapat Mohalla.

The JJ colony households in the DJB managed areas are at a clear disadvantage with 27.5 percent of the households getting only hard water as compared to none of the private managed area households. The distinction between soft and hard water is more critical for the JJ colony households as these households cannot afford the expensive RO for making the water potable and are forced to drink hard water.

Be it the DJB managed or the private company managed areas, the inequality in provisioning of soft water between the various settlement categories is evident.

5.3.3 Reliability of Water Supply

Continuous water supply is considered the optimum water supply as it eliminates the possibilities of dirt and filthy water being sucked in and also a continuous water pressure is maintained which facilitates the smooth functioning of equipments like meters etc. The private players were contracted to supply 24 x 7 water supply like in many other parts of the world, but at present, most of the areas under the private operators do not receive 24X7 water. The plan was to provide 24x7 water supply by August 2013 in West End colony, Sheikh Sarai and Golf View Apartments and the other areas were to get it by 2015 **(Lalchandani, 2013).** It was found during the survey period that, other than West End, none of the other areas were getting 24x7 water supply. Continuous water supply was introduced in Geetanjali Enclave for some time but discontinued after protests from the residents due to high bill amounts **(Interview with MNWS Pvt. Ltd, 2016).** In March, 2017, continuous water supply was started in Navjivan Vihar, a part of the Malviya Nagar Improvement Scheme **(Alavi, 2017)** but the survey took place before the implementation and thus does not reflect the new status. The other areas were getting intermittent supply, thus water supply duration and frequency have been chosen as indicators to gauge the reliability of water supply at the user end.

5.3.3.1 Duration of Water Supply

The duration of water supply varies considerably across the category of settlements. The duration is usually two hours a day in most of the categories in both the management areas. In the private management areas, category A, B and C planned colonies get water supply between 3-6 hours. At the same time, the sample households in urban villages, unauthorised colonies and JJ colonies also get water for the same duration. The difference in the two is that while the category A, B and C category households get 3-6 hours of treated soft water, the other categories get soft water for some time and hard water for rest of the time.

Table 5.9: Duration of Water Supply by Settlement Categories in Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				DJB (Percent)			
		0-2 hr	2-6 hr	6-10 hr	10<hr	0-2 hr	2-6 hr	6-10 hr	10<hr
1	Planned Colony	20.0	75.0	5.0	-	100	-	-	-
2	Urban Village	-	100	-	-	-	100	-	-
3	Unauthorised Colony	15.0	85.0	-	-	40.0	60.0	-	-
4	JJ Cluster	10	56.67	13.3	20	10.0	65.0	17.5	7.5
	Pearson's Chi Square Test = 70.728 p<0.01					Pearson's Chi Square Test=131.556 p<0.01			

Source: Computed from Field survey, February- April, 2016

Table 5.9 can be misleading as it presents the total number of hours of water supply received from the utility. It is seen that both in the private areas and the DJB areas, JJ cluster households receive water for the highest duration. These are provided with water for higher duration as many of them depend on public taps for their daily water. Most of the JJ clusters surveyed had one tap for around 30-50 households, so unless water was provided for a higher duration, many of the households would go waterless. In the private areas, majority of the households in all settlement categories receive water for two to six hours i.e 75 percent of the planned colony households, 100 percent of the urban village households, 85 percent of the households in unauthorised colonies and 56.67 percent of the JJ households. In the DJB areas, none of the households in the planned areas, all the houses in the urban villages, 60 percent of the households in the unauthorised colonies, and 65 percent of the households in JJ clusters received water for two to six hours.

In the absence of a clear picture and dilemma of the lower income settlements getting water for higher duration, it is imperative to analyse the duration of soft water supply in each of these settlements, also because soft water was considered superior by the respondents and they would prefer being supplied soft water for less duration than hard water for a longer duration.

Table 5.10: Duration of Soft Water Supply by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				DJB (Percent)			
		None	0-2 hr	2-6 hr	6-10 hr	None	0-2 hr	2-6 hr	6-10 hr
1	Planned Colony	3.33	10.00	81.67	5.00	-	100	-	-
2	Urban Village	6.67	78.33	15.00	0	12.5	52.5	35.0	-
3	Unauthorised Colony	18.33	48.33	33.33	0	-	100	-	-
4	JJ Cluster	6.67	30.00	63.33	0	27.5	17.5	50.0	5.0
		Pearson's Chi Square Test = 91.437 p<0.01				Pearson's Chi Square Test =91.284 p<0.01			

Source: Computed from Field survey, February- April, 2016

Photo 5.1: Position of Water Supply Pipeline in Karotiya Camp

A higher percentage of planned colony households (5 percent) in the private areas and JJ colony households (5 percent) in the public areas receive soft water for the highest duration (6-10 hours). While Shivalik in the MNWS Pvt Ltd area was getting 6.5 hours of soft water supply during the survey period, Karotiya Camp in Alaknanda (DJB area) got around 9 hours of soft water. Interestingly, although 6.5 hours of water supply was the highest for a planned colony, yet residents were unhappy. Although, Shivalik received 6.5 hours of water supply at good pressure, sufficient to fill up the water tanks, yet there was a sense of deprivation just because the duration had decreased from before. The residents of Karotiya Camp were also unhappy because although they were getting sufficient water, the way it was being supplied was unhygienic.

5.3.3.2 Frequency of Water Supply

In an intermittent water supply, frequency is important as that influences the water storage capacity a household needs to have. Thus households getting water once a day need to have bigger tanks as compared to households receiving water twice a day or more. This has implications on the expenditure incurred to purchase big tanks and the space required to keep them. Frequency of water supply varies among the settlements. In both the areas, majority of the households get water supply twice a day. Some of the JJ clusters in both areas get water supply thrice a day. Again, a higher frequency is often associated with a mix of soft and borewell water. Although, nearly 31.67 percent of the planned colony households in the private management areas got water supply once a day, they got it for longer hours.

Table 5.11: Frequency of Water Supply by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				DJB (Percent)			
		Once a day	Twice a day	Thrice a day	Once every alternate day	Once a day	Twice a day	Thrice a day	Once every alternate day
1	Planned Colony	31.67	68.33	0.00	-	2.5	97.5	-	-
2	Urban Village	0.00	100.00	0.00	-	35.0	65.0	-	-
3	Unauthorised Colony	0.00	100.00	0.00	-	-	60.0	-	40.0
4	JJ Cluster	11.67	68.33	20.00	-	45.0	47.5	7.5	-
		Pearson's Chi Square Test = 80.2265 p<0.01				Pearson's Chi Square Test = 95.226 p<0.01			

Source: Computed from Field survey, February- April, 2016

The unauthorised colonies in the DJB areas, being in the peripheral areas of the city are the worst off in terms of frequency with the households getting surface water once every alternate day. The households have arranged for their own water supply through community borewells. A higher frequency of water supply is seen among the JJ clusters with 20 percent of the households in private area and 7.5 percent of the households in the DJB areas receiving water thrice a day. Majority of the households in both the areas; private and DJB receive twice a day water daily. One anomaly also seems to be, 31.67 percent of the planned colony households in the private areas getting water once a day. On further enquiry, it was found that these households also get water for a longer duration (2.5-3 hours daily) and at such pressure that underground tanks get filled without online boosters.

Table 5.12: Frequency of Soft Water Supply by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				DJB (Percent)			
		No Surface Water	Once a day	Twice a day	Total	No Surface Water	Once a day	Twice a day	Once every alternate day
1	Planned Colony	3.33	33.33	63.33	100 (60)	-	-	100	-
2	Urban Village	6.67	85.00	8.33	100 (60)	12.5	40.0	47.5	-
3	Unauthorised Colony	18.33	46.67	35.00	100 (60)	-	60.0	-	40.0
4	JJ Cluster	6.67	0	93.33	100 (60)	27.5	32.5	40.0	-
		Pearson's Chi Square Test = 111.034 p<0.01				Pearson's Chi Square Test = 134.287 p<0.01			

Source: Computed from Field survey, February- April, 2016

While there were no households in the private area receiving soft water once every alternate day, 40 percent of the households in the unauthorised colonies in the DJB areas received surface water once every alternate day. The pipelines had been laid in the unauthorised colonies six months before the survey. Before the laying of pipelines, the residents had their own arrangement of pipelines supplying water to every household from a common borewell.

5.3.4 Water Quantity and Perceived Sufficiency of Water

It is very difficult to estimate the quantity of water consumption at the consumers' end as it is influenced by seasonal variations, number of household members present etc. A crude attempt has been made to understand the variation in water consumption among settlement categories for both public and private management areas by taking information regarding the size of the water tank and the time duration for which the water pump is switched on to fill the full tank. The assumption is that the size of the installed tank (storage capacity) is on the basis of the water need of the household and is also influenced by the unreliability of the water supply. In this case, the categories within planned colonies have also been taken.

Table 5.13: Average Water Storage Capacity and Duration of Water Pump Operation, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)		DJB (Percent)	
		Average Water storage size (litre)	Duration of water pump (minutes)	Average Water storage size (litre)	Duration of water pump (minutes)
1	Planned	-	-	-	-
1a	A&B	4290	42	3750	80
1b	C	970	35	1250	45
1c	D	750	20	800	44
2	Urban Village	1040	52	2890	90
3	Unauthorised Colonies	890	36	940	48
4	JJ Cluster	265	36	200	50

Source: Computed from Field survey, February- April, 2016

The tank size, in both the areas, reflects the general belief of higher water consumption among higher income group households. In the private areas, the A and B category households have the largest water tanks with the average capacity being 4290 litres and the smallest is found in the JJ households where instead of tanks, innumerable buckets/paint containers are used for storing water, although some of the slightly better off households use 200-500 litres tanks also, but their number is miniscule. In the DJB areas, the A and B category colonies, again, have the highest average tank size (3750 litres) followed by the urban village households. The JJ households again have the lowest. Although, the storage capacity is a function of unreliability of water supply but it does not reflect the immediate situation as households invest in tanks for at least 15-20 years and while they might upgrade to a bigger size in case of quantity of water supply reducing, they seldom shift to a smaller sized tank if the water supply gets better. The JJ households also, often, do not have enough space for keeping big tanks and as a result might not invest in them despite the need. The duration for which the water pump is run gives a better picture about the present situation.

Analysis of the total duration for which the water pump is run to draw water from the main pipeline is a rudimentary way to understand the water consumption, since the time is also dependent on many other factors such as size of the tank, demand for water, pressure of water etc. In many of the A&B category colonies, there are automatic pumps which run on their own based on the level of water in the tank. Thus, these respondents were not able to tell the duration of pump operation and had to be excluded from this analysis. There was an association between the tank capacity and the duration for which the water pump was run. Computation of Pearson's Coefficient of Correlation between tank capacity and pump duration was found to be 0.556, statistical significance at 0.01 level.

Table 5.14: Perceived Sufficiency of Water Supply by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent of HH with Sufficient water)	DJB (Percent of HH with Sufficient water)
1	Planned Colonies	86.67	100.00
2	Urban Village	65.00	55.00
3	Unauthorised Colonies	66.67	57.50
4	JJ Cluster	50.00	40.00

Source: Computed from Field survey, February- April, 2016

Households belonging to the planned colonies of both public and private areas reported water supply to be sufficient at the time of the survey. None of the D category households in the private areas reported water to be sufficient as these households were getting very little soft water from DJB and thus were supplementing it with ground water. These households were located within an upmarket colony where the water situation has recently improved. Thus, these households were feeling left out of the development process. All the households in the unauthorised colonies in the public utility areas reported water to be insufficient as they were getting water once in two days and had to depend largely on their personal borewells.

In both the DJB and the private company managed areas, a higher percentage share of the planned colony households reported water supply to be sufficient as compared to the households in the other settlement categories. Least percentage of JJ households reported getting sufficient water.

5.3.5 Perceived Water Quality of the Primary Source of Water

Three parameters have been taken to understand the quality of water being supplied, smell, taste and appearance. The quality of water not only depends on the source of water but also on the condition of pipelines as the water flows through the pipelines to get to the house tap. Since the pipelines have been re-laid and upgraded recently in the privately managed areas, less percentage of respondents complained of foul smell and dirty water. This indicator has its limitations as it is dependent on the perception of clean water which itself is very subjective. In the case of smell and appearance, the response of the households pertained to the initial flow of water. This is also important as studies show that the contamination in water passes on to the customers in the first 10-30 minutes **(PWC et al, 2004).**

5.3.5.1 Smell of Water

The smell of water has been assessed on the basis of the reporting by the respondents. It also pertains to piped water being supplied by the utilities, might be through shared connections or house connections. A large number of respondents found the water to be foul smelling initially, immediately after they would switch on the motor. This was probably due to the motor sucking in impurities from and around empty pipelines.

Table 5.15: Perceived Quality of Water (Smell) by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)			DJB (Percent)		
		No smell	Foul	Total	No smell	Foul	Total
1	Planned Colonies	100	0	100 (60)	72.5	27.5	100 (40)
2	Urban Village	38.33	61.67	100 (60)	17.5	82.5	100 (40)
3	Unauthorised Colonies	50.0	50.0	100 (60)	65.0	35.0	100 (40)
4	JJ Cluster	21.67	78.33	100 (60)	17.5	82.5.0	100 (40)
		Pearson's Chi Square Test = 82.139 $p<0.01$			Pearson's Chi Square Test = 43.294 $p<0.01$		

Source: Computed from Field survey, February- April, 2016

In the private management area, highest percentage of JJ households (78.33 percent) and minimum percentage of planned colony households reported foul smell in water. It was a similar scenario in the DJB area as well with JJ households (82.50 percent) and planned colony households (27.5 percent) reporting foul smell in water. A large number of JJ cluster respondents complained of water smelling foul as seen in the table 5.15, also because they were largely drinking water without treating it. Also in most cases, in the planned colonies, households were using water after it was stored in the tanks and not the supply water directly.

5.3.5.2 Taste of Water

Taste of water was largely dependent on the source of water. Most of the households which reported poor taste of water were also from areas which received hard water. While some households used this water for drinking, others opted to get supplementary sources of water.

Table 5.16: Perceived Quality of Water (Taste) by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)			DJB (Percent)		
		Good/Tasteless	Bad	Total	Good/Tasteless	Bad	Total
1	Planned Colonies	96.67	3.33	100 (60)	100	0	100 (40)
2	Urban Village	70.00	30.00	100 (60)	35.0	65.0	100 (40)
3	Unauthorised Colonies	63.33	36.67	100 (60)	17.5	82.50	100 (40)
4	JJ Cluster	63.33	36.67	100 (60)	25.0	50.0	100 (40)
		Pearson's ChiSquare Test= 23.182 p<0.01			Pearson's ChiSquare Test= 60.484 p<0.01		

Source: Computed from Field survey, February- April, 2016

In the DJB areas, a high percentage of respondents in the urban villages (65 percent) and unauthorised colonies (82.50 percent) reported water to have a bad taste. On the contrary, none of the respondents in planned colonies reported water to have a bad taste. Majority of the respondents in the urban villages, unauthorised villages who reported water to have a bad taste were getting hard water. In the areas managed by private companies, minimum percentage (3.33 percent) of respondents residing in planned colonies reported water to have a poor taste. The highest was for unauthorised colonies (36.67 percent) and JJ clusters (36.67 percent).

The poor taste of water has been an issue, more so in the JJ households, as these do not use RO treatment machines unlike households in the other settlement categories. The households that reported water to have a poor taste also reported several related issues. Since they found the water hard to drink, they had to arrange for alternate sources of water which involved time and effort and sometimes, money. Most of these JJ clusters had fewer soft water public stand posts than hard water public stand posts, which meant standing in the queue for long duration. Despite having access to adequate water, the households value water with palatable taste is summarised by the following case study:

Jawahar Camp, 22.02.2016 (DJB Managed Area): *Munni has been residing in the JJ for the past ten years along with five more household members. She stated that although there is no dearth of hard water, soft water is difficult to find. Borewell water was found to be stored in a 1000 litre tank on the periphery of the jhuggi and the residents had access to that water throughout the day. She said that borewell water was hard water and was used only for uses other than drinking and cooking. The residents would take soft water from tankers earlier, but now pipes had been laid from Govindpuri and most of them would take water from these taps for drinking and cooking. She said that she bought water from another house in their neighbourhood as her house was deep inside the jhuggi and there were no public taps there. She paid Rs.100 in a month and usually took 5 bottles (5 litres) of water from them in a day.*

5.3.5.3 Appearance of Water

Appearance of water mainly refers to the way the water looks like when it is supplied from the main pipeline directly. This could be because of the intrusion of mud in the pipelines or the natural impurities in ground water. In most of the cases, the water was muddy in the beginning but became clear later. In such cases, the households wait for the muddy water to run out before filling up water for drinking or other purpose.

Table 5.17: Perceived Quality of Water (Appearance) by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S. No	Settlement Category	Private Management (Percent)			DJB (Percent)		
		Clear	Muddy/ Cloudy	Total	Clear	Muddy/ Cloudy	Total
1	Planned Colonies	96.67	3.33	100 (60)	95.0	5.0	100 (40)
2	Urban Village	45.00	55.00	100 (60)	35.0	65.0	100 (40)
3	Unauthorised Colonies	90.00	10.00	100 (60)	85.0	15.0	100 (40)
4	JJ Cluster	30.00	70.00	100 (60)	40.0	60.0	100 (40)
		Pearson's Chisquare test= 86.250 $p<0.01$			Pearson's Chisquare test= 26.311 $p<0.01$		

Source: Computed from Field survey, February- April, 2016

In private management areas, the percentage of households reporting clear water was the highest among the planned colony category residents (96.67 percent) and the least in the JJ cluster households (30 percent). In the DJB areas, the highest percentage of households reporting clear water is found among the planned colonies again (95 percent) and the least was reported by urban village households (35 percent).

While the households that treated water before drinking did not bother too much about the appearance, the JJ cluster households were careful about storing the water only after clear water started flowing out of the tap. For this, they would often have to wait for five minutes before filling water, also resulting in wastage of water.

5.4 CONSUMER'S EFFORTS TO COPE WITH PRESENT SERVICE LEVELS: INITIATIVES IN IMPROVING QUANTITY AND QUALITY

In the absence of ideal conditions of water supply, the consumers themselves take initiative to improve the quality and quantity of water to meet their demands. Coping strategies are often divided into enhancement strategies and accommodation strategies. The former are targeted at the increasing the quantity and quality of water by supplementing water and treatment respectively. Accommodation strategies comprise bringing about changes in the daily water consumption or adjust routine of household work to suit the timings of water supply. Households' choice of the coping strategies is determined by its socio-economic and demographic characteristics **(World Bank, 1993).** This has implications on the household expenditure, more so for the lower income households. Coping strategies also reflect the resilience of the households in the face of odds. This section provides an understanding of the difference in the household effort to cope with present levels of water supply between the various settlement categories drawing parallels between the DJB and private management areas through various parameters such as daily supplementary source of water, alternate source of water during summers, different sources of water for different uses, treatment of water to make it potable etc.

5.4.1 Supplementary Source of Water

A household uses supplementary source of water on a daily basis if the water need is not satisfied by the main source, in terms of both quantity and quality. The dependence on the supplementary water varies considerably across the settlement categories. While none of the households in planned colonies supplemented water from other sources, the highest was for unauthorised colonies both among the private and public management areas.

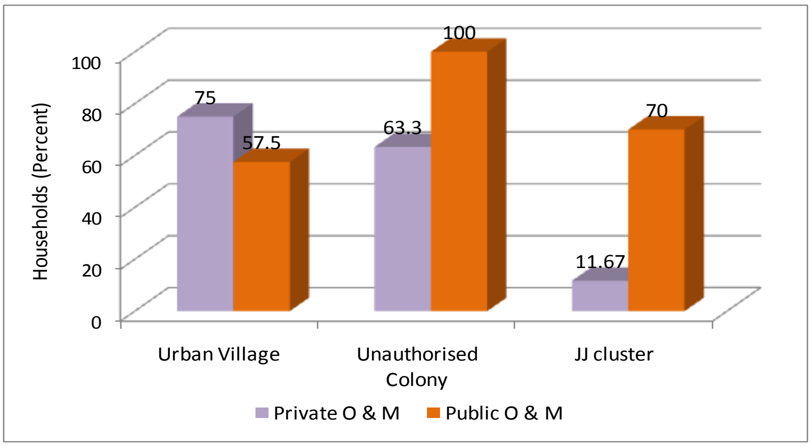

Figure 5.7: Comparison of the Household Dependence on Supplementary Source of Water in Private and Public Management Areas, Study Area with Networked Water, 2016

Source: Computed from Field survey, February- April, 2016

The difference between the percentage of households relying on supplementary source of water in the private and DJB areas is the starkest between the planned colonies and the JJ clusters. The situation in the urban villages and unauthorised colonies in both the private and public management areas are similar to each other. Despite all the surveyed households in the urban villages and unauthorised colonies having tap connections inside the house, a large percentage of these households also relied on other sources of water underlining the inadequacy of water supply in these areas. As discussed earlier, these households receive hard water which largely is being used for non-potable uses. There is much difference in the choice of source of water among the settlement categories. The common sources were DJB tanker, neighbour's household connection, public water tap/standpipe, private tanker, private borewell and bottled water. Table 5.18 presents the percentage of responses for preference for each type of supplementary source of water for daily use.

Table 5.18: Source of Supplementary Water by Settlement Categories, Study Area with Networked Water, Delhi, 2016

S. No	Settlement Category	Private Management			DJB						
		Private Borewell	Bottled Water	Total	DJB Tanker	Neighbour's HH connection	Public Water Tap	Private Tanker	Private Borewell	Bottled Water	Total
1	Planned Colonies	-	-	-	-	-	-	-	-	-	-
2	Urban Village	100	4.2	100 (45)	8.70	0	0	8.70	78.26	8.70	100 (23)
3	Unauthorised Colonies	100	18.4	100 (48)	5.00	0	0	5.0	100.0	12.5	100 (40)
4	JJ Cluster	-	100	100 (7)	78.57	14.29	7.14	0	0	0	100 (28)

Figures are not mutually exclusive

Source: Computed from Field survey, February- April, 2016

In the private management areas, only the planned colony households do not have to rely on a supplementary source of water for their daily use which also indicates a sufficient water supply. In urban villages, 100 percent of the households using water from supplementary source reported use of private borewell and 4.2 percent of the households reported use of bottled water. In the unauthorised colonies, 100 percent of the households reported use of private borewell and 18.4 percent of the households used bottled water. In the DJB areas, the households exercise more choice with respect to the supplementary source of water. In the urban villages, 78.26 percent of the households used private borewells and 8.7 percent used private tankers and bottled water each. In the unauthorised colonies, 100 percent of the surveyed households using supplementary water used private borewells, five percent used the private tanker and 12.50 percent used the bottled water. In the case of the JJ households, majority of the households using supplementary water relied on DJB tanker for soft water as their primary source of water was borewell water provided by DJB. Around 14.29 percent households depended on neighbour's household connection again for soft water needed for drinking and cooking. Nearly 7.14 percent used the public water taps, again for soft water.

5.4.2 Alternate Source of Water in Summer Season

Summer season in Delhi is harsh and while the demand of water goes up, the supply declines owing to lower water levels in the sources. Many households manage their water demand to tide over these two critical months (May-June), while many others have to get water from alternate sources. This can be a great burden on households with respect to finances, time and effort. The vulnerability of the households surviving on the edge is further exacerbated during these months.

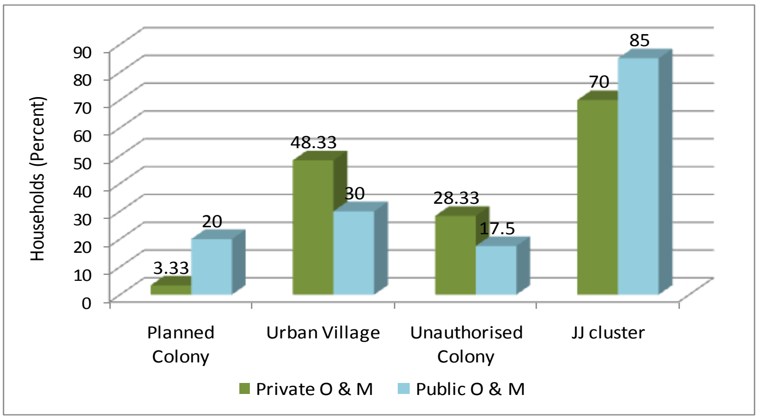

Figure 5.8: Comparison of Household Dependence on Alternate Source of Water during Summers, Study Area with Networked Water, 2016

Source: Computed from Field survey, February- April, 2016

The dependence of JJ cluster households on alternate sources of water during the difficult months of summers is much more than households of other settlement categories magnifying their vulnerability. The following case study throws light on the difficulties JJ households have to face during summer months.

Soami Nagar Jhuggi (Private Company Managed Area) 10.03.2016: *Reshma Khatoon has been residing in Soami Nagar Jhuggi for the past 25 years and has seven household members. She did not have a tap in front of her house and depended on two other families to give her water from their taps. She also said that in summers, when the water supply is for less time, these families were not willing to give her water. She would have to get water from the tap in front of the MCD office which was about 200 metres from her residence. Sometimes, she would also get drinking water from the house where she worked as a domestic help. On asking for water for too many times in a month, they would also get irritated. She found it very difficult to arrange for water in summers and said that it took up a lot of her effort and time.*

5.4.3 Source of Water used for Cooking and Drinking Purpose

Dual water distribution is not uncommon**.** While in some countries, there are dual pipeline system for water supply whereby, cleaner water is supplied in one pipe for drinking and cooking and recycled or seawater is supplied in another pipe for purposes like washing, gardening etc. These lessen the burden on drinking water systems. Hong Kong is one of the cities with the oldest dual pipeline water distribution systems since 1950. Bangalore, In India, had shown initiative in constructing dual pipeline system for new layouts to be constructed by Bangalore Development Authority (**New layout with 50,000 sites planned, 2005**) but this has been difficult to implement due to high initial capital costs.

In the case of the study area, with multiple sources of water in the urban villages, unauthorised colonies and JJ colonies, households use different sources of water for different purposes. Unfortunately, this is not a result of a green initiative, rather a function of inability of the water utility to provide clean water and over-dependence on ground water despite poor quality. The cleanest and soft water is reserved for drinking followed by cooking. While in some cases, the utility itself supplies dual water at different times of the day, in others, households draw water from their private borewells. Bottled water has also emerged as an important drinking water source in the recent times. While it is perceived to be the cleanest source, it might not be so. More than 10,000 packaged water bottling units operate in Delhi illegally. Not only do they use labels of licensed manufacturers but also sell packaged water without BIS certification thus putting at risk the health of many **(Lives at risk with 10,000 illegal bottled water units**

in Delhi, 2014). A 20 litre bottle of packaged drinking water is available at prices ranging from Rs.15 to Rs.80, making it affordable for different income groups.

There is least and most diversity in the sources of drinking water among the planned colony households and JJ households respectively.

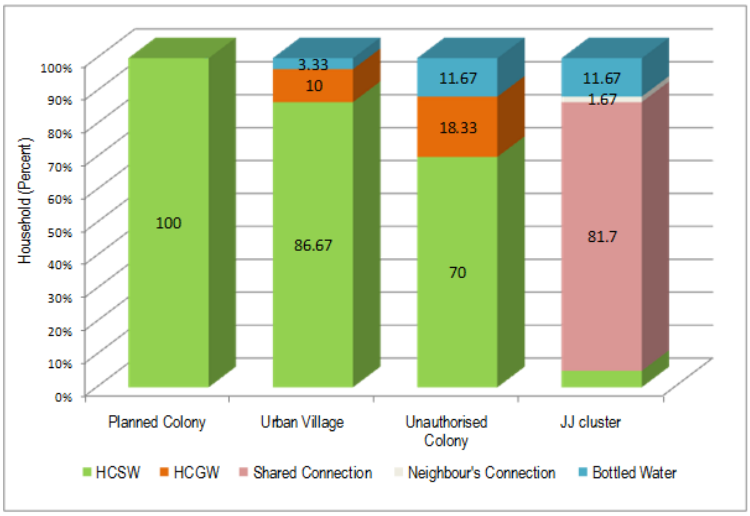

Figure 5.9: Source of Water used for Drinking Purpose in Study Area with Networked Water –Private Management, 2016

Note: HCSW: House Connection (Soft Water), HCGW: House Connection (Hard Water)

Source: Computed from Field survey, February- April, 2016

Among the settlements in the private utility areas, respondents of the planned colonies depended on a single source while those of the JJ clusters depended on several sources. In the private management areas, the JJ cluster households primarily had access to soft water, mainly through unauthorised connections with 11.67 percent of the households relying on bottled water for drinking purpose. The situation was similar for urban unauthorised colonies with majority of the respondents relying on house connection and 11.67 percent of the respondents getting bottled water for meeting their drinking needs. Households which were using house connection (hard water) usually used reverse osmosis filters to make water potable.

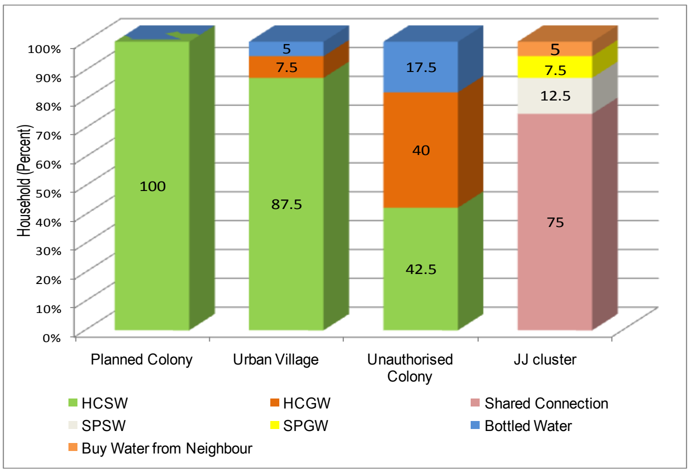

Figure 5.10: Source of Water used for Drinking Purpose in Study Area with Networked Water –DJB Management, 2016

Note: HCSW: House Connection (Soft Water), HCGW: House Connection (Hard Water), SPSW: Standpost (Soft Water), SPGW: Standpost (Hard Water)

Source: Computed from Field survey, February- April, 2016

Similar to the private management areas, respondents in the planned colonies in the DJB areas rely on a single source while those in the JJ clusters depend on many sources. Preference for soft water is clear with 75 percent of the JJ respondents depending on shared connection, 12.5 percent on stand posts supplying soft water and 5 percent on neighbour's household connection. In the urban villages, 87.5 percent of the households used their surface water house connection for drinking purposes while the rest used a mix of bottled water (5 percent) and hard water house connection (7.5 percent). In the unauthorised colonies, 42.5 percent of the surveyed households used soft water from house connection, 40 percent used hard water from house connection while 17.5 percent used bottled water.

In the study area, while the cleanest water was used for drinking purpose, the next best water was being used for cooking purpose. Again the highest variety of sources was seen among the JJ cluster households highlighting their vulnerability.

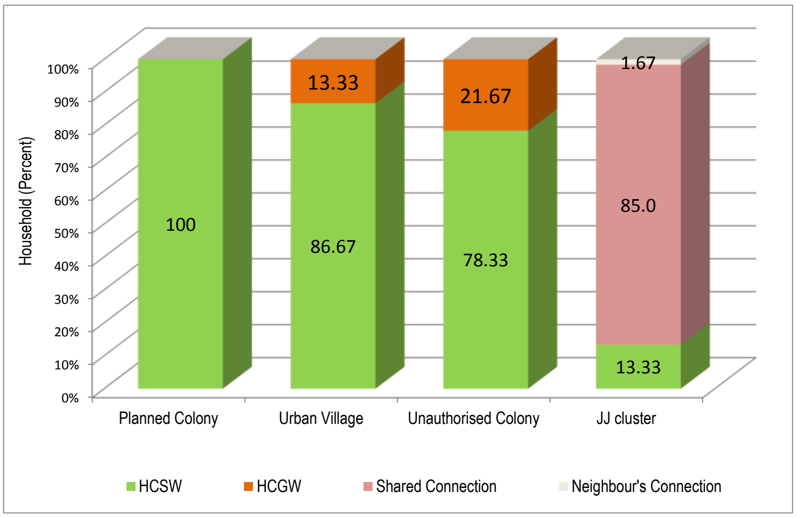

Figure 5.11: Source of Water used for Cooking Purpose in Study Area with Networked Water :Private Management, 2016

Note: HCSW: House Connection (Soft Water), HCGW: House Connection (Hard Water)

Source: Computed from Field survey, February- April, 2016

In the private management areas, all the respondent households in the planned colonies used tap water (soft water) while in the urban villages, all but 13.33 percent of the respondent households used tap water (borewell water). Similarly, in the unauthorised colonies, a large majority (78.33 percent) used soft water from tap and the rest used hard water from tap. In the JJ clusters, a large percentage of surveyed households were using water from shared connection (85 percent) for cooking purpose.

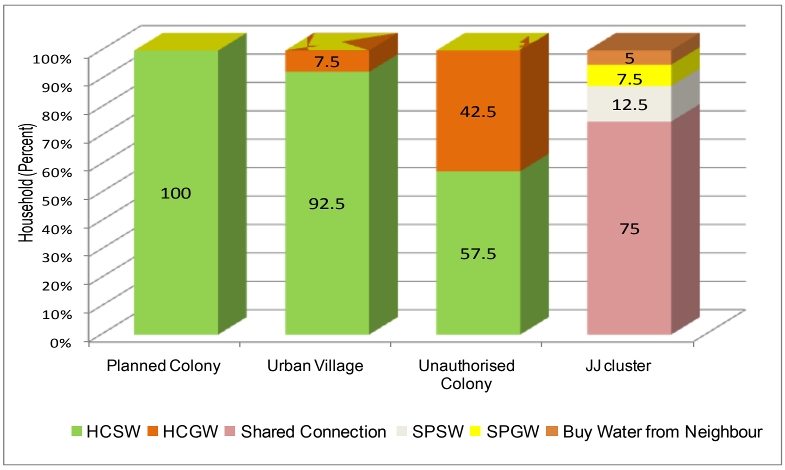

Figure 5.12: Source of Water used for Cooking Purpose in Study Area with Networked Water :DJB Management, 2016

Note: HCSW: House Connection (Soft Water), HCGW: House Connection (Hard Water), SPSW: Standpost (Soft Water), SPGW: Standpost (Hard Water)

Source: Computed from Field survey, February- April, 2016

A pattern similar to the private management areas is seen in the DJB areas. All the surveyed households in the planned colonies used tap water (soft water) for cooking purposes. In this case, majority of the households of the urban villages (92.5 percent) and unauthorised colonies (57.5 percent) use tap water (soft) for cooking purpose. Among the JJ households, 75 percent used water from shared connections, 12.5 percent used water from standpost (soft water), 5 percent bought water from neighbour and a small percentage (5 percent) used water from the standpost (hard water).

5.4.4 Household Treatment of Water

In Delhi, like most other Indian cities, water has to be treated at the household level to be made potable. Most of the households in all the settlement categories, except JJ clusters, treat water before drinking. The significance of this variable is in terms of the cost and effort households have to undertake to make water portable, in the absence of which health risks are magnified. Some of the accepted methods of water treatment comprise sedimentation, filtration and disinfection.

Among the surveyed households, 75.75 percent of the households treated water before drinking. The reason for not treating water varies from the ignorance about water being the cause of diseases to gas being expensive etc. The belief that boiling is the only method for purifying water was prevalent in the JJ colonies.

Table 5.19: Percentage Households not Treating Water before Drinking, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Rs.)	DJB (Rs.)
1	Planned Colony	0	0
2	Urban Village	0	10.00
3	Unauthorised Colonies	0	0
4	JJ Cluster	88.33	100

Source: Computed from Field survey, February- April, 2016

In the private management areas, only respondents of the JJ clusters (88.33 percent) reported not treating water before drinking while in the other settlement categories, all respondents were found to be treating water to make it potable. In the DJB areas, all the JJ cluster respondents and 10 percent of the urban village respondents reported not treating water.

Table 5.20: Reasons for not Treating Drinking Water, Study Area with Networked Water, Delhi, 2016

S. No	Settlement Category	Private Management (Percent)				DJB (Percent)			
		Not Required	Expensive LPG	Fill Water after waiting	Total	Not Required	Expensive LPG	Fill Water after waiting	Total
1	Urban Village	-	-	-	-	100	0	0	4 (100)
2	JJ Cluster	18.87	62.26	18.7	53 (100)	69.23	15.38	15.38	40 (100)

Source: Computed from Field survey, February- April, 2016

Out of the 53 surveyed households in the private management areas which did not treat water, nearly 18.87 percent of the households did not think that their piped water needed to be treated at all. These households were mainly from the surveyed JJ clusters. One of the reasons for this was also a lack of awareness regarding the components which make up quality of water. Most of the respondents considered water to be clean and of potable quality if it was clear. The concept of germs was non-existent among these households. This gets reflected in 18.7 percent of the households filling up water when clear and considering it to be potable water. There was another group of households not treating water, but were aware that water needed to be treated before drinking. This group comprised 62.26 percent of the households who did not treat water for drinking. This group considered boiling to be the only method of water treatment but according to the respondents, they could not treat water by boiling due to lack of resources. Given the large family size, they found cooking gas (LPG) to be very expensive and thus could not use it for boiling water. There was also lack of awareness regarding the use of gravity filters and the associated costs. In the DJB managed areas, 69.23 percent of the 39 surveyed JJ households did not think that water treatment was required. Some of the respondents from the urban villages also thought the same, the reason cited being the purity of groundwater. Nearly 15.38 percent of the JJ households each, considered LPG to be expensive and filled water after waiting for some time, Table 5.19 presents the percentage of respondents who do not treat water before drinking in the various settlement categories.

Among the respondents treating water, various methods were popular including using gravity filter, electric filters, reverse osmosis filters and boiling water. A large number of households were found to be using bottled water. Although, bottled water is not really a part of the household water treatment methods, it has been taken as one of the treatment method as it implies that the household is not drinking untreated water.

Table 5.21: Methods used for Treating Water for Drinking, Study Area with Networked Water, Delhi, 2016

S. No	Settlement Category	Private Management (Percent)					DJB (Percent)				
		Gravity Filter	Electric Filter	Reverse Osmosis Filter	Bottled Water	Total	Gravity Filter	Electric Filter	Reverse Osmosis Filter	Bottled Water	Total
1	Planned Colony	10.0	83.33	6.67	0	100 (60)	5.00	77.50	17.50	0	100 (40)
2	Urban Village	15.0	35.00	46.67	3.33	100 (60)	33.33	27.78	33.33	5.56	100 (36)
3	Unauthorised Colonies	6.67	50.0	31.67	11.67	100 (60)	0	65.00	17.50	17.50	100 (40)
4	JJ Cluster	0	0	0	100.0	100 (7)	-	-	-	-	-

Source: Computed from Field survey, February- April, 2016

There is a distinct difference between the choices of treatment method among the settlement categories. Electric filter seems to be the most popular choice among the respondents of the planned colonies with 83.33 percent in the private managed areas and 77.50 percent in the DJB areas using electric filters for treating water. In the private managed urban villages, 46.67 percent of the respondents use reverse osmosis filters and 3.33 percent use bottled water. In the case of DJB urban village areas, less percentage of respondents use reverse osmosis filters (33.33 percent) than in the private areas, 33.33 percent use gravity filters and 5.56 percent use bottled water. The dependence on bottled water is highest among the household respondents of unauthorised colonies also implying the high level of unreliability in water supply in these areas besides the supply of hard water. In the private areas, 11.67 percent of the unauthorised colony households use bottled water while in the DJB areas, the figure is 17.50 percent. One disturbing pattern that has emerged is the use reverse osmosis filters by households which are receiving surface water due to the general belief that they are the best type of water purification equipment available. This is unnecessary as large volume of water gets wasted in RO units and should not be employed where the water is not hard.

5.4.5 Use of Online Boosters

Online boosters are usually used for increasing water pressure so that the containers or tanks get filled quickly. All the surveyed households, including households in JJ colonies, with piped water were connected to online boosters. Online boosters, once an exception, in the absence of legal action have become the norm. These are dangerous for the water supply system, sucking in dirt and sewage water through corroded pipelines. They also deprive households which cannot afford online boosters.

Table 5.22: Online boosters in Households in Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management Households (Percent)	DJB Households (Percent)
1	Planned Colony	86.67	100.00
2	Urban Village	100.00	100.00
3	Unauthorised Colonies	100.00	100.00
4	JJ Cluster *	76.67	35.0

*Only HH with piped water

Source: Computed from Field survey, February- April, 2016

During the survey period, MVV Pvt Ltd and MNWS Pvt Ltd had started supplying water at high pressure, such that water reached a height of 40 feet in some areas. These houses were not using online boosters at that time. This also shows that households have employed the use of boosters, mainly because of the low water pressure and they are ready to forego it once the pressure improves.

In the absence of online boosters, the JJ households were disadvantaged as in many cases the water was being supplied in such a way that was hazardous for the health of the residents. In Lal Gumbad Basti which is in the private managed area and Nehru Ekta Camp which is in the DJB managed area, an arrangement was seen in which the water was collected in a shallow trench first and then taken out with mugs or small vessels. This was done as the pressure of water was extremely low.

Photo 5.2: Trench in Nehru Ekta Camp for Collecting Water (DJB Managed Area)

Photo 5.3: Trench in Lal Gumbad Basti for Collecting Water (Private Company Managed Area)

Source: Field survey, February- April, 2016

Lal Gumbad Basti, 15.02.2016 (Private Company Managed Area) *Meena lives in Lal Gumbad Basti with her husband and two daughters. She complained of low water pressure in their area. She said that they collected water from below the ground level. During the rainy season, all the water from the surrounding areas flowed into the trenches and because of this arrangement, the water situation was actually worse during the rainy season than in summers. Even during the rainy season, water would come through the pipes and fill up the trenches as usual but this water could not be used as it would mix with the overflowing drain water. She said that during rains, the residents of the lane would have to go to other lanes where taps were there above ground level.*

Coping strategies are highly socially differentiated. The wealthy have access to more range of easily available alternate options as compared to the poor **(Mehta, 2011).** They have the biggest buffer against uncertainty. In this case, households with borewells and capacity to pay for private tankers are best cushioned against water supply irregularities. This holds true for households of both the public and private company managed areas.

5.5 COST OF WATER: CUSTOMERS' PERSPECTIVE

In Delhi, there are several aspects to cost of water. First, the water tariff which households have to pay on the basis of consumption of water. Water is supplied free of cost upto 20,000 litres per month. The water tariff is applicable only for households which have authorised water connections. The tariff is the same for all areas in Delhi, irrespective of being operated and managed by private companies or by public utility. Second, the amount a household spends for drawing water from the main pipeline and filling up the water tank (a recurring expenditure), the cost of the water tank (one time expenditure) can also be added to this. Third, the non-potable quality of water forces households to treat water which also has a bearing on the expenses. Households that do not have access to piped water have arranged for water by tapping into the main pipelines. The cost borne by households for doing so can be treated as a one-time expenditure.

5.5.1 One Time Expenditure

There is a one-time expenditure which households have to incur for getting tap water inside or near their house. In the case of authorised connections, a connection price is charged by DJB. Otherwise, the households have to arrange for tap water on their own by tapping into existing pipelines.

5.5.1.1 Connection Price for Authorised Connections

The connection price comprises the development charges, road restoration charges, House Service Connection Charges and regularisation charges (unauthorised connection) (Interview with MNWS official, 2016 and DJB website). In the case of planned/approved colonies, the water connection charges are built into the cost of housing and thus the individual household has to pay a nominal fee to get it activated.

5.5.1.2 Capital Expenditure

The one time expenditure for coping with the unreliable and inadequate water supply comprises purchase of online booster, storage tank, purchase of water treatment machine and private arrangement of water pipelines in JJ clusters. The online boosters were found to be employed by most households with networked water supply including JJ households. The price of a 0.5 HP pump is around Rs.2000. The price of a water storage tank ranges from Rs.4500 for a 500 litre tank to Rs.20,000 for a 4000 litre tank. The price of household water treatment machines also vary for different types of treatment methods, the most expensive being the RO treatment machines priced at Rs. 10000 and above. The gravity filters are the cheapest, priced at Rs.2000. Digging a borewell is also an expensive affair costing about a lakh for digging a borewell 60-80 metres deep.

In order to receive water at home or near home to increase convenience and reduce time for accessing water, in both the areas, more than half of the JJ colony households (52.6 percent) have invested in shared connections or *gali taps*. The installation of gali taps which involves plumbing and eventually the sanction of the system from the local politicians, Police and DJB employees, is paid collectively. A hierarchy is observed, with households which have paid for the gali tap getting the first priority in filling up water followed by the ones who have not paid. In the case, when motors are used to draw water, households which run the motor are reluctant to give access to water to other households as it adds to their electricity bill. The survey revealed that the initial expenditure for installing the *gali taps* was around Rs.90,000 (around 20 years ago), inclusive of plumbing and money given to Police and DJB employees, which amounts to Rs.10,000 per household after dividing among the interested households.

5.5.2 Recurring Expenditure

Recurring expenditure is the expenditure that a household incurs on a regular basis, in this case for arranging for water to meet the household needs.

5.5.2.1 Expenditure (Monthly Water Bill) on Water as Share of Household Income

Expenditure on water as share of household income should not exceed 3-4 percent ideally **(World Bank, 2002; ADB).** In Delhi, the water bill is calculated on the basis of a telescopic tariff with an additional service charge and 60 percent of the volumetric water charge as sewer maintenance charge. There is additional expense for household which depend on other sources such as bottled water to meet their drinking water needs. During the period of survey, the scheme of free 20,000 kl of water was already implemented, as a result of which several households were getting bill amount of zero rupees.

Table 5.23: Expenditure (*Monthly Water Bill*) on Water as Share of Household Income, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	HH Private Management (Percent)			DJB (Percent)		
		Zero Bill	0-3	Total	Zero Bill	0-3	Total
1	Planned Colony	55.00	45.00	100 (60)	55.00	45.00	100 (40)
2	Urban Village	66.67	33.33	100(60)	70.00	30.00	100(40)
3	Unauthorised Colony	73.33	26.67	100(60)	65.00	35.00	100(40)

Source: Computed from Field survey, February- April, 2016

Majority of the households with metered water supply have benefited from the free water upto 20 kl scheme. In the case of the urban villages and unauthorised colonies, a higher percentage of households were seen to be benefiting from this scheme as compared to the planned areas despite a higher water requirement due to bigger household sizes and presence of tenants in many cases. This could be due to the fact that they rely partially on borewell water to meet their daily requirements.

5.5.2.2 Cost of Supplementary Water

Many of the households depend on supplementary sources of water for meeting their daily water requirement, as seen in section 5.4.1.Use of private tanker, buying bottled water and running the pump for extracting borewell water have been included in the analysis.

a) Private Water Tankers

In the study area, private tankers were usually called by households that want to fill up their storage tanks with fresh water since they were receiving only ground water. Each tanker costs about Rs.1500 for 8000 litres. Only two households were using water from private tankers on a regular basis. They would call the tankers fortnightly to supplement the borewell water.

b) Bottled Water

Bottled water (20 litre jar) was found to cost Rs.80 in the planned colonies and Rs.20-40 in the urban villages and unauthorised colonies.

c) Borewell water

Borewell is an important source of supplementary water, particularly in the urban villages and the unauthorised colonies. Groundwater is out of the purview of the State. Landowners own the ground water in their owned land parcel which also mean that the landless and the JJ dwellers are left out. For calculation of cost of supplementary water, only those households have been taken which are drawing water from private borewells. The cost has been calculated on the basis of the following assumptions: a) Ground water is found at 60-80 metres in the surveyed areas on the basis of CGWB data. b) 1.5 HP pump (single phase) is required to extract water from a borewell with water at 60-80 metres depth. c) 1.5 HP consumes about 1200 watts @220 volts. d) 1 Kwh is equivalent to 1 unit of electricity (BSES). Further calculation has been done by taking into account, the time a household runs the motor for filling up their tanks on a daily basis. The time varied from 15 minutes to 30 minutes daily. This would mean a cost of Rs.36 to Rs.73 per month.

5.5.2.3 Use of Online Boosters

The duration for which the online boosters are run depends on several factors such as water pressure, power of the pump, size of the tank etc. The running of water pumps also add to the electricity consumption. A half horsepower pump uses 12 Kwh in a month while a one horsepower pump uses 22 Kwh, if run daily for an hour each day. This is equivalent to adding Rs.44@ Rs.4 per unit and Rs.88 @ Rs.4 per unit to the monthly electricity bill.

Table 5.24: Duration for which the Online Booster is Operational, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)				DJB Management (Percent)				
		<30 mins	30-60 mins	60-90 mins	Total	<30 mins	30-60 mins	60-90 mins	More than 90 mins	Total
1	Planned Colony	52.38	47.62	0	100 (42)	3.45	93.10	3.45	0	100 (29)
2	Urban Village	1.67	90.0	8.33	100 (60)	17.50	2.50	17.50	62.50	100 (40)
3	Unauthorised Colony	71.67	28.33	0	100 (60)	0	100	0	0	100 (40)
4	JJ Cluster	48.48	51.52	0	100 (33)	0	100	0	0	100 (14)

Source: Computed from Field survey, February- April, 2016

In both the private managed and DJB managed areas, the households in the urban villages run their online boosters for a longer period of time compared to households of other settlement categories. While in the private managed areas, the planned colony and unauthorised colony households are in a better situation with respect to running online booster for less duration, in the DJB areas, a large percentage of the planned colony, unauthorised colony and JJ households are clustered in the category of using the online booster for 30-60 minutes.

5.5.2.4 Household Water Treatment Costs

Household water treatment entails costs which also act as a deterrent to using these methods, especially for the lower income groups. A perceived notion was prevalent among the JJ households that high costs were involved in treating water. They largely knew only of boiling as one of the best methods for disinfecting water, the lower income groups were not doing it as they considered it to be very expensive and the higher income groups found it to be too much of a hassle and preferred other methods. While water can be boiled using electric kettle, LPG or firewood, in this case LPG has been taken, as the respondents who reported that they would like to boil water but were not doing so because of high LPG costs. There is no initial cost involved since LPG is also used for cooking purposes and not solely for this purpose. The cost has been calculated by taking into account the LPG required for boiling water for a family of five. Around two litres of water per person is recommended for a person leading a sedentary life in moderate weather. Thus, 10 litres per day of drinking water would be required for a family of five. World Health Organisation recommends boiling water to a rolling boil to disinfect water. The quantity of heat required to raise the temperature of 10 kg of water from 25^{0}c (room temperature) to 100^{0}c considering the specific heat of water to be 4200 J/kg^{0}c would be: 10 kg x 4200 J/kg^{0}c x (100-25) = 3150000 J or 3150 KJ. LPG has a calorific value of around 55000 KJ/kg with efficiency of 85 percent (www.hindustanpetroleum.com). Thus, approximately two kg of LPG would be required per month for boiling purpose for a household of five members which would be around Rs.100 assuming the cost of one LPG cylinder (14.2 kg) being around Rs.723 (Price in Delhi as on 07.04.2017)

Table 5.25: Annual Household Water Treatment Estimated Cost, 2016

S.No	Water Treatment Methods	Initial Cost (Rs.)	Annual Recurring cost (Rs.)
1	Boil	-	3000
2	Filter (Gravity based Purifiers)	2000	500
3	Electric Water Purifier	8000	500
4	Reverse Osmosis purifier	10000	2000

Source: www.kent.co.in,www.eurekaforbes.com

5.5.2.5 Opportunity Cost

In comparison to the other settlement categories, the JJ households are at a great disadvantage as many of them do not have the provision of piped water inside their houses. This implies that they have to wait either at the water tanker, public standpost or shared connection. Households getting water from shared connections have to wait the least as less number of houses take water from the same connection as compared to a public standpost. Thus, while the opportunity cost for waiting is nil for the other settlement categories, it can be substantial for the JJ households. The opportunity cost has been calculated @Rs.513/day (minimum wage for unskilled labour a per Government of NCTD). It is based on the time spent waiting for water to be collected at the tanker points, shared connections and the standposts. The time spent waiting for water is shown in table 5.26. It includes tanker water, shared connections and public standposts.

Table 5.26: Time Spent Waiting for Water, Delhi, 2016

S.No	Settlement Category	Private Management (Percent)					DJB (Percent)				
		No Waiting Time	<20 mins	20-40 mins	40-60 mins	Total	No Waiting Time	<20 mins	20-40 mins	40-60 mins	Total
1	Planned Colony	100	-	-	-	100 (60)	100	-	-	-	100 (40)
2	Urban Village	100	-	-	-	100 (60)	100	-	-	-	100 (40)
3	Unauthorised Colony	100	-	-	-	100 (60)	100	-	-	-	100 (40)
4	JJ Cluster	30.0	66.66	3.33	-	100 (60)	32.50	30.0	17.5	20	100 (40)

Source: Computed from Field survey, February- April, 2016

The JJ cluster households were found to be spending most time waiting for water collection. The time was largely dependent on the source of water. Households relying on taps inside the households did not spend time waiting for water collection, while those getting water from public standposts were found to be spending the maximum time. The JJ cluster households were at a distinct disadvantage as they largely depended on shared connections and public standposts for meeting their daily water requirement.

5.5.2.6 Overall Recurring Expenditure

The overall recurring expenditure has been calculated as the sum of cost of supplementary water, cost incurred in running online boosters, household water treatment costs and opportunity costs. This gives a truer picture of the costs incurred by households to access water.

Table 5.27: Expenditure (Recurring) on Water as Share of Household Income, Study Area with Networked Water, Delhi, 2016

S.No	Settlement Category	HH Private Management (Percent)				DJB (Percent)			
		0-3	3-5	More than 5	Total	0-3	3-5	More than 5	Total
1	Planned Colony	100	0	0		100	0	0	
2	Urban Village	100	0	0		95.00	0	5.0	
3	Unauthorised Colony	100	0	0		80.0	17.5	2.5	
4	JJ Cluster	88.33	0	11.67		100	0	0	

Source: Computed from Field Survey, February- April, 2016

The share of monthly expenditure on water is the highest for JJ clusters in the private managed areas as some of the households were using bottled water which was priced @ Rs.20 for 20 litres in the JJ clusters and nearly Rs.500-600 was getting added to their monthly expenditure on water due to this. While some were using bottled water because there were children in the house who had been regularly falling sick and had been advised by the doctor to drink clean water, others were buying bottled water as they wanted to be assured of drinking water since they were dependent on shared connections and surety of getting water was always not there.

5.6 CUSTOMER ORIENTATION OF SERVICE PROVIDER

There are some aspects common to both the private and public managed areas such as the difference in the way the service provider is approached by the residents among the settlement categories. While the residents of formal settlements approach the service provider directly, the residents of the informal settlements approach through the MLA of the area. This can be largely attributed to two reasons; first, since there is no formal water supply in the JJ clusters as a result of which the households cannot approach the utility directly and secondly the JJ clusters have the patronage of the area MLAs and the power of vote bank is evident from this.

Some of the major reasons cited for approaching service provider were issues with working of the meter, excessive billing amount (much more than what the household believes to have consumed), water quality and new water connection.

Table 5.28 : Reasons Cited for Approaching Service Provider , Study Area with Networked Water, Delhi, 2016

S. No	Settlement Category	Private Management HH (Percent)					DJB HH (Percent)				
		Meter Issue	Overbilling	Water Quality	New Connection	Total	Meter Issue	Overbilling	Water Quality	New Connection	Total
1	Planned Colony	0	52.94	47.06	0.00	100 (17)	60.00	20.0	20.0	0	100 (5)
2	Urban Village	34.78	0	0	65.22	100 (46)	35.00	10.0	7.50	47.50	100 (40)
3	Unauthorised Colony	0	0	0	100.0	100 (20)	11.54	42.31	26.92	19.23	100 (26)

Source: Computed from Field survey, February- April, 2016

Installation of new meters and overbilling has been a cause of several complaints especially in the planned colonies. Households also perceive these two issues to be linked with each other as they reported more instances of overbilling after the new meters have been installed. They allege that the new meters, being air flow meters, bill even for the air that gets sucked in from the pipelines before the water reaches the meter. This position has been countered by the utilities by saying that the new meters are the ones which give the correct reading and also cannot be tampered with. Earlier residents would tamper meters so that they would give less reading, thus now they were shocked at the high bill amounts **(Interview with MNWS Customer Care Official, 2016).** To understand the situation better, cross tabulation was employed between problem and resolution of the problem.

Table 5.29: Type of Issue and Status of Resolution, Study Area with Networked Water, Delhi, 2016

S.No	Problem	Problem Resolved	Problem not Resolved	Total
1	Issue with Meter	80.56	19.44	100 (36)
2	Inflated bill	44.00	56.0	100 (25)
3	Water Quality	84.21	15.79	100 (19)
4	New Connection	90.54	9.46	100 (74)
5	Average	79.87	20.13	100 (154)

Pearson’s Chisquare Test= 27.351 pr=0.00

Source: Computed from Field survey, February- April, 2016

It is seen that among all the issues that the respondents pointed out, inflated bill has the lowest percentage of resolution (56.6 percent). The reason could be the general nature of ambiguity in the issue. As compared to the other problems, it is more of a perception based problem as it is a function of what the household thinks about the quantity of water consumed. The private companies can also resolve a billing issue if the amount is less than Rs.15000, otherwise it has to pass it on to DJB. The Turn Around Time (TAT) for technical complaints is 24 hours and for commercial is 5 days if within the purview of the Company. Usually 70 percent of the technical complaints are resolved within 24 hours. About 50 technical complaints come every day **(Interview with MNWS Pvt. Ltd Official, 2016).**

5.7 HOUSEHOLD WATER VULNERABILITY INDEX

Certain households are more water vulnerable than others, determined by the distance from the source, quality of drinking water, source of water, use of supplementary source of water, duration of water supply, water storage capacity of the household, monthly water bill as percentage of income, availability of household water treatment and last, but one of the most important household income. A short explanation has been given for each of them.

Distance from source of water has been taken as an indicator with water availability through private taps or 'public standposts and shared connections' as the two criteria. In the case of a private tap, the household does not have to share the resource with others and as a result the household members also do not have to wait for collecting water saving time, energy and efforts. The household members also do not have to carry water from the source to their houses, reducing the physical burden.

Type of Water refers to hard water and soft water in this case. The hard water is not fit for drinking. It was also reported that washing clothes and utensils is difficult with this water. The treatment machine is more expensive for this kind of water. Households getting this hard water are at a disadvantage as compared to households getting soft water.

Use of supplementary water: Households using supplementary water do so because the water they receive through the formal networked system is either inadequate in quantity or quality. They are already at the bottom of the rung, not receiving sufficient water during normal months, their vulnerability gets exacerbated during the summer months.

Duration of water supply less than two hours in a day was considered by many households as grossly inadequate and thus has been taken as the cut-off.

In the scenario of intermittent water supply, the water storage capacity of the households is very important. Many of the poorer households barely have any storage capacity amounting to only 150-200 litres per household while some of the households in the A and B category of planned colonies had 2000-3000 litres of storage capacity. A higher storage capacity also implies better resilience in dealing with water scarcity. The criteria was whether the water storage capacity of the household was more than the daily water demand of the household (calculated at 135 lpcd), then that household was given a score of 1.

Monthly water cost as a share of the monthly household income should not exceed five percent, as a thumb rule. The monthly water cost was calculated by taking recurring cost as calculated earlier.

The quality of potable water is not reliable and varies across months. Households practising *household water treatment* have an advantage of drinking safe and clean water, minimising the health hazards.

Household income is one the most important factors as it determines the resilience to water scarcity to a large extent. The low income families, whether residing in unauthorised colonies, urban villages or JJ clusters are at a great disadvantage as they cannot "buy" water in times of scarcity unlike the income groups. An income of Rs.16000 per month has been taken as the cut off as the household annual income is Rs.200,000 or below for LIG households (Government of NCTD).

Table 5.30: Indicators and Criteria for Household Water Vulnerability Index

S.No	Indicator	Criteria
1	Distance from Source	Shared Connection and Standpost - 0 Connection Inside House - 1
2	Source of Water	Hard Water – 0 Soft Water -1
3	Use of Supplementary Source	Yes – 0 No- 1
5	Duration of Water Supply	Less than 2 hours- 0 More than 2 hours- 1
6	Frequency of Water Supply	Less than Once a day- 0 More than Once a day- 1
7	Storage Capacity	Water demand> Storage Capacity- 0 Water demand< Storage Capacity-1
8	Monthly water cost as percentage of income	More than 5 percent -0 Less than 5 percent- 1
9	Household Water Treatment	No treatment -0 Treatment -1
10	Household Income	Above Rs.16000 per month-1 Below Rs.16000 per month-0

Household water vulnerability index was calculated separately for the privately managed areas and the DJB managed areas. PCA was used for calculating the index. The first component of PCA was taken as the index.

Table 5.31: Household Water Vulnerability Index, Study Area with Networked Water, 2016

S.No	Settlement Category	Private Management HH (Percent)				DJB Management HH (Percent)			
		Highest Quartile	2nd Quartile	3rd Quartile	Lowest Quartile	Highest Quartile	2nd Quartile	3rd Quartile	Lowest Quartile
1	Planned Colony	0	6.67	21.67	71.67	0.	15.00	67.50	17.50
2	Urban Village	0	11.67	70.00	18.33	2.50	12.50	70.00	15.00
3	Unauthorised Colony	0	21.67	48.33	30.00	0	5.00	92.50	2.50
4	JJ Cluster	88.33	11.67	0.00	0.00	100.00	0.00	0.00	0.00

Source: Computed from Field survey, February- April, 2016

Since it is a vulnerability index, the highest quartile has been allocated to the households with the lowest PCA scores and vice versa. In the case of areas with private management, planned colony households are clustered in the lowest quartile reiterating their superior situation. A large percentage of urban village and unauthorised colony households are in the 3rd quartile while the highest quartile has 88.33 percent of the JJ households. In the case of the DJB area households, a large percentage of households are clustered together in the second and the third quartile, including that of the planned colonies. All the JJ households are in the highest quartile.

A higher concentration of planned colony households in the lowest quartile as compared to the other settlement categories shows how skewed the vulnerability levels are, more so in the private managed areas. The urban villages and unauthorised colonies are positioned in between the planned colony and JJ households. Powerful discourses of water have largely served the interest of the rich **(Mehta, 2011).** In this case, the rich and the middle class directly benefit from the technological and management intervention that has been introduced in the study area.

5.8 SUMMARY

The present chapter focussed on the inequalities in the networked water supply between the households of the four selected settlement typologies with different legal entitlements and the subsequent histories of access to formal water supply. The analysis was done for settlements in both the public managed and private managed areas separately, based on indicators such as household coverage, source of water, reliability of water supply, water quantity and perceived sufficiency of water and perceived water quality. Planned colonies in both the areas were in a better position compared to the other three in both the areas. The coping strategies arising out of inadequate water supply differed for the various settlement categories. Dependence on borewell water as a source of supplementary water was predominant in the urban villages and unauthorised colonies which also allowed these households to tide over the water crisis. In this context, the JJ cluster households were in the worst position as their options of supplementary water is limited due to affordability issues. This holds true for both the private and the public managed areas. In the areas with private management, vis-à-vis the other settlement categories, nearly three-fourth of the households of planned colonies were bunched together in the lowest quartile of the household water vulnerability index as compared to majority of the urban village and unauthorised colony households being in the third quartile and a large percentage of JJ cluster households in the highest vulnerability quartile. In the areas with public management, majority of the households of planned colonies and urban villages are bunched together in the third quartile. The unauthorised colony and JJ cluster households are worse off with nearly two third of the households in the second quartile and all the households in the first quartile respectively. The benefits seem to be more skewed in favour of the privileged settlement category in the case of the areas with private management. It is clear from the analysis that be it public or private operation and management, the inequalities are entrenched in the socio-political system of water governance and will continue to exist unless drastic measures in terms of overhauling of policies and their implementation is done to make a more inclusive society.

The next chapter focuses on the new initiatives that have been taken to make potable water available to households in areas without networked water supply. The discussion centres on "who is availing these facilities?" and subsequently "who benefits?"

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CHAPTER VI

PRIVATE SECTOR PARTICIPATION IN NON-NETWORKED WATER SUPPLY: A CASE OF SAVDA GHEVRA

6.1 INTRODUCTION

The acceptance of non-networked infrastructure is slowly finding mention in not only the current urban literature but also among the State owned utilities. These urban spaces created by policy driven practices have been without formal water supply since the beginning with the individual need based efforts being dependent largely on the unregulated ground water use **(Allen et al, 2017).** The Government agencies are realising that they cannot be connected to the network any time soon **(Allen et al, 2017).** Denial of the existence of these spaces is giving way to a healthy acceptance of the needs of the people occupying these spaces. This is in tandem with the increasing awareness about the rights of the poor and the pressure from the global community regarding getting more households in the fold of receiving clean drinking water. Many cities of the Global South are experimenting with various combinations of community led efforts, private entrepreneurship and public initiatives, particularly in the urban fringe. The present case study is one such urban experiment launched by DJB in the resettlement colony of Savda Ghevra inhabited by low income households. This settlement is one of the many settlements in Delhi which do not get networked water. The Government in its effort to provide access to safe drinking water to colonies inhabited by the lower income groups has introduced water dispensing units also called water ATMs, in collaboration with private companies.

DJB invited tenders for setting up of water dispensing kiosks in Savda Ghevra resettlement colony in 2013, post which the water ATMs were set up by the Corporate Social Responsibility wing of Piramal Pvt Ltd (Sarvajal). Sarvajal was later converted into a private, for profit water enterprise **(Safe Water Network, 2016).** During the time of the survey in April, 2016, there were nine such water ATMs in the colony. The plant is also located inside the colony where water is taken from borewells and treated with the reverse osmosis method. Nearly 2500 litres of water gets filtered everyday **(Interview with Plant Operator, 2016).** The treated water is carried in small tankers to the dispensing units where they are refilled. There are meters fixed in these ATMs, such that information about the low water volumes is relayed to the operator. The Savda Ghevra operation has been clocking a profit. Monthly operating cost is Rs.45,900 while the monthly revenue is Rs.67,350 **(Safe Water Network, 2016).**.

An attempt has been made to understand the dynamics of the use of the water ATMs in the selected study area. “Who uses these water ATMs?” and “Whom is it benefiting?” are some of the questions to be addressed in the chapter. The chapter has been divided into six sections. The chapter has been introduced in the first section giving a brief background. The profile of the respondents and their households has been discussed in the second section. An account of the multiple sources of water being used in Savda Ghevra has been studied in the third section. The characteristics of the use of water from these sources have been discussed in the next section. The determinants of the use of water ATMs and the factors acting as barriers and acceptance for its use have been examined in the fifth section. The chapter has been summarised and main findings gave been highlighted in the last section.

6.2 PROFILE OF RESPONDENTS: NON-NETWORKED WATER

In this section, background information regarding the profile of the respondents has been analysed. A sample of 60 households, 30 for households using water ATM and 30 for households not using water ATM, were surveyed and the characteristics and behavioural pattern regarding water use was analysed for both the categories. Since only one settlement was selected for the study, not much variation was found in the various socio-economic aspects.

6.2.1 Average Household Size

The average household size along with the lifestyle, as discussed earlier, has implications on the water consumption. In this case, since the comparison is across the households in the same settlement typology and are assumed to have similar lifestyles, the household size might have implications.

Table 6.1: Average Household Size, Savda Ghevra, 2016

Management Type	HH using ATM (Percent)	HH not using ATM (Percent)	Total (Percent)
Average HH Size	4.1	5.8	5.0

Source: Computed from Field survey, February- April, 2016

The average household size of the respondents was 5.0. Among the households using water ATM, the average household size was 4.1 while the household size was 5.8 among households not using water ATM.

6.2.2 Sex Distribution of Respondents

The survey was conducted in the daytime, yet male members were found to be at home in many of the cases.

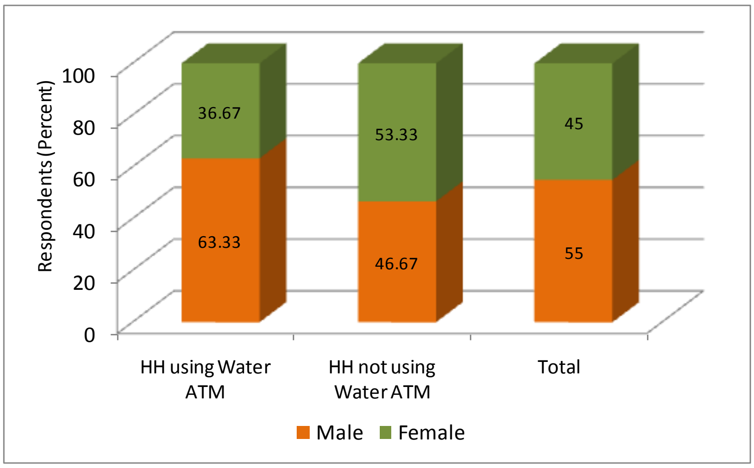

Figure 6.1: Sex distribution of Respondents : Savda Ghevra, 2016

Source: Computed from Field survey, February- April, 2016

The percentage share of male respondents (63.33 percent) was higher among the households using water ATM, while it was the other way round for the households not using water ATM.

6.2.3 Age Distribution of Respondents

A difference in age distribution is seen among the households using water ATM and not using water ATM. Respondents in households using water ATM largely belonged to the 35-55 years age group (66.67 percent) with only 13.33 percent being in the 55-65 years age group. On the contrary, 43.33 percent of the respondents in the households not using water ATM belonged to 25-35 years age group, 33.33 percent were from 35-55 years age group and half of the respondents were from the oldest age group.

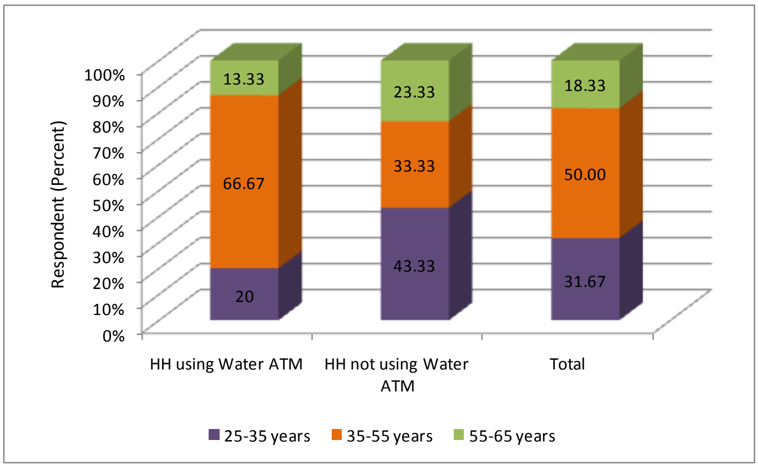

Figure 6.2: Age Distribution of Respondents : Savda Ghevra, 2016

Source: Computed from Field survey, February- April, 2016

6.2.4 Marital Status of Respondents

A large percentage of the total respondents (70 percent) were reported to be married with only 30 percent of the respondents being unmarried in households using water ATM. These respondents were also living alone. All the respondents of households not using water ATM reported to be married.

Table 6.2: Marital Status of Respondents: Savda Ghevra, 2016

S.No	Management Type	HH using ATM (Percent)	HH not using ATM (Percent)	Total (Percent)
1	Married	70.0	100.00	85.0
2	Unmarried	30.0	0.00	15.0
3	Total	100.00	100.00	100.00

Source: Computed from Field survey, February- April, 2016

6.2.5 Educational Level of Respondents

The level of education is low in the area. Due to the presence of a sizeable Muslim population, some respondents also reported being educated in Madarsas.

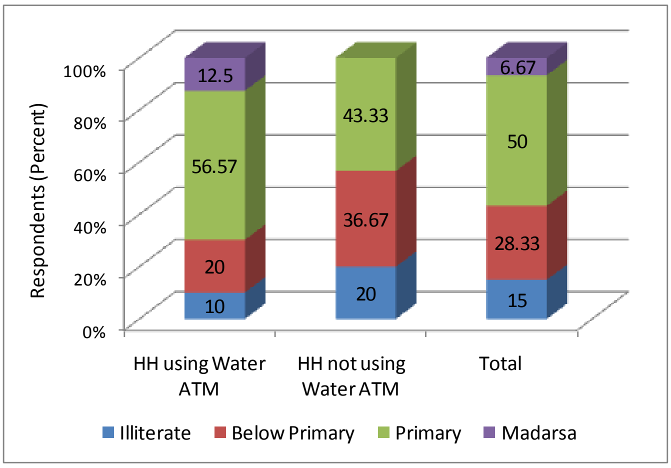

Figure 6.3: Educational Level of Respondents : Savda Ghevra, 2016

Source: Computed from Field survey, February- April, 2016

The educational level was found to be higher among the respondents of households using water ATM as compared to households not using water ATM. Among respondents of households using water ATM, 10 percent, 20 percent and 56.57 percent reported to be illiterates, educated till below primary and primary levels respectively. Nearly 12.5 percent of the respondents had received their education in Madarsas. In the other group not using water ATM, 20 percent were illiterates, 36.67 percent and another 43.33 percent, were educated below primary and primary level respectively.

6.2.6 Occupational Structure and Work Related Aspects

The type of work in which the earning members were engaged were very limited in the resettlement colony due to the distance between the area of residence and the places of work. A large percentage of the earning members were engaged as daily wage labour in the nearby factories.

In the 60 household sample, 66 earning members were reported with some of the households (10 percent) also reporting unemployed male members. Men huddled in a group playing cards or chatting during daytime was a common sight in the resettlement colony.

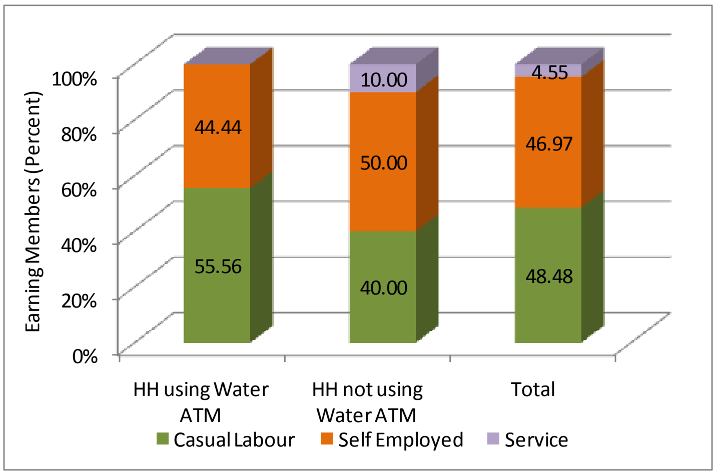

Figure 6.4: Occupational Structure of Earning Members : Savda Ghevra, 2016

Source: Computed from Field Survey, February- April, 2016

Majority of the earning members were engaged in casual labour and self-employed occupations such as factory worker, domestic help, driver and shopkeeper. A miniscule percentage was engaged in regular salaried service. Among the households using water ATM, 55.56 percent of the earning members were engaged in casual labour and 44.44 percent were engaged in self-employed occupations. Among the households not using water ATM, 40 percent were engaged in casual labour, 50 percent were engaged in self-employed activities and 10 percent were salaried individuals.

The number of earning members in a household is important as a higher number helps in cushioning the family against financial difficulties in the eventuality of one member losing his job. Table 6.3 presents the percentage of households with the number of earning members.

Table 6.3: Households with Number of Earning Members: Savda Ghevra, 2016

S.No	Earning Members	HH using ATM (Percent)	HH not using ATM (Percent)	Total (Percent)
1	One Earning Member	80.0	100.0	90.00
2	Two Earning Members	20.0	0	10.00
3	Total	100.00	100.00	100.00

Source: Computed from Field survey, February- April, 2016

Among the households using water ATM, 80 percent of the households had only one earning members while 20 percent had two earning members. Among the households not using water ATM, all the households had only one earning member. Overall, it was seen that fewer households had more than one earning member as compared to the slum areas surveyed for networked water. This could be because of the isolated location of the settlement with poor connectivity making it inconvenient for women to go out and work as they would prefer to do work of domestic help in the mornings leaving the day free for their own household chores.

Work timings of the earning members is important in this context as that means that household members are unavailable for household chores during that time of the day. In a scenario where water delivery through tankers is done at fixed time of the day, this has implications on the availability of water for the household.

Table 6.4: Work Timings of the Earning Members: Savda Ghevra, 2016

S.No	Work timings	HH using ATM (Percent)	HH not using ATM (Percent)	Total (Percent)
1	7 AM to 12 AM	8.33	13.33	10.61
2	8 AM to 8 PM	5.56	0	3.03
3	9 AM – 6 PM	0	23.33	10.61
4	10 AM – 8PM	66.67	26.67	48.48
5	11 AM – 2 PM	0.00	23.33	10.61
6	Shift timings	19.44	13.33	16.67
7	Total	100 (30)	100 (30)	100 (60)

Source: Computed from Field survey, February- April, 2016

Majority of earning members (66.67 percent) in households using water ATM were engaged in jobs which required them to report at 10 AM for work and be there till 8 PM, at least. Least percentage of earning members (5.56 percent) reported reaching workplace at 8 AM and being there till 8 PM, besides that there were no working members engaged in work in the time slot 9 AM to 6 PM and 11 AM to 2 PM. In the case of households not using water ATM, the percentage share of earning members is more evenly spread out with the highest percentage of earning members (26.67 percent) engaged in work from 10 AM to 8 PM.

Table 6.5: Average Household Income: Savda Ghevra, 2016

S.No	Household Income (Rs.)	HH using ATM (Percent)	HH not using ATM (Percent)	Total (Percent)
1	5000-7500	10	5.56	8.83
2	7500-10000	70	66.66	68.75
3	10000-12500	13.33	27.78	18.75
4	12500-15000	6.66	0	4.16
5	Total	100	100	100

Source: Computed from Field survey, February- April, 2016

Majority (68.75 percent) of the households reported a household income of Rs.10000-15000. Among the households using water ATM, 70 percent had a household income of Rs.7500-10000, 10 percent had a household income of Rs.5000-Rs.7500 and 6.66 percent had a household income of Rs.12500-15000. Among the households not using water ATM, 66.66 percent had a household income of Rs.7500-10000, 5.56 percent had a household income of Rs.5000-Rs.7500. None of the households had an income above Rs.12500, in this category.

A wealth index was also created using Principal Component Analysis (PCA) by using the ownership of residence, television, bicycle, air cooler, refrigerator, cellular phone and private toilet as variables (Table 6.6)

Table 6.6: Wealth Index of Households: Savda Ghevra, 2016

S.No	Asset Variable	PCA Value	N-Yes	Percent
1	Television	0.032	57	95.0
2	Cycle	0.069	15	25.0
3	Air cooler	0.267	27	45.0
4	Refrigerator	-0.146	28	46.67
5	Cellular Phone	0.046	53	88.33
6	Private Toilet	0.712	21	35.0
7	Ownership of House	0.912	39	65.0

Source: Computed from Field survey, February- April, 2016

Pearson's correlation coefficient between the reported income and wealth index was 0.305 of statistical significance at 0.05 levels.

6.3 SOURCES OF WATER: NON- NETWORKED WATER

In the scenario of non-networked water, the choice of sources of water is more limited than in an area served by networked supply. In this case, the distinction between potable water and non-potable water and their respective uses is very clear. Households do not drink the borewell water, rather they use it for washing clothes and other household chores. The DJB tanker water, water from the water ATMs and bottled water is used for drinking.

6.3.1 Main Sources of Potable Water: Non- Networked Water

The main sources of drinking water, in terms of the perception of the residents, were the DJB tanker, water ATMs and bottled water. Since it is disproportionate sampling, it is difficult to assess the popularity of each of the sources in the entire area, but during the survey it was easier to find households using DJB tanker water for drinking compared to households using water ATM. Out of the 7000 households in Savda Ghevra, 900 RFID cards had been issued at the time of the survey **(Interview with RO Plant operator, April, 2016)** implying that only around one-eighth of the households could be using the water ATM, not necessarily regularly.

Table 6.7: Sources of Potable Water: Savda Ghevra, 2016

S.No	Source	HH using ATM (Percent)	HH not using ATM (Percent)
1	DJB Tanker	50	100
2	Water ATM	100	0
3	Bottled Water	20	0

Not exclusive

Source: Computed from Field survey, February- April, 2016

Households not using water ATM used water from DJB tankers for meeting their drinking water needs while households using water ATMs sourced their water from DJB tanker, water ATMs and bottled water. It is interesting to note that respondents who use the water ATM also used bottled water for drinking implying that the demand for drinking clean water could be driving the use of both.

6.3.2 Main Source of Water for Uses Other than Drinking: Non- Networked Water

The resettlement colony, in the absence of piped water, has only two options for accessing water i.e through borewells and DJB tankers for non-potable purposes. Since water needs to be carried from tankers by hand which is a physical strain, household prefer to use borewell water which is available near their house. The disadvantage of borewell water is that it is hard water and thus the use is restricted.

Table 6.8: Main Source of Water for Uses other than Drinking, Savda Ghevra, 2016

Source of Water	HH using ATM (Percent)	HH not using ATM (Percent)	Total
Borewell	70	100	85.0
DJB Tanker	50	56.67	53.33

Not exclusive

Source: Computed from Field survey, February- April, 2016

For both categories of households, borewell is the preferred choice of source for uses other than drinking. While some households have their own private borewells, others buy water from owners of these borewells.

6.4 SOURCES OF WATER AND THE CHARACTERISTICS OF THEIR USE

6.4.1 Water from DJB Tanker

Water from DJB tankers is a lifeline for the households in Savda Ghevra resettlement colony. Ideally, all the households should have equal access to it but this is not the case. Factors such as where the tanker stops first, for how much time the tanker stops at the designated places were found to be influenced by the exertion of power.

Savda Ghevra Resettlement Colony, 05.04.2016: *A resident living in the Muslim dominated part of Savda Ghevra claimed that their family was influential in that area. He cited the presence of nine household members as the reason for high water consumption. He also said that since it was not possible to carry so much water from the DJB tankers to their residence, they had asked the DJB tanker driver to come in front of* *their residence first. The family members filled up their tanks with pipes and then when the tanks were full, the tanker is left to go the designated tanker point. He also said that the driver is given some money for 'chai-paani' but refused to divulge the amount.*

Cases like this exemplify the role of water as an agent for power struggle. While the household in the above mentioned case study benefits from the arrangement with the tanker driver, there are others who are deprived of the water over which they had an equal right.

Tankers visit the colony regularly, at different times of the day. The tanker schedule is rather complex with one set of tankers coming every day and the other set coming every alternate day. The one which comes everyday stands only for half an hour while the one which comes every alternate day stands for one hour. There are pre-scheduled tanker stands. It was not clear that how these stops were decided upon, but it was definitely advantageous to those whose houses were located near it. Some of the households also have access to two tankers due to locational advantage.

6.4.1.1 Quantity of DJB Tanker Water

The quantity of DJB tanker water taken by each household at a time has been assessed on the number of buckets or containers they fill and the volume of each of the containers. The quantity varied depending on the availability of household members to carry water, availability of water in the tanker, the requirement for the day etc. The amount of water taken from the tankers varies for households and is a bone of contention in the colony. At some tanker points, the number of containers, one household can fill is restricted to three containers by the households themselves so that there is more equitable distribution of water.

Table 6.9: Amount of Water usually taken from Tanker at a Time , Savda Ghevra, 2016

S.No	Amount of Water (Litres)	HH using ATM (Percent)	HH not using ATM (Percent)	Total
1	Less than 50	44.44	80.0	62.75
2	50-100	50.0	20.0	29.41
3	More than 100	5.56	0	7.84
4	Total	100 (30)	100 (30)	100 (60)

Source: Computed from Field survey, February- April, 2016

The residents collect water in buckets or any container with a handle which can be carried. Half of the surveyed households using water ATM took 50-100 litres of water while majority of the surveyed households not using ATM took less than 50 litres of water from the DJB tankers. This was as per the information given by the households for the first week of April. The findings were found to be different from the expected results. Households using water ATM were expected to take less water from the tankers but it was found that a higher percentage of households using water ATM were taking more water from the tanker as compared to households not using water ATM. This was largely because water from the ATMs formed a small proportion of the total household daily water intake, thus an association between amount of water taken from ATM and tanker could not be established.

Photo 6.1 People Fetching Water from a DJB Tanker: M Block, Savda Ghevra

Source: Field survey, February- April, 2016

6.4.1.2 Quality of DJB Tanker Water

All the respondents, whether using ATM or not, considered the tanker water to be tasteless and foul smelling at times. While 66 percent of the respondents found the water to be sometimes muddy and 26 percent found the water to be sometimes muddy and with insects, 8 percent found the water to be always muddy.

6.4.1.3 Reliability of DJB Water Tanker Visits

Tanker visits were regular, mainly concentrated in the mornings. The respondents reported the situation to be much better now. Earlier, they had to travel to Ghevra village to get water, as a result of which many households had drilled their own borewells. But the borewells yield hard water and DJB tanker water is the primary source of water for majority of the households.

The standing time of tankers varied from point to point, the households taking water from the points where tankers would stand for a longer time or come more frequently were at an advantage. For instance, there was one tanker standpoint where one small tanker would stand for half an hour every day and a big tanker would stand for 2 hours every alternate day. A large percentage of surveyed households were found to be taking water from this tanker point.

The timings of the DJB tankers are given in table 6.10. The timings pertain to only the standpoints from where the respondents take water. The timings have implications on the access to water as households that do not have manpower during that time are also not able to access water.

Table 6.10: Timings of DJB Tankers Savda Ghevra, 2016

S.No	Tanker Standpoint	Time (A.M)	HH using ATM (Percent)	HH not using ATM (Percent)	Total (Percent)
1	M Block	6:30 (Every day), 9:00 ((Thrice a Week), 12:00 (Thrice a Week)	40.00	33.33	36.67
2	C Block	9:00 (Thrice a week)	16.67	43.33	30.00
3	A Block	10:00 (Thrice a Week)	20.00	0.00	10.00
4	H Block	10:30 (Every day)	3.33	23.33	13.33
5	K Block	11:00 (Thrice a Week)	20.00	0.00	10.00
6	-	Total	100 (30)	100(30)	100(60)

Source: Computed from Field survey, February- April, 2016

All the tankers are scheduled to visit the various tanker points in the morning. The half tanker which comes at 6.30 AM stands for only half an hour at the M block standpoint, after which it leaves. Full tankers visit thrice a week at the same standpoint and stand till everyone fills or the tanker becomes empty. Similarly, one full tanker visits the C block tanker point every alternate day at 9 AM. The duration for which the tankers stand also varies from point to point. While at some places, tankers stand till the tanker is empty or everybody has taken water, at other places like A block tanker point, the tanker comes at 10 AM and waits for only 15 minutes and there are 10-20 people always waiting for taking water at that point. As a result of which, there is a lot of jostling and fights also erupt, many a times.

6.4.1.4 Distance from Tanker Point

The distance of the residence of the households from the tanker points is critical as the household members have to carry water in buckets from the tanker point to their houses. The distance acts as a deterrent in getting too much water due to the load that has to be carried. Distance from the tanker point emerged as an important factor in tanker water use during discussions.

> Savda Ghevra Resettlement Colony, 05.04.2016: *A resident of Savda Ghevra, since its inception, with five household members complained that getting water from the tanker was difficult. She stated that the tanker point was around 50 m from her house and lugging 25-30 litres for that distance everyday took tremendous amount of effort. She also said that only two household members were able-bodied adults, the rest being children or elderly which made things more difficult. Sometimes, her husband was not available for that task as he worked in shift timings in a factory in Nangloi. This also meant that she had to make 3-4 trips every day to get water for meeting their basic needs. She complained of a recurrent shoulder and back pain, like many others in the colony.*

Households were found to use less of tanker water and reserve it for important functions like cooking and drinking if the distance was more and there were less number of household members for carrying water.

Table 6.11: Distance from Tanker Point, Savda Ghevra, 2016

S.No	Distance	HH using ATM (Percent)	HH not using ATM (Percent)	Total
1	In front of Residence	6.67	3.33	5.00
2	Within 20 m	16.67	13.33	15.00
3	20- 50 m	70.00	83.33	76.67
4	50- 75 m	6.67	0.00	3.33
5	Grand Total	100 (30)	100 (30)	100 (60)

Source: Computed from Field survey, February- April, 2016

For households not using water ATM, all the households were within 50 m of the tanker point while for households using the water ATM, 6.67 percent were beyond 50 m.

6.4.1.5 Characteristics of Household Members Fetching Tanker Water

Household members fetching water from tankers is dependent on the availability of members at the time when the tanker is there. Although the difference, in the distribution of household members going to fetch water between the households using ATM and households not using ATM is of not much consequence, the difference is worth studying for household members fetching water from tanker and water ATM.

Table 6.12: Household Members Fetching Water from Tanker Savda Ghevra, 2016

S.No	Distance	HH using ATM (Percent)	HH not using ATM (Percent)	Total
1	All available members	43.33	63.33	53.33
2	Both Adult Males and Females	10.00	0.00	5.00
3	Only Adult Males	36.67	0.00	18.33
4	Only Adult Females	10.00	36.67	23.33
5	Total	100 (30)	100 (30)	100 (60)

Source: Computed from Field survey, February- April, 2016

In majority of the surveyed households, all available members were engaged to collect water from the tankers. In the cases, where adult females would only fetch water, that was because adult males were not available at the time when the tanker visits were scheduled.

6.4.2 Water ATM

Water ATMs are installed at a distance of around 200-300 metres from each other, but not evenly spread throughout the colony. The plant is in the north-western part of the colony. RFID card are issued to the residents at a one-time cost of Rs.100 and water is sold @30 paise per litre from the ATMs and 15 paise per litre from the ATM within the plant premises. Water from ATM was reported to be used only for drinking purpose and very rarely for cooking. Some of the features associated with the use of water ATMs are discussed in this section.

6.4.2.1 Quantity of Water taken from Water ATM at a Time

The amount of water taken from a water ATM was less than that taken from a tanker as this water was used only for drinking and probably because one had to pay for it. For many households, water from the water ATM was a secondary source of drinking water, which they would take only when the tanker water was dirty or if they had missed the tanker.

Table 6.13: Amount of Water taken from Water ATMs at a Time Savda Ghevra, 2016

S.No	Amount of Water (Litres) Approx.	HH using ATM (Percent)
1	5	11.11
2	10	29.63
3	15	33.33
4	30	14.81
5	Rarely	11.11
6	Grand Total	100 (30)

Source: Computed from Field survey, February- April, 2016

Two types of behaviour was observed, one where households would take water from the ATM nearly every day and the other, where households would take water for 3-4 days at one go. The former would take water upto five litres at a time while the latter would take about 30 litres. The issue that needs to be highlighted here is the container that was being used to carry the water from the ATM to the residence. While those taking out less amount of water would carry it in 2 litre pet bottles, the ones taking out more than 10 litres of water would do so in small buckets increasing the chances of contamination and negating the benefits of clean ATM water.

Savda Ghevra Resettlement Colony, 05.04.2016: *Meena, a 65 year old resident, lives with her son and daughter in law. She said that they both worked outside Savda Ghevra. They left in the morning and came back late in the evening. On every Sunday, her son and daughter-in-law collected about 25-30 litres of water from the water ATM, as according to her, she did not have the strength to collect water from the tanker on a daily basis. She said that they used borewell water for their other uses.*

6.4.2.2 Distance of Residence from Water ATM

Distance again plays an important role in influencing the use of water ATM. This is again because one has to carry water from the ATM to the residence.

Table 6.14: Distance of Residence from Water ATM, Savda Ghevra, 2016

S.No	Distance	HH using ATM (Percent)	HH not using ATM (Percent)	Total
1	Within 20 m	20.00	0.00	12.50
2	20-50 m	73.33	33.33	58.33
3	50-75 m	6.67	0.00	4.17
4	75-100 m	0.00	66.67	25.00
5	Grand Total	100 (30)	100 (30)	100 (60)

Source: Computed from Field survey, February- April, 2016

All the households using water ATMs were within a distance of 75 metres of the water ATM with majority being within 50 metres. On the contrary, nearly two-third of the households not using the water ATM were more than 75 metres from any water ATM.

6.4.2.3 Characteristics of Household Members Fetching ATM Water

There was a dominance of male household members going to get water from the water ATMs with male household member going to fetch water in nearly 63 percent of the households. Thirty percent can be excluded from this share as they were single men staying alone. In the rest 33 percent of the households, males were going to get water despite other household members being present. It was observed that there was some kind of "coolness" quotient attached to the operation of the ATM and young men did not mind getting water from the ATMs unlike from the tankers.

Table 6.15: Household Members fetching Water from ATM, Savda Ghevra, 2016

S.No	Distance	HH using Water ATM
1	Both Males and Females	36.67
2	Only Males	16.67
3	Only Males –Staying Alone	30.00
4	Young Male Adult	16.67
5	Total	100 (30)

Source: Computed from Field survey, February- April, 2016

Photo 6.2: Young Adults taking Water from a Water ATM

Source: Field survey, February- April, 2016

6.4.3 Bottled Water

Bottled Water is another popular option for potable water. Twenty litres of bottled water costs Rs.10 for regular buyers and Rs.20 for non-regular buyers. Thus, for a family of five consuming 3 litres of water each, nearly Rs.20 is required every day to meet the potable water demand which translates to Rs.600 in a month.

6.4.4 Borewell Water

Borewell water was the preferred option for non-potable uses, more out of compulsion rather than choice. Since it is difficult to carry so much water as required for complete household chores, most of the surveyed households relied partially on borewell water for meeting their daily needs. While tanker water, water from ATMs and bottled water compete for the same use, borewell water is purely for a different use.

6.4.4.1 Source of Borewell Water

While some of the households had their own borewells, many did not. The latter took water from either the neighbour's borewell on payment basis or the common borewell. The common borewell was used by a group of 3-4 households close to each other. They fixed their pipes and pumps and draw out water. The households which own a borewell or use a common borewell fill up water in 500 litre tanks while those buying water either carry the water in buckets or fix a pipe to fill their containers or tanks.

Table 6.16: Source of Borewell Water, Savda Ghevra, 2016

S.No	Source of Borewell Water	HH using Water ATM (Percent)	HH not using Water ATM (Percent)	Total
1	Own	28.57	56.67	45.10
2	Neighbour	14.29	43.33	31.37
3	Common Borewell	57.14	0.00	23.53
4	Total	100	100	100

Source: Computed from Field survey, February- April, 2016

The majority of households using water ATM (57.14 percent) used a common borewell for drawing water while in the case of households not using water ATM, 56.57 percent of the households used their own borewell.

6.4.4.2 Cost of Borewell Water

Borewell water entails costs for both the owners of the borewell and the households taking water from these borewells. While the owners had to bear the initial costs for drilling the borewell and pay for the electricity used for pumping of water on a regular basis, others who took water from these households pay on a monthly basis. The households reported that the submersible pump had to be run for 10-15 minutes to fill up a 500 litre water tank. Two case studies have been described below, one of a household which owns a borewell and the other of a household which buys borewell water from others, giving two perspectives.

Savda Ghevra Resettlement Colony, 06.04.2016: Asha has been living in Savda Ghevra resettlement colony for the past six years. *They have had a borewell for the past four years. They spent Rs.10,000 in digging the borewell. She complained that the water was of very poor quality. Use of this water spoilt their clothes and washing of the floors was making the flakes come out but she was happy that at least they did not have to stand in queue and fight for water daily. Her family also sold water to those in need. They did not* *find the water suitable for drinking, thus they either got water from the DJB tankers once in two days (around 20 litres) which sufficed for their family of four persons or take water from the water ATM.*

Savda Ghevra Resettlement Colony, 07.04.2016*: Lata lives in a large family with her husband, mother in law and three children. Her mother in law is bedridden and children still very young. Her husband leaves for work at nine in the morning. That leaves only her for fetching water from the tanker at the nearest tanker standpoint which was about 50 metres from our house. She tries to get at least two containers of water (about 40 litres) every alternate day so that water for their basic drinking and cooking needs are met. She said that they cannot afford to dig their own borewell so they buy water for washing clothes, utensils and other such household chores from their neighbour. They pay the neighbour Rs.200 per month and fill up their 500 litre tank once in three days.*

6.5 Determinants of Use of Water ATM

The determinants of use of water ATM give an insight into "who is using these water ATMs". During the household survey, it was seen that while some households were using the installed water ATMs, others were not. Thus, an attempt was made to understand the barriers and acceptance in the use of water ATMs. Both quantitative and qualitative analysis has been done to ascertain the factors which encourage the use of water ATMs. Binomial regression was done to understand the reasons for the use of ATMs.

Table 6.17: Determinants of ATM use among Households in Savda Ghevra (Binomial Logistic Regression), 2016

Variable	B	SE	Significance	OR
Households using Water ATM; Yes=1, No=0 Dependent Variable				
Constant	2.048	2.917	0.483	7.751
Household Members	-1.552	0.560	0.006*	0.212
Distance of ATM from residence	-0.113	0.034	0.001*	0.893
Household Monthly Income	0.001	0.001	0.017*	1.001

N=60
** p< 0.05*
Source: Computed from Field survey, February- April, 2016

A binomial logistic regression was performed to ascertain the effects of household size, distance of residence from water ATM and wealth index on use of water ATM. Although, the quality of tanker water could also have been a determinant but most of the households considered it to be not so clean and thus the factor has been left out in the model. The logistic regression model was of statistical significance, $\chi 2(4) = 42.200$, $p < .0005$. The model explained 73.9 percent (Nagelkerke R^2) of the variance in water ATM use and correctly classified 80 percent of cases. Smaller households were 0.212 times more likely to use water ATM. Increasing distance between the residence and water ATM was also a key factor in inhibiting water ATM use. Households at a higher distance from the water ATMs were 0.893 times less likely to use the water ATMs. Households with higher monthly household income were 1.001 times more likely to use water ATMs.

Respondents who had reported poor quality of tanker water and yet were not using the private water dispensing unit were separately asked for the reasons. It emerged that reluctance to adopt an innovation was an important factor and acted as a barrier to the use of the ATMs. An FGD was conducted in Savda Ghevra regarding the use of the water ATMs. Four dominant themes emerged in the FGD a) Water from DJB tanker was dirty, sometimes with insects. b) Helplessness at the lack of options for clean and easily available potable water. c) Apprehension in operating the water ATMs and d) Not attaching importance to keeping the ATM card carefully and further ignorance of how to get it made again.

According to most respondents, the water has been priced reasonably @ 30 paise per litre which comes to be around Rs.135 per month for a family of five assuming three litres per person per day. Households getting water from the main plant ATM get it even cheaper at 15 paise per litre costing Rs.67 for the entire month which most respondents found affordable for the convenience it offered.

Photo 6.3: The Main Sarvajal Plant at Savda Ghevra

Source: Field survey, February- April, 2016

During Focus Group Discussion, the timing of the water tankers also emerged to be dominant theme in the discussions. The tankers are scheduled in such a way that they reach their points after 9 AM. By this time, most men leave for their work place. Only males who are unemployed, self-employed or work in shift timings are able to avail the services of the tankers. This also means that the burden of getting water from the tankers was largely on the women of the house. Respondent males who lived alone are also not able to take water from the tankers and they were found to be using ATM water for their drinking needs and buying water from residents with borewells for their other needs.

Besides, the distance to water ATM and reluctance to use the water ATMs due to unfamiliar technology, other factors such as low levels of awareness among the respondents on how to get new cards or replace old ones, charge the existing cards was also a barrier in use of the water ATMs. The cards could be charged only at the main plant which is in one extreme corner of the inhabited settlement. Some of the households which were located far from the plant but near the ATMs and yet were not using it, cited difficulty in recharging as a problem as the distance between their residence and the plant was more than a kilometre and travelling so much within the settlement was a problem in the absence of one's own vehicle. Some respondents also complained that it took 5-10 days to repair the ATM, once it goes out of order.

6.6 SUMMARY

The initiative of DJB and Sarvajal is commendable to the point that it has given an alternative source of clean, affordable drinking water to the residents of Savda Ghevra. Unfortunately, the source of water is ground water in an area with already brackish water. In this context, the Government should explore other options to bring surface water to the site, not necessarily through networked water supply, and treat water at the site and then dispense through vending machines to meet the needs of potable water. The acceptance of water ATMs by the private company has been a low in Savda Ghevra. One of the main barriers to use of the dispensing unit was the fear and the discomfort of using a new technology. There was disinterest in getting the pre-paid cards charged once the amount ran out as many respondents found the main plant to be very far from their house. Another interesting finding was that only young adult males in the family were operating the units reiterating past studies that youth take to new technology more easily, but also showing some male bias.

The major determinants of use of water ATMs emerged to be the number of household members and the distance between the residence and the ATMs. Households with less number of members and/or located near the ATMs were also more likely to use ATMs. the Although, the regression results showed that households with higher household income were more likely to use the water ATMs, underlining the inherent bias in introducing paid water, the odds of households with higher income using the water ATMs and not using the water ATMs were very similar.

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CHAPTER VII

POLITICAL ECOLOGY OF NEO-LIBERALISED WATER

7.1 INTRODUCTION

Privatisation of urban water services has been an important and inseparable part of neo-liberalisation of water, but it is neo-liberalisation which has brought in the institutional and economic changes that further influence the socio-ecological components and processes. It is important to understand the changing relations between nature, state and society instead of concentrating on the specific drivers **(Ioris, 2014).** Water circulation is influenced not only by the hydrological cycle but also the institutions and practices **(Bakker, 2003).** Political ecology allows transcending the public-private barrier and understanding the repositioning of the State from State hydraulic to market conservation **(Bakker, 2003).** Governance failure is simultaneously political, ecological and socio-economic **(Bakker, 2010).** The study of the commodification and commercialisation of water is important as it has seeped deep into the institutions and is being perpetrated by the State itself. Ironically, good governance has come in the form of reforms- a term associated with complicity between global interests, national governments and international financial institutions aimed at changing public resources into profit making ventures **(Coelho, 2006).**

It was seen in the previous two chapters that the benefits of PSP is limited to a certain section of the society and the status quo of inequality in access to water is maintained. The inequalities are a result of deep rooted bias and discrimination, which supersedes the technical improvements. There might have been improvement at the aggregate level but vulnerabilities, scarcities and inequalities have been maintained and reinforced as seen in previous studies **(Ioris, 2013).** Sustainability has been reduced to an imaginary fantasy, effective techno-scientific eco-management has often neglected and dominated the socio-ecological inequality, environmental destruction and associated power relations **(Swyngedouw & Kaika, 2014)**

The prevailing inequalities in access to water among the selected settlement categories have been studied in the present chapter. The chapter is introduced in the first section. The changing role of the State reflected in the changing nature of the policy instruments being introduced in Delhi has been explored in the second section. State induced barriers to entry and continuation of water connections has been studied in the third section. The present Government of Delhi has introduced programmes and schemes to facilitate access of formal water to all households of Delhi, this has been critiqued in the fourth section. Water is indispensable for life and every human should have an equal right over it, but it is not so in reality. The role of RWAs in resource capture and the struggle of JJ households to get water through political influence has been discussed in the next two sections. Electricity and water are intertwined in the urban context. The burden on the poor due to the introduction of privatisation of electricity has been studied in the seventh section followed by willingness to pay among the JJ households in the study area. Private companies do not exist in isolation and operate within the existing set up making them equally susceptible to the web of politics and rules as public utilities. This has been discussed in the eighth section of the chapter. The next two sections deal with the preference for PSP in water supply among the various socio-economic groups and the perceived performance of the private players among the respondents. The chapter has been summarised in the last section.

7.2 THE PROCESS OF PRIVATISATION OF WATER IN DELHI

The 1990s was a transformative decade for India. The rural bias of the early decades coupled with rapid urbanisation had resulted in urban centres getting crushed under rising population and resource gaps **(Walters, 2013).** This was also the time when neo-liberal reforms were being proposed to "set things right". Delhi had also jumped into the bandwagon and had begun to embrace the reforms in the late 1990s. The first reform was implemented in the institutional sphere by transferring Delhi Water Supply and Sewerage Disposal Undertaking (DWS & SDU) from the Municipal Corporation to the State Government in 1998. This was the first instance when municipal water supply, a responsibility of the local self-Government, under the influence of the global neo-liberal discourse had separated itself from the local government. This was done with an intention of depoliticising the water utility. The reasons for bringing in reforms was cited as gaps in service delivery of both water and sewerage, lack of infrastructural and operational records, lack of adherence to service standards, inefficient customer interface, inadequate service provision to the poor, inadequate use of IT and financial issues such as low tariff resulting in low cost recovery making DJB rely on excessively on loan assistance from the government. In the same year, DJB applied for a loan from the World Bank to upgrade its water supply and distribution services. It was recommended by World Bank to hire a consultant to suggest reforms. Following this in 1998, the World Bank gave DJB $2.5 Million to hire a consultant to undertake a study on the infrastructure and services provided by DJB **(Shiva, 2007).** Reports have been there that the World Bank arm-twisted DJB to give the contract to its favoured consultant, PriceWaterhouseCoopers **(Asthana, 2008).** The study commenced in 2002 and came out with recommendations in 2004 in the form of the report 'Delhi Water Supply and Sewerage Project Preparation Study'.

Around the same time in 2002, Ondeo Degremont, a subsidiary of the French water giant, Suez Lyonnaise was awarded the contract for building and operating the Sonia Vihar water treatment plant for supplying water to South and East Delhi. The water was to be taken from the upper Ganga canal of the Tehri Dam project and attracted strong protests from the farmers in Haridwar to Muradnagar belt. They feared that after channelisation, only 30 percent of the water would be available for agricultural purposes hitting them hard in the lean seasons **(Kaur, 2003).**

The Delhi Water Supply and Sewerage Project Preparation study recommended key reforms to be achieved over a period of ten years. Some of the suggested reforms included corporatisation of DJB bringing in more financial transparency, 24x7 water supply in the Phase I zones, setting up of independent regulator, installation of bulk and consumer meters and setting up of computerised customer care centres. Private companies were to be contracted for five years for the operation and management of the pilot areas. Eventually, all 21 zones were to be given to private companies for management. The private company would be given management fee and not have any investment stake in the investment for infrastructure upgradation. The disbursal of the variable fee would depend on the performance of the private company. One of the greatest fear of this move was the increase in tariff in order to recover the payment of management fees, with the water bill of an average household touching Rs.1000 per month **(Protest against water privatisation, 2005).** In 2005, after the contents of the study were made public by an NGO called Parivartan which had accessed it through RTI, large scale protests broke out. The privatisation initiative was opposed by NGOs and RWAs alike. Finally, the plan to privatise was called off, albeit temporarily. In 2011, the then Chief Minister of Delhi (Sheila Dikshit) declared that her Government was open to privatisation of water supply and distribution services similar to the power sector **(Government open to privatisation of water, 2011).** Prior to this, the water tariff was increased four-fold in 2010 with a 10 percent increase every year. It is clear that attempts at bringing in private sector in water services in Delhi have been preceded by tariff hikes, both in 2005 and 2011. In the second phase of privatisation (post 2011), the World Bank was not directly involved. A High Powered Expert Committee was set up to explore privatisation in the water sector in Delhi in 2011. On June 15, 2011; the HPEC endorsed the proposal by DJB to contract private companies for operation and management **(CSE, n.d).** By this time, private companies had been contracted in various capacities for different work. In 2010, TCS was brought on board for water billing **(Delhi Govt ropes in TCS for water billing, meter installation, 2010)** and 2011 another private company was contracted for meter installation and maintenance. Despite civil society protest, three pilot projects for operation and management in water distribution were contracted out to three consortiums between 2011 and 2013. In 2013, Central Bureau of Investigation (CBI) initiated enquiries against officials of DJB, SPML Infra, Suez Environnment, Veolia Water India limited, Shiv Marwah and Jalakam Solutions for making tenders specifically suited for the bidders (**Multi-crore Delhi Jal Board projects under CBI lens, 2013).** In 2015, the Chief Minister of Delhi; Arvind Kejriwal declared that water sector will not be privatised in Delhi and the ownership will remain with the Government. At the same time, he also added that the Government was open to private sector participation in the water sector (**Kejriwal rules out privatisation of water distribution in Delhi, 2015).**

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7.3 COMMODIFICATION OF WATER THROUGH POLICIES, ACTS AND REGULATIONS

The acceptance and propagation of water as an economic good has been central in the policy framing exercise. National Water Policy and the various other water related acts and regulations drafted after 1998 reflects the paradigm shift at the global and the national level regarding the value of water. The Delhi Water Policy (draft), Delhi Jal Board Act (1998) and Delhi Water and Sewer (Tariff and Metering) Regulations, 2012 mirror the changes taking place at the national level reiterating the pushing of policy reforms by the Central Government.

7.3.1 Delhi Water Policy (Draft)

The National Water Policy, 2002 made it mandatory for all states to draft their own water policies. Delhi has been slow in finalising its water policy in comparison to other states such as Karnataka (2002), Madhya Pradesh (2003, Maharashtra (2003), Odisha (2007), Kerala (2008). Delhi is yet to formulate its final water policy, it is still in the draft stage. The policy seeks to provide water security to all the citizens of Delhi over a long term horizon of 2050 and building resilience for facing challenges of resource variability. It recognised the shifting of emphasis from supply side to demand side management. Water as a human right has been given importance in the document, further seeking to achieve that through ensuring guaranteed service of potable water for all citizens. The role of citizens as responsible water consumers has also been emphasised upon. In tandem with the National Water Policy, 2002; it has also been stressed that the reduction in non-revenue water to below 15 percent is what the DJB should strive for. Metering and further water conservation through pricing instruments at all levels has also been strongly advocated by the Policy. It suggests the achieving of 100 percent metering by 2020. It has been suggested that water may be priced such that in the domestic sector, the first 100 lpcd is billed at meeting the operating and maintenance cost, consumption beyond that should be considered at full cost recovery. The pricing for the institutional, commercial and industrial sector should be profitable such that it can compensate for the losses incurred in the domestic sector. Despite pricing, the policy clearly mentions that the norm based water supply would be maintained. The policy also advocated the formation of an independent regulatory body for fixing tariff. It strongly advocates the bringing together of all water related agencies under one roof (DJB) to improve the coordination.

The Policy claims to be based on demand management, optimisation of available resources, augmentation of internal resources and building resilience and equity. Drinking water and human fresh water use has been given the highest priority followed by ecology, power sector, irrigation and industry. The Delhi Water Policy does not comment on the need for involvement of private sector in water supply and distribution unlike the National Water Policy (2012) although it recognises that private operation and management have been able to bring down water losses to less than 15 percent in many cases in other Indian cities. Promotion of innovation in the water sector involving social, technical, governance and regulatory practices to improve the sustainability, affordability, service delivery and equity in the water sector has been advocated in the policy.

7.3.2 Delhi Jal Board Act, 1998

The Act lays down the functions and responsibilities of the Delhi Jal Board. It is apparent from the provisions of the Act that full cost recovery and private sector participation were part of the plan way back in 1998. The Board is required to treat, supply and distribute water to inhabited areas either through pipes or other means but only if it can be done at a reasonable cost and to legally inhabited areas. There is no obligation to provide water, sewerage or drainage to the unauthorised areas. It is also required to plan, regulate and manage the ground water. Its responsibilities also include management and regulation of sewerage and drains.

The Act itself has made provisions for private sector involvement through "*The Board may, with the prior approval of the Government entrust any of the tasks and functions referred to in this section to a local body, limited company, registered society, research institute or government undertaking, including provision for private investment in any works thereof including ownership of the facility, on such terms and conditions as may be approved by the Board*". The board can also entrust to any company the construction or operation of any water works, sewerage works, billing or revenue collection. The Board also does not permit the installation of booster pumps. With respect to metering, the Act clearly mentions that the Board shall provide water meters to measure the water consumption or may allow a resident to use his own water meter as per the Board's discretion.

The concept of full cost recovery is reflected in the Act's clauses. The charges for the services rendered may be recovered through fees, charges, development charges and rentals and they should be fixed to ensure the recovery of all costs of operation, maintenance, repayment of debt and a return of not less than three percent on next fixed assets. The development charge should also be not less than the actual expenditure.

The Board is also permitted to borrow money from any source by the issue of bonds, debentures or such other instruments.It can also borrow, with the consent of the Central

Government, money from any bank of financial institution from outside the country. It also has the power to write off irrecoverable amounts

7.3.3 Delhi Water and Sewer (Tariff and Metering) Regulations, 2012

The changing economic environment in the country and particularly in the water sector in Delhi led the Delhi Water and Sewer (Tariff and Metering) Regulations, 2012 to be framed. The regulation covers the conditions under which water and sewer connections can be provided. They have been fine-tuned and provisions have been further detailed out. It clearly mentions that no person is permitted to draw water from the Board's pipelines without a formal connection. The number of connections in a dwelling unit cannot exceed six in number. This was leading to unauthorised connections in a building as there are upto four floors in unauthorised colonies with two dwelling units on each floor. This has been increased to ten by the present AAP Government. The regulation also states that arrangement for proper disposal of waste water is a pre-requisite for providing water supply. An attempt was also made to separate provision of water supply from the ownership status in an effort to provide water and sanitation facilities to all residents of Delhi through the clause "*The sanction of connection in any premises does not acknowledge or confer any title, ownership or occupancy right in favour of the applicant"*. Charges including development charge have been detailed out in the Regulation. Development charge has been defined as a charge which is to be taken from the consumers situated in a locality where the services are being extended without any grant/non-refundable aid by the government. This has repurcussions on the willingness to give up unauthorised connections and take new connections as the development charge is often seen as high by the consumers. Infrastructure charge is levied on the development agency and the consumer owner of property size of more than 200 sq.m for loading additional burden on the system. Regularisation charges are to be paid by the occupiers with unauthorised connections in technically feasible areas for getting regular connections.

It also clearly mentions that all water supplied by the Board should be metered. The Board can be requested for water tankers on the basis of advance payment. It is silent on the provisions of water tankers to areas which do not receive regular water supply, although the board is required to provide water tankers in case of stoppage or contamination of water supply. The regulation states that water supply can be disconnected in case of a default in the payment of water bills, meter rents or meter repairs.

Mandatory rainwater harvesting for plots of 500 sq.m or more within three years of the regulation coming into force for residential properties, otherwise the resident will have to pay 1.5 times the applicable tariff.

It is evident from the above discussion that commodification of water is entrenched in our policies, acts and regulations. These might have been framed with the intention of introducing PSP in water supply, but even without PSP, these will continue to exist. Since 2010, the successive Delhi Governments have been trying to implement these, but it has been a long drawn process.

7.4 STATE INDUCED BARRIERS TO ACCESS WATER

The emphasis on cost recovery in all aspects of water operation and management has led to the pricing of water at every step of gaining access to formal piped water supply. This acts as a barrier to entry into the formal water system.

7.4.1 Criteria for Application for Water Connection

Till 2016, one of the important criterion for granting a water connection was the pre-condition of an authorised/legal property. Proof of identity and ownership/occupancy was also to be furnished at the time of application. The property should also have a proper means of disposal of waste water. In the case of regularisation of unauthorised connection, the consumer has to pay cumulative of three years charges, a penalty of Rs.3000 per unauthorised connection, water development charges and initial charges **(DJB website, 2016).**

The criterion of proof of ownership, sometimes, acted as a hindrance in accessing authorised water connections especially in urban villages where a proper property deed was not available for many households. For the private management project area, DJB has permitted the acceptance of indemnity bonds in lieu of property papers for facilitating the provisioning of water connections. This has particularly helped the urban village and regularised unauthorised households **(Interview with MNWS official,**

2016). In August 2016, DJB went one step ahead and declared that any household with a valid ID proof can get a water connection. Even households in JJ clusters can get legal water connections called "DJB Jal Adhikar Connection" **(Delhi: DJB utility promises water connections for everyone with valid ID proof, 2016).** DJB seems to have taken a leaf out from the electricity DISCOMS' book whereby electricity connection has been provided to any household willing to take connection irrespective of the settlement typology it belongs to. This is an indirect benefit of financial reforms since the main agenda is to increase revenue. Increasing connection coverage and bringing more customers in the revenue net is one of the accepted ways to increase the revenue base.

7.4.2 Connection Price: Effect on Inclusion of Low Income Households

The connection price comprises the development charges, road restoration charges, House Service Connection (HSC) Charges and regularisation charges for unauthorised connections **(Interview with MNWS official, 2016 and DJB, 2016)**. The development charges which forms bulk of the connection charge is Rs.440/sq.m which would be around Rs.22,000 for a plot of 50 sq.m. As an incentive to apply for authorised connections, the development charges were reduced from Rs.440/sq.m to Rs.100/sq.m, from June 25 to September 26, 2015 and again from February to July, 2016.

Under the new rule of providing water connection to all households, several households, mainly in the urban villages and unauthorised colonies have been provided the option of applying for authorised water connections or regularising unauthorised connections. The connection price was largely perceived to be high by many of residents residing in low income unauthorised colonies.

In the present study area, two areas were selected which had been offered house service connection by the private water company around the same time for in-depth interviews and FGDs. One was Indira Enclave near Neb Sarai, a middle income unauthorised colony built on forest/ASI land against Master Plan regulations and the other was Jahapanah Mohalla, a low income colony built on ASI regulated land. The interviews in these areas revealed that the connection price was a clear impediment to residents applying for new authorised connections in Jahapanah Mohalla. Even after reduction in the water development charges, the total connection charges in these areas were around

Rs. 19000-Rs.24000 assuming a property size of 50-100 sq.m. This was seen as a huge amount to be given by the households in these areas, especially in lumpsome. The MNWS Pvt. Ltd official also stated that that the high connection price is an impediment for applying for connections and instead of taking the amount at one go, it should be broken up and billed every month or waived off for low income households. The utility had also met with a low response in Jahapanah Mohalla **(Interview with MNWS Pvt Ltd official, March 2016.)** Interestingly, another theme that emerged during the FGDs was the reluctance towards applying for an authorised connection due to the availability of water through the present unauthorised connections. There was also a lot of confidence that the present connections will not be disconnected, as they had never been done till date. On the other hand, most of the households in Indira Enclave had applied for and have been already given household service connections. The concerns here were different and the respondents were not worried about the connection charges, many had also availed the reduced connection charges. The residents were more interested in getting clean, soft water as they were depending on borewell water which was of hard quality.

The above two sections described the barriers to entry into the formal water supply system and the present Government's attempt at bridging the gap. While the present Government is taking initiatives for facilitating and easing the process of applying for new connections, the efforts might be falling short. The connection price need not be reduced uniformly for all the income categories, special rates should apply for the lower income groups. Besides the group's lower affordability, they would have to be incentivised to leave their unauthorised connections. Water for all serves the dual purpose of provisioning of clean, tap water to all households and reduction of non-revenue water.

7.4.3 Water Tariff: Effect on Household Income

The barriers to entry in the piped water system has been discussed in the previous sections, the aspect which influences the affordability of water after entry into the formal piped water system has been discussed in the present section.

The rising water tariff has been a bone of contention and the centre of protests from the civil society and the political opposition alike **(BJP protests against water tariff hike, 2009).** Large scale protests were seen against the tariff hike brought into force on January 1,2010. It was ironical that there were large scale protests against water shortage in the summer of 2009, the summer season preceding the tariff hike **(Protests over water shortage continue in Delhi, 2009).** The sharp rise in water tariff from 1998 to 2015 was studied in chapter four. It is important to understand the effect of this tariff rise on the various settlement categories. A short exercise has been attempted to illustrate the effect of the tariff rise on the monthly water bill for different settlement categories considering the water supply norms as adopted by DJB. The prevailing tariffs at various time periods have been used to calculate the average bill amounts (Refer Section 4.5.10 for details). A household of five has been assumed for the calculations. This is not based on the household survey, but is a hypothetical scenario to understand the public resistance against tariff hike.

Table 7.1: Estimated Water Bill, Delhi -1998-2015

S.No	Settlement Typology	Water supply Norm (LPCD)	1998-2004 (Rs.)	2004-05 (Rs.)	2005-10 (Rs.)	2010-15 (Rs.)	2015-28th February 2015 (Rs.)
1	Planned Colonies	172	13.5	53.5	180	537	786
2	Regularised unauthorised Colonies, Urban villages	155	13.0	50.0	162	498	730

Source: Computed from data available on DJB website

In the decade spanning 2004-2015, the effect of the tariff rise has been drastic on the monthly water bills as evident from table 7.1. The amount also seems very high as households were used to paying one year's water bill amount at one go in the early 2000s as the amount was very low, but now DJB generates bill once every two months which is also much higher than the previous bills. The increase has been very steep from 2004 to 2015.

Another issue that came to the fore and which the respondents felt very strongly about was the cases of higher bill amounts than the estimated or the expected amount. Households reported cases of amounts as high as Rs.5000 for two months for regular use of water before the scheme of 20 kl free water was initiated. Interview with the operator officials suggested that many households perceived receiving a higher water bill as they had not still mentally adjusted to the new tariff introduced in 2015 which is considerably higher than the previous one. Also the tariff for water has always been very low. DJB also sends bill for two-three months together which adds to the burden of paying a large amount at one go. It was suggested that billing cycle should be made more regular like the electricity bills so that the households can budget accordingly **(Interview with MNWS official, 2016).**

In the absence of the free 20 kl water scheme, the increase in tariff would have severe repercussions on the monthly budget of the low income households. Individual connections for JJ households have already been proposed in Delhi and will soon become a reality. A short analysis has been done for understanding the effect of such a situation on JJ households. The per capita per day litre consumption for JJ dwellers is 50 lpcd, as per DJB norms and 70 lpcd as per CPHEEO norms. Besides, the 50 lpcd and 70 lpcd norms, the bill has been calculated for incremental lpcd values of 90, 110 and finally 135 lpcd also which is the norm for domestic water consumption **(CPHEEO, 1999).** 50 and 70 lpcd might have been suggested by the respective institutions assuming that JJ clusters do not have a sewerage network and do not need water for flushing thus reducing the total water consumption. But, it was seen during the primary survey that there were JJ clusters which had sewerage network largely a result of the MLA benevolence. Private toilets was at the top of the demand list of the surveyed JJ households since the public toilets provided in these clusters have many issues such as non-maintenance, closing down at night, lack of security for women after dark etc. Thus, more and more JJ clusters are expected to have private toilets in the future thereby increasing their total water consumption. A household size of 5 members has been assumed. The monthly bill amount has been calculated on the basis of the prevailing water tariff in the absence of the free 20 kl scheme.

Table 7.2: Estimated Monthly Bill Amount for JJ Households – Individual Connections

S.No	Water Supply Norms (lpcd)	HH consumption (Litres per day)	HH consumption (Litres per month)	Monthly Bill Amount (Rs.)
1	50 (DJB)	250	7500	198.70
2	70 (CPHEEO)	350	10500	219.80
3	90	450	13500	240.80
4	110	550	16500	261.90
5	135 (CPHEEO)	675	20250	931.40

Source: Delhi Jal Board

The monthly bill amount is still in the affordable range as per the willingness to pay survey undertaken for this study (section 7.9) till 110 lpcd. At 135 lpcd, the consumption becomes more than 20,000 litres for a household and the corresponding tariff shoots up from Rs.4.39/kl to Rs.21.97/kl, taking the total monthly bill amount to Rs.931.40. The concern is that once the JJ households take the individual metered water connections, the water consumption will not be restricted within the norms. There have also been complaints against the new meters which capture the flow of air along with water as well as registering higher units. This could prove to be an issue for the JJ households for whom even a slight overshooting of the 20kl mark could prove to be a financial disaster.

7.4.4 Location of Settlements and Land Ownership

Ownership of land has been one of the biggest impediments for provisioning of services. The unauthorised colonies and the JJ clusters have been at the receiving end. Even in unauthorised colonies where water connections were given, it was done so only after its regularisation, maintaining the association between tenure status and service provisioning. This rule has only exacerbated the difference between the planned colonies, where services are in place even before the residents move in, and the unauthorised colonies and JJ clusters. The present Government of AAP has claimed in its budget 2016-2017 that all households in Delhi will have piped water by the end of 2017. The budget also highlighted the improvement of quantity and quality of water in areas already being served as a priority over new areas **(Piped water supply in entire Delhi by end of 2017: AAP govt, 2017).** Planned colonies will benefit from this stand as they are already connected to the formal networked system.

The type of land owning agency is crucial in the case of the JJ clusters as those built on DDA land stand a better chance in being provided piped water supply as compared to those built on Archaeological Survey of India (ASI) or forest land. The following discussion with an AAP party worker in Lal Gumbad Basti, Panchsheel Park throws light on the linkages between the land ownership agency and service provisioning.

Lal Gumbad Basti, 15.02.2016: *Reena is an AAP party worker residing in the JJ cluster. She has been laisoning between the AAP MLA and the jhuggi residents. She said that she along with other party workers have approached DUSIB and DJB many times for water supply, sewerage network and improvement of drainage system but have been told that since this is a non-notified JJ cluster on ASI land, the Government cannot give those facilities. She also said that there was one water pipeline in the jhuggi and it was not enough as residents had extended pipelines from this to take water near their homes. She complained that there were no latrines as there was no sewerage network. She also said that the residents cannot build pucca houses because the fear of the jhuggi being demolished was always there. They were in a worse situation compared to other jhuggies as some of the other JJ bastis had sewerage network and covered drainage built with MLPAD fund*

7.5 A CRITIQUE OF THE AAM AADMI PARTY (AAP) WATER RELATED POLICIES

Access to water and electricity and reduced bills was one of the most important components of the AAP electoral manifesto. AAP fulfilled its promise by bringing in several changes in the water governance of Delhi. Delhi Jal Board has introduced several schemes to, first, include more households in the water network by easing the process of taking water connections and secondly, reward low water consumption by introducing a scheme of free 20kl water in a month per water connection (metered) in February 2015. The latter also takes care of the low income households which are supposed to have a low water consumption. The third scheme has been to waive off the old bill amounts and allow the customers to starts payment with a clean slate.

7.5.1 Reduction of Entry Barrier

In order to get more residents in the piped water fold, the present Government of Delhi introduced a scheme where the water development charge was reduced to Rs.100/sq.m from June 26 – September 25, 2015 (Phase I) and from February to June 30, 2016 (Phase II) **(Charges on New Water Connections To Be Cut By 80 Per Cent: Arvind Kejriwal, 2016).** Properties in D,E,F,G and H categories of unauthorised colonies upto a size of 200 sq.m were eligible under this scheme. 1.5 lakh consumers were added in the first phase. The regularisation charges for illegal connections were also reduced from Rs.18000 to Rs.3300 in May, 2015 **(DJB scheme to regularise illegal connections, 2015)**. According to DJB, the scheme has not been very successful as there has been an increase of only 9.19 percent in new connections in the period March 2015 to February 2016.The reason cited by an AAP MLA as per a newspaper report was the reluctance to pay for water that the households were getting for free **(Nath, 2016).** This attitude was seen during the field survey as well when households were found to be unwilling to pay either the connection charge as they perceived it to be too high even after reduction or pay the water bill. The disinterest was attributed to receiving water free of cost at present, although through an unauthorised connection. This has already been discussed in chapter five.

7.5.2 Incentive for Low Water Consumption

With respect to 20 kl free water, the amount seems to have been decided by DJB assuming a household of 5 persons@135 LPCD. To avail the scheme, households need to have a working meter. The beneficiaries do not pay the sewer maintenance charges as well. Households consuming water more than the 20kl water, pay for the entire water volume consumed with no free water **(Kejriwal keeps his promise, 20,000 litres of free water to Delhi households from January 1, 2013).** The hike in the tariff is also very high from nothing to Rs.21.97 per kilolitre.

Although, this scheme is beneficial for only those households that have authorised, metered connections, it emerged during the survey that it was acting as an incentive for applying for authorised connections.

7.5.3 Waiver of Old Bill Amount

The third scheme that was introduced was the waiver of old water bill amount accrued till November 2015. The scheme was introduced in February 2016 and extended till September 2016. Consumers in E,F,G and H categories of colonies got a waiver of 100 percent, C and D category got 50 and 75 percent waiver respectively and A and B categories got 25 percent waiver. The pre-condition for waiver of E, F, G and H categories bill was to have a water meter in a working condition **(DJB extends bill waiver scheme, 2016).**

It is evident from the nature of the schemes that there is a focus on increasing the consumer base availing metered piped water. A working meter has been a common theme in the latter two schemes. It is acknowledged that a working meter is the key to equitable distribution of water through telescopic pricing in which the high volume users will pay for their use, while the low volume users and also the low income group households will benefit. The new meter has met with stiff resistance among the households due to the perception that it has resulted in inflated water bills.

While the initiatives taken by the AAP Government are laudable, in the absence of legality of the schemes, they might actually create more issues for the low income groups in the future. The schemes have been introduced with a view to get more households in the revenue net, thereby reducing the non-revenue water of DJB and moving towards full cost recovery. These are also an initiative of a particular political party which came into power on the basis of reduced water and electricity bill. A change in Government might result in the withdrawal of the schemes. Once all the households are connected to formal water supply and the scheme is withdrawn, they would be subject to high charges.

7.6 ATTEMPTS AT RESOURCE CAPTURE BY ELITES: ROLE OF RWAs

The Residents Welfare Associations (RWAs) have emerged as an important institution in the Delhi urban space, a result of the withdrawal of state in regular municipal functions. It has also been touted as a successful example of participatory governance and has been productive for the beneficiaries, giving the already strong middle class and the rich a higher bargaining power by the virtue of being an organised, cumulative power. Thus, the RWAs of the planned colonies with their increased bargaining power are in a better position to ask for better services from the water utilities. The RWAs, with their knowledge base and sometimes eminent residents as office bearers, use the judicial and the administrative route to exercise their importance in the urban social space **(Mohapatra, 2014).** The RWAs are also supported by the Government and have been institutionalised in the development process through programmes such as Bhagidari **(Kundu, 2011).**

In the study area, the RWAs have been active in fighting for water, especially in the private managed areas since these were water parched before the new system of water distribution was established. Water had also been an electoral issue in the Malviya Nagar area **(Pandey & Rehman, 2013).** The entry of private player in water distribution rehabilitation has made the RWAs of each of these pockets more alert. They want to ensure that the benefits of increased water supply should reach them first. Since new areas like urban villages and unauthorised colonies are being added in the distribution network, the distribution network is also being changed. The RWAs are very particular about being kept in the loop about the changes. The PSP being a controversial initiative in water distribution, the private companies are also careful about keeping the RWAs happy with the work, in order to avoid further problems. The power of RWAs is seen in the following example where 24x7 was introduced in Geetanjali Enclave for a short while, then reversed as the bill amount had gone up and the residents were not willing to pay **(Interview with MNWS Pvt Ltd., 2016)**. In 2017, 24x7 water started in Navjeevan Vihar, an upscale colony near Malviya Nagar, despite the urban village and unauthorised colonies still not receiving the minimum water. MNWS Pvt Ltd holds consultation meetings with RWAs twice a month. The RWAs are informed about the water situation for the day through technological innovations such as WhatsApp. In contrast, the RWAs of urban villages and unauthorised colonies which like their residents are being left behind in the development process. In their case, the elected government representative is arguably the most important character in the water narrative.

Interview, Secretary, Shivalik, MNWS Pvt. Ltd, 12.02.2016 *"Earlier water used to come thrice a day; morning, afternoon and evening (10 hours a day); now it comes only twice a day (total 6.5 hours a day). The earlier pipeline system has been disconnected and Shivalik has been connected to Begumpur (urban village) and Savitri Nagar (regularised unauthorised colony).We do not mind them getting water but why should we get less water because of them"*

A similar case was seen in the case of Vasant Vihar, an upmarket colony, under the management of MVV Pvt Ltd. The residents of Vasant Vihar protested when a part of their improved water supply was proposed to be diverted to the nearby Basant Gaon (urban village) where the water situation is dismal. The MLA was accused of wooing voters residing in the urban village. The main argument of the Vasant Vihar residents was that first their area should get 24x7 water supply, then the neighbouring areas can be supplied water **(Sharma, 2016).** Even during an interview with an RWA representative of the upscale colony of Shantiniketan, the general feeling was that why should the rich and the middle class bear the cost of water supply to the poor **(Interview with RWA representative, 2016).** This has been referred to as water revanchism in literature (Coutard, 2015).

The expectations from the private companies are much higher than that from DJB. The RWA members of a pocket in Saket were disappointed that water was still not being supplied for 24x7 despite three years of project launch. They expected that a private company would put everything in order just because they were private and being paid for it (**Interview with RWA, Saket, 2016).**

7.7 POLITICAL AGENDA IN PROVISIONING OF WATER TO THE POOR

The RWAs play an important role in ensuring that the benefits arising out of a new project are captured for their own residential pockets, irrespective of whether they deprive others or not. In the case of the poor, the competitive electoral environment has brought some semblance of order in the service provisioning.

In Delhi, some settlement typology categories such as JJ clusters and unauthorised colonies do not have access to a formal water supply system legally through household service connections, yet they access water from the formal system. Contrary to popular belief, the present political system emerging from the democratic set up aids the JJ households to access water from the formal system.

This is also possible as both MLA and DJB are under the State Government. Many of these arrangements are not there in the books of DJB and have been informally arranged for. Many such cases emerged during the field survey, the major ones through case studies have been documented below. The cases show how political willingness can improve access to water in JJ clusters.

Jagdamba Camp, Sheikh Sarai, 10.02.2016: *In Jagdamba camp, Sheikh Sarai, there is a dual system of water supply. Ground water is supplied through pipes from a borewell in front of the Camp. There are several pipes which go into the Camp. Residents attach their own pump when water comes and take water from these pipes. The well off households have laid pipes from these points to their homes for convenience. As a result, water pressure declines considerably and does not reach the other end of the slum. The area MLA has laid a new 1 inch diameter pipeline from the recently rehabilitated pipeline (Malviya Nagar PPP) and has provided 10 taps inside the slum at a distance of 50-60 m from each other. These taps supply surface water at good pressure.*

JJ Colony, Giri Nagar, 18.03.2016*: JJ colony, Giri Nagar is a JJ cluster settlement near the DJB Pumping station, Giri Nagar. Around four to five houses share one tap connection of surface water and the JJ colony also has a sewerage network. This was undertaken by the former MLA, Subhash Chopra. Water is supplied twice a day (6-7.30 AM and 4.30-5.30 PM). People are happy with the water situation here.*

Nehru Ekta Camp, RK Puram, 25.02.2016: *Meena is the pradhan of Nehru Ekta Camp. She said that Nehru Ekta Camp, R K Puram was about 40 years old with 500 jhuggies and has always been a Congress stronghold. She said that they all voted for the AAP candidate, Pramila Tokas in the last election. She complained that soft water supply was very low in the area. Every lane had one tap of surface water and tap of borewell water and each lane had about 40-50 households. Motors were not used to draw water here* *since the pressure was extremely low. She rued that fights took place during supply hours and got ugly sometimes. She said that they call DJB directly for tanker whenever water does not come or get water from the Delhi Jal Board premises. She complained that the present MLA was not very active unlike the previous MLA, Barkha Singh who had got all the taps and pipes installed with her MLA fund.*

Interestingly, JJ clusters which were the strongholds of a particular political party especially the ruling party (AAP) reported a higher level of initiative in the JJ clusters. Also the pro-activeness of the MLA is critical in the level of services in the JJ clusters. This is in consonance with the literature (Moser, 2008) where it was found that political leaders favoured their political base the most.

7.8 BURDEN OF OTHER PAID SERVICES: ELECTRICITY

Electricity is as important as water in the process of shaping urbanisation **(Silver, 2016).** Implementation of the neo-liberal policies, resulting in the privatisation of the distribution of electricity in Delhi has had multiple effects, particularly on the low income groups. The State in order to reduce the non-revenue losses for the private companies allowed JJ households to have individual connections. The consequences have been far reaching, nearly 11 to 12 years after the JJ households became part of the formal electricity network. The present section focuses primarily on the burden on the JJ households due to the change.

7.8.1 Electricity Tariff

The rising electricity tariff has been a bone of contention since the time electricity was privatised in Delhi. The tariff has also increased from time to time. The tariff was hiked by 22 per cent in 2011 followed by five per cent hike in February 2012. It was increased by up to two per cent in May 2012 year and again by 26 per cent for domestic consumers in July 2012. To address the high electricity tariff, the Delhi Government announced 50 percent subsidy on monthly power consumption of upto 400 units which was expected to benefit 90 percent of the customers **(Kejriwal announces 50 per cent cut in power tariff up to 400 units, free water, 2015).** For domestic consumers, the current (2017) energy charge is presented in table 7.3 for BSES. The units are in KWh.

Table 7.3: Current Energy Charges (BSES),Delhi, 2017

Fixed Demand charge		Energy Charge				
Load (KW)	Rs./Month	0-200 units	201-400 units	401-800 units	801-1200 units	Above 1200 units
Upto 2	40	Rs.4.00	Rs.5.95	Rs.7.30	Rs.8.10	Rs.8.75
2 to 5	100					
Above 5	25/KW/month					

Source: BSES, 2017

Ideally, a slum household would not be consuming more than 400 units. As per the survey findings, single storeyed households had one fan, one tubelight, one television and in some cases refrigerator and air cooler. Houses which had access to piped water, were using a water pump. An average slum household with all of the above appliances would be consuming about 200 units per month in summers and about 150 units in winters, based on the energy consumption level of each appliance. The assumptions for summer months include using tubelight for 16 hours as the slum houses are dark even during daytime, fan for 24 hours, air cooler for 12 hours (afternoon and night), refrigerator for 24 hours, and television for 8 hours and water pump for one hour. In winters, the air cooler gets replaced by immersion heater. Besides the energy charge, there is another component in the bill namely the fixed demand charge. This is dependent on the sanctioned load allocated to the consumer by BSES. Based on the appliances found in a JJ cluster household, the load should be less than 2 KW. Thus, the bill amount in summers should be around Rs.440 and around Rs.340 in winters after 50 percent subsidy. This was rarely the case. The average bill amount was nearly Rs.650 with the highest amount being Rs.5600 and the lowest being Rs.200. Many of the households also reported having a sanctioned load of more than 2KW because of which they have to pay Rs.100 instead of Rs.40 as the fixed demand charge. The security deposit also increases at a rate of Rs.600 per KW. As per DERC, the sanctioned load has to be renewed annually as per the load being used by the consumer **(Pandey, 2013).**

Despite the 50 percent subsidy, there were several households that found it difficult to pay the electricity bills on time. Majority of the total surveyed households reported that they found it hard to pay the monthly bills and often would pay two months bill at one go after saving money by cutting down on life’s necessities. Nearly 59 percent of the households reported not paying their last month's bill. Table 7.4 presents the households' ability to pay last month's power bill and the bill amount as a share of the household income.

Table 7.4: Bill Amount as Share of Household Income and Household's Ability to Pay Power Bill, Delhi, 2016

S.No	Ability to Pay	Less than 5 (Percent)	5-10 (Percent)	11-20 (Percent)	More than 20 (Percent)	Total (Percent)
1	Not able to Pay	15.5 (33.33)	51.7 (63.8)	24.1 (70.0)	8.6 (100)	100 (58.6)
2	Able to Pay	43.9 (66.7)	41.5 (36.2)	14.6 (30)	0	100 (41.4)
3	Total	27.3 (100)	47.5 (100)	20.2 (100)	5.1 (100)	100 (100)

Fischer's test 11.73 $p<0.05$

Figures in bracket add up to 100 percent across rows (Vertical)

Source: Computed from Field survey, February- April, 2016

Among the respondents who were unable to pay the last month's bill, nearly 85 percent were those whose utility bill as share of the household income was more than 5 percent. Five percent has been taken as the first cut-off as ideally each utility bill should not be more than 3-5 percent of the household expenditure **(World Bank, 2016).** In these households, the income is nearly equivalent to the expenditure. The ability to pay also declined with increase in share of bill amount to household income.

7.8.2 Implications of Increase in Sanctioned Load

A higher sanctioned load than 2 KW does not only have implications on the extra amount that has to be paid in the form of security deposit and monthly charge but also on the eligibility criteria of getting the new ration card. A new ration card has been launched under National Food Security Ordinance 2013 and eligibility criteria have also been fixed for both inclusion and exclusion of households. One of the exclusion criteria is the sanctioned load for electricity being above 2KW. This implies that households which have more than 2KW sanctioned load on their electricity bills do not have access to subsidised food and have to buy at the market price. This is a double burden for these households as they not only have to pay the increased bill amounts but also have to pay a much higher price for grains. The situation is captured in a case in a JJ cluster in Kalkaji.

Subhash Camp, Kalkaji, 02.02.2016: *A resident of JJ cluster in Kalkaji described his misery which he has been going through, after an increase in his sanctioned load. He said that the household sanctioned load was increased from 2KW to 4KW four months back after a high bill amount was generated. Around this time, new ration cards were also being made. When he went to get the ration card, he was told that he was not eligible as the sanctioned load on his electricity bill was more than 2KW. He approached BSES for reducing his sanctioned load. He was told that the new load had been sanctioned as he had consumed a much higher amount of electricity at least twice in the past one year. He was also told that the sanctioned load could only be reduced after one year of changing. He was distressed that he was stuck with the new sanctioned load and could not avail the subsidised grains.*

As per DERC, BSES can revise the sanctioned load annually based on the average of three highest demand readings. A prior notice is to be given to the consumer in April. In case of increase, the consumer has to pay within thirty days and if not paid then, the amount can be recovered in the next bill.

7.8.3 Unjustified Bill Amounts and Recurring Debt

Nearly 41.4 percent of the surveyed households also reported that in the past one year, they had received a bill at least once of much more amount than what they thought they would have consumed. There were cases also in which the bill for one month was much higher than expected as seen in one particular case in a slum in Malviya Nagar.

Indira Camp, Malviya Nagar, 20.03.2016: *A resident of the JJ cluster received a bill of Rs.3500 for one month in the month of March. According to him, that was a very a high amount considering that the household had only a 200 sq.feet living space spread over two floors with two tubelights, two ceiling fans, one table fan, one television and one water pump that was run for 30 minutes every day. He had to borrow money to pay off the bill after two months as ground level officials from the electricity company had* *started coming and asking him to pay the bill, otherwise they would disconnect their electricity. He explained that he ran a tailoring shop from his house and could not afford to not have electricity as his livelihood would get affected. He borrowed some money from friends and the rest from the money lender on interest. He despaired that now he had an additional financial burden.*

In another case in a slum in RK Puram (Nehru Camp, RK Puram, 26.02.2016*), Lata has been residing in the slum for the past ten years in a household of five members with only earning member. Her husband worked as a painter which meant that he did not have a regular income. She said that the rainy season months were the worst because he had hardly any work then. There were months when they could not pay the bill and hoped that they could pay the next month when there was enough money. In case, they were unable to pay for two-three months, then they would take a loan from friends or relatives and pay the bill, but then many a times, they also had shortage of money and were unable to lend. In that case, they would have to approach the local moneylender and it would take several months to pay off the borrowed amount to the moneylender. She despaired that in addition to school fees, medicine cost and daily expenditure, they had to worry about electricity bills also.*

7.8.4 Grievance Redressal

The respondents who had been charged higher bill amounts than expected were asked if they had approached the private utility for addressing their grievance. All the respondents answered in the affirmative, but they were also unhappy that their problem had not been resolved by the utility. One of the experiences is captured in the following case study in a slum in Soami Nagar:

Soami Nagar JJ, Soami Nagar, (10.03.2016) Harish *lives in the JJ with his wife and two children. He had received an electricity bill of Rs.4500 for one month last year. He approached the BSES office and informed the officials that he did not have any appliance at home which could have led to consumption of so many units. The officials said that the bill was based on the meter reading taken by the ground staff and they have to pay the amount. Eventually, he had to take a loan to pay the bill.* The respondents also said that in the absence of problem resolution at the first level, they did not know whom to approach next and would accept the situation.

It emerged that the formalisation of services had also weakened the influence of the political representatives which implied that the bargaining power of the poor had declined. In such a scenario, it is even more important for the rules and regulations to have a separate provision for the poor and the State needs to protect the rights of the marginalised.

7.8.5 Dependence on Alternative Unclean Fuel

Although, it is difficult to conclude that dependence on unclean fuel has increased as a result of increase in tariff hike, evidence from some cases suggest that due to high tariff, the slum dwellers use electricity only for the basic minimum. This is captured in the case in a JJ cluster of:

Lal Gumbad Basti, Panchsheel Park (15.02.2016): *Sheela lives with her family comprising her husband, two children and mother in law. Earlier, they would use the heater for cooking food, boiling water and heating water for bathing as they did not have to pay for electricity, but now that was not possible as the electricity bills were high anyways. They used LPG stoves for cooking now but found it to be expensive. She also said that they do not boil water for drinking unless somebody is very sick and take bath in cold water. Sometimes, when they don't have money to pay for LPG, they cut down on the fuel expenditure by using a mix of firewood and LPG.*

7.9 WILLINGNESS TO PAY FOR PIPED WATER AMONG JJ HOUSEHOLDS

Willingness to pay has been the 'mantra' for the international financial institutions in pushing forward the agenda of full cost recovery. The justification has centred on the argument that the poor pay much more in accessing water for their daily needs from informal vendors and they would be willing to pay for water if connected to the formal water supply. Recent studies have shown that willingness to pay for clean water through formal means is not just determined by the amount of money a household is paying for water through informal means but rather a host of social, environmental and political factors **(Littlefair, 1998).** Water is being seen as a commodity to be sold to customers on the basis of willingness to pay and not ability to pay **(Bakker, 2003).**

Water was considered a human right by all the respondents and many felt that the price for piped water should be kept affordable for all sections of the society. Interestingly among the 100 JJ households that were taken for the willingness to pay survey, very few households were paying for water from alternate sources on a regular basis. A cross tabulation between willingness to pay and household income was computed to ascertain the association between the two. The results were not of statistical significance. That excluded the economic factors influencing the willingness to pay.

A binomial logistic regression was performed to ascertain the effects of self-reported sufficiency of water, distance from the source of water, type of water i.e. soft or hard water, waiting time for fetching water on the likelihood of the respondents residing in JJ clusters willing to pay for metered piped water.

Table 7.5: Determinants of Willingness to Pay for Piped Water (Binomial Logistic Regression), Delhi, 2016

Dependent Variable Willingness to Pay No-0,Yes-1	**B**	**SE**	**Exp (B)**	**Sig.**
Independent Variables				
Distance from Water Tap/Standpost	0.18	0.35	1.019	0.602
Type of Water				
Soft Water	-1.135	1.330	0.321	0.393
Hard Water®				
Reported Sufficiency of Water				
No	1.687	0.486	5.405	0.001*
Yes®				
Waiting Time for Fetching Water	0.46	0.27	1.047	0.082**

n=100

* Statistical significance of 0.01

** Statistical significance of 0.10

Computed from Field survey, February- April, 2016

The model explained 35.8 percent (Nagelkerke *R2*) of the variance in willingness to pay and correctly classified 74 percent of cases. An increased willingness to pay for piped water services among the respondents was associated with reported insufficiency of water and the waiting time to fetch water. Households reporting insufficiency of water were 5.4 times more likely to be willing to pay for piped water as compared to those reporting sufficient water. Similarly, households reporting higher time for fetching water were more likely to opt for paid services for piped water.

The empirical finding is further supported by qualitative data and case studies. Two case studies of two different JJ clusters with similar average household income have been taken to show how household's perception of sufficient water influences their decision making regarding willingness to pay for piped water.

JJ Colony, Giri Nagar, 18.03.2016: *JJ Colony, Giri Nagar is a JJ cluster settlement near the Giri Nagar DJB Pumping station. Four to five households share one tap connection of surface water and the settlement also has a sewerage network. Water is supplied twice a day for one hour each. The respondents were satisfied with the water situation here and were not willing to pay for water.*

Manav Kalyan Camp, Giri Nagar, 19.03.2016 *: Four 750 litre tanks have been installed in front of the JJ cluster such that borewell water is available to the residents throughout the day. In addition, there is a tap for every 3-4 households for borewell water. The residents were satisfied with the arrangement in terms of quantity of water available but were unhappy with the taste of the water. The JJ cluster had two public stand posts for about 80 households that supplied soft water for one hour in the morning and one hour in the evening. The residents collected water for drinking and cooking from there. They complained of a low water pressure and said that it took half an hour to fill up four bottles (2 litres). There were also days when all the households did not get a chance to fill water. Willingness to pay for individual tap connections of surface water was found to be Rs.300-400 per month*

In the case of the present study, willingness to pay for piped water emerged as a function of facing inconveniences, not directly monetary but related to time and effort.

A sense of entitlement also determines the willingness to pay. During FGDs, it emerged that the JJ cluster residents expected basic amenities such as piped water and electricity, more so if the political party they had voted for was in power. They considered that amenities should be provided to them free of cost as it was their votes that had brought the ruling political party into power. This was also a function of the promises that the representatives of a political party make while campaigning for elections as it was evident from the FGD.

Willingness to pay and be connected to the formal water system also has its underpinning in the need for respectability and to be a legitimate part of the city. The JJ households already have had an experience of moving from illegal connections to formal, metered connections in the case of electricity. Some of the respondents drew parallels between the two situations of water and electricity. An FGD was conducted to understand the effect of privatisation of electricity on the poor. The following response in an FGD summarises the feeling among many of the respondents who thought it would be better to have metered water connections than the existing situation. The main theme which emerged in the FGD has been given below:

Manav Kalyan Camp, Giri Nagar, 19.03.2016: *Earlier, the residents would draw electricity from the overhead wires outside the colony. The officials would come and cut off their electricity at their whim and fancy. Often, the residents would collect money and give to the officer so that he would spare them. The participants opined that while a kind officer would take the money and go away without disconnecting, a strict officer would not listen to them. Then, they would have to spend few days without electricity and again tap electricity from the main wires. All the participants agreed that it was very insulting, always being at the mercy of the officers. They also found the situation to be better now, since they had their own individual connections. Some of the participants opined that it was expensive, but they also thought that on using electricity judiciously, the bill amount was around Rs.500-600 per month after AAP had come to power since there was 50 percent rebate on the electricity bills. They found the amount to be affordable. Most of the participants were happy that unlike earlier, there were hardly any power cuts even in summers. They were also satisfied that the power cut affects the entire area including the kothis nearby and not just their jhuggi.*

Among the respondents who were willing to pay for piped water, the amount varied from Rs.100 to Rs.400. Out of the 46 respondents who were willing to pay for piped water, nearly 78.26 percent of the respondents were willing to pay an amount of Rs.200, Rs.250 or Rs.300. Only 15.22 percent of the respondents were willing to pay either Rs.350 or Rs.400 per month. No particular explanation can be given for the reason of willingness to pay a higher amount as the respondents which reported Rs.300 or Rs.400 had a household income of less than Rs.10,000 per month, had reported sufficient water, all except one had taps near their houses with waiting time less than ten minutes and were getting soft water. This could only be explained by the reasoning that the respondents might have suggested that price for piped water at that moment and might not really pay up that amount later. This has been seen in past studies and is also one of the drawbacks of the WTP surveys **(Wedgewood & Sansom, 2003).**

7.10 CHALLENGES FACED BY THE PRIVATE OPERATORS

The private companies do not work in isolation. They also have to work within the system reiterating that unless urban governance improves, private companies or public utilities will face similar problems and only maintain status quo.

Absence of inter-agency collaboration emerged as a major reason for delay in work progress in the private areas. The Malviya Nagar project and the Vasant Vihar projects were launched in 2011 and 2012 respectively. The target year for the completion of upgradation and rehabilitation of the infrastructure for the entire project area was fixed as December 2014 for the Malviya Nagar project. The target has not been achieved in both the areas.

In 2012, initially South Delhi Municipal Corporation (SDMC) had asked DJB to deposit money for road restoration. Later, to facilitate the progress of the project, Delhi Chief Secretary had passed an order related to the "cut and restore" whereby DJB can restore the roads after laying the pipelines on their own through select agencies listed by MCD or PWD. Till January 2014, work progressed at Business as Usual pace, after which SDMC refused the permission to continue with "Cut and Restore" and insisted on "deposit and dig" After much deliberation, in June 2014, after nearly five months of no progress in laying of pipelines, SDMC again allowed "cut and restore". This was allowed only in the PPP areas. This itself was a clear indication that PPP projects were being meted with special treatment in order to complete the work within the given timeline. There should be parity between the public and the private projects.

The fact that the MCD and DJB are managed by two different political parties exacerbated the problems. As per newspaper reports, the DJB PPP was Congress Government's pet project and thus it was delayed by BJP led MCD **(Lalchandani, 2014).** Even after Aam Aadmi Party (AAP) came into power with majority in 2015, there has been a tussle between AAP and MCD.

Besides, the absence of inter-agency collaboration creating issues in smooth implementation of the PPP projects, there have been other issues also, largely related to the mismatch between the data given in the detailed project reports and the ground reality. According to a MNWS Pvt Ltd. Official, the network data given to the company after signing of the contract was not sufficient and a considerable amount of discrepancies were seen between the given network design and the reality. This had led to nine revisions of design and it took nearly three years for understanding the network. This also led to delay in implementation of the project **(Interview with MNWS Pvt Ltd Official, 2016).**

The companies have faced great resistance from residents in changing of water meters. The life of one meter is seven years and it needs to be changed after that **(Interview with MNWS Pvt Ltd Official, 2016).** It is interesting that DJB and the private companies seem to be both taking initiatives with reduction of non-revenue water in mind. While DJB has introduced schemes with metering as their central criteria (discussed in section 7.5), MNWS Pvt Ltd. has also been trying to persuade DJB to ease the connection norms so that more households which are presently tapping water in an unauthorised manner can apply for house connections. Such households are also not keen on taking house connections. According to MNWS Pvt. Ltd official, whenever camps are organised or door to door campaigns are held for promoting household service connections, the residents ask that why should they take connection and how would it benefit them as they would have to pay for water which they are getting free now **(Interview with MNWS Pvt Ltd Official, 2016).** Similar findings also emerged in the primary survey.

The private companies are dependent on the water being supplied by DJB. They are held responsible for poor service by the customers even if enough water is not available at the inlet points **(Interview with MNWS Pvt Ltd Official, 2016)**.

7.11 PREFERENCE FOR PSP IN WATER AMONG SOCIO-ECONOMIC GROUPS

Private sector participation in water supply and distribution has different connotations for different groups of residents. While some associate it with the efficiency of the private sector and thus improvement in services, others associate it with high tariff, inapproachability. Preference for PSP among the surveyed residents has been assessed on the basis of their education level, age group and income levels. This also gives an insight into the needs, demands and aspirations of the residents. In the survey areas, since electricity had already been privatised, the respondents held that as a benchmark when asked whether they would want private companies to operate and manage water distribution in their areas. This particular question of whether the respondents would want the private companies to take charge of water distribution was canvassed only to the non-JJ households. The JJ households wanted clean, affordable water, irrespective of whether it was being supplied by private or public utility.

The response to whether PSP should be introduced in the water sector is based on the characteristics the respondent associates with PSP. A large percentage of respondents in almost all the age groups were non-committal about their preference for participation of private companies in the water sector in Delhi. While some did not perceive any difference between a public or a private utility as long they were getting good service, others were not aware that private companies were responsible for O & M in many of the areas.

Table 7.6: Age of Respondent and Preference for PSP in Urban Water Sector, Delhi, 2016

S.No	Age Group (years)	Yes	No	Cannot Say	Total
1	18-29	25.0	12.5	62.5	100 (8)
2	30-39	30.6	22.2	47.2	100 (72)
3	40-59	18.2	39.6	42.2	100 (187)
4	Above 60	21.2	42.4	36.4	100 (33)
5	Total	21.7	35.0	43.3	100 (300)

Pearson's ChisquareTest=11.221 $p < 0.10$

Source: Computed from Field survey, February- April, 2016

The largest percentage share of respondents reporting preference for PSP in urban water sector was in the age group 30-39 years followed by 25 percent in the 18-29 years age group. This was also the age group which had spent most of their lifetime in the neo-liberalised environment.

Table 7.7: Level of Education of Respondent and Preference for PSP in Urban Water Sector, Delhi, 2016

S.No	Level of Education	Yes	No	Cannot Say	Total
1	Illiterate	0	100	0	100 (3)
2	Primary	0	0	100	100 (1)
3	Secondary	12.5	25.0	62.5	100 (8)
4	Higher Secondary	2.0	58.8	39.2	100 (51)
5	Graduate	18.9	28.0	53.1	100 (175)
6	Post Graduate	47.7	34.1	18.2	100 (44)
7	Technical Education	50.0	33.3	16.7	100 (18)
8	Total	21.7	35.0	43.3	100 (300)

Pearson's Chisquare Test=62.543 $p < 0.01$

Source: Computed from Field survey, February- April, 2016

Respondents with higher education level were also seen to associate PSP with higher efficiency, better management practices and perceived that the situation would improve under PSP. The percentage share of the respondents supporting PSP increased steadily after higher secondary level of education. Since income often mirrors education, the findings were similar for both.

Table 7.8: Household Income of Respondent and Preference for PSP in Urban Water Sector, Delhi, 2016

S.No	Income Group	Yes	No	Cannot Say	Total
1	10000-20000	0	60.0	40.0	100 (5)
2	20000-50000	10.3	20.5	69.2	100 (39)
3	50000-100000	9.7	51.3	38.9	100 (113)
4	100000-150000	12.5	29.7	57.8	100 (64)
5	150000-200000	35.0	25.0	40.0	100 (40)
6	More than 200000	71.8	17.9	10.3	100 (39)
7	Total	21.7	35.0	43.3	100 (300)

Pearson's Chisquare Test=98.183 $p < 0.01$

Source: Computed from Field survey, February- April, 2016

The total income of the households is a reflection of the affordability. The preference for PSP increased with increase in household income after the income group Rs.50,000-

100,000. Many respondents in the highest income group were of the opinion that since the tariffs are already so high and DJB is unable to provide services commensurate with the high tariffs, private companies should be made responsible so that the service improves.

7.12 PERCEPTION ABOUT PERFORMANCE OF PRIVATE COMPANIES

There are two scenarios in this study, one in which the operation and management of water distribution is already with private companies and the second in which DJB is still responsible for O & M. A perception based study was conducted in which questions were canvassed regarding the change in quantity of water supplied, change in quality of water supplied and the change in ease of customer grievance redressal mechanism in both the areas. The difference was that while the respondents in one area had already experienced the change in management, the respondents in the other area were asked to imagine that how a private company would affect the selected water supply parameters. The questions were asked on a five point Likert scale.

Table 7.9: Respondent's Perception of Change in Quality with PSP in Areas with Private Management, Delhi, 2016

S.No	Settlement Typology	Improve a Lot	Improve a Little	Same	Deteriorate a Little	Deteriorate a Lot	Total
1	Planned Colony	0	0	100.0	-	-	100 (60)
2	Urban Village	6.67	55.0	38.33	-	-	100 (60)
3	Unauthorised Colony	38.33	30.0	31.67	-	-	100 (60)
4	Total	15.00	28.33	56.67	-	-	100 (180)

Source: Computed from Field survey, February- April, 2016

The improvement in quality of water was perceived to be higher by the respondents in the urban villages and unauthorised colonies. These comprised the households which had been provided with new connections or had started receiving soft water. All the respondents in the planned colonies were of the opinion that water quality had not changed since private company had taken over.

Table 7.10: Respondent's Perception of Change in Quantity with PSP in Areas with Private Management, Delhi, 2016

S.No	Settlement Typology	Increased a Lot	Increased a Little	Same	Reduced a Little	Reduced a Lot	Total
1	Planned Colony	81.67	15.00	3.33	-	-	100 (60)
2	Urban Village	33.33	28.33	38.33	-	-	100 (60)
3	Unauthorised Colony	3.33	61.67	35.00	-	-	100 (60)
4	Total	39.44	35.00	25.56	-	-	100 (180)

Source: Computed from Field survey, February- April, 2016

The major beneficiaries of the change in quantity seem to be largely in the planned colony. Nearly 81 percent of the respondents in the planned colonies were of the opinion that water quantity had increased a lot since the private company had become responsible for O&M. This was also because the areas in which private companies had been contracted for, were water stressed before they were brought in. By the virtue of infrastructural improvement such as construction of a UGR in these areas and the subsequent rehabilitation of the system, the water situation had improved than before.

Table 7.11: Respondent's Perception of Change in Customer Grievance Redressal with PSP in Areas with Private Management, Delhi, 2016

S.No	Settlement Typology	Improve a Lot	Improve a Little	Same	Deteriorate a Little	Deteriorate a Lot	Total
1	Planned Colony	25.00	50.00	11.67	1.67	11.67	100 (60)
2	Urban Village	6.67	20.00	65.00	0.00	8.33	100 (60)
3	Unauthorised Colony	11.67	41.67	46.67	0.00	0.00	100 (60)
4	Total	14.44	37.22	41.11	0.56	6.67	100 (180)

Source: Computed from Field survey, February- April, 2016

While there were neutral or positive responses regarding change in quality and quantity of water, there has been some negative responses for change in customer grievance redressal particularly among the respondents of the planned colony. Some respondents complained of too many agencies to deal with now unlike earlier where they would just call up DJB helpline. Some of the respondents in the upscale areas also complained that in the cases of higher billing than the expected amount exceeding a certain amount, the case would get transferred to DJB from the private company. These respondents were also of the view that DJB was very inefficient and should be dismantled and the water supply and distribution be given to the private company completely like in the case of electricity. They were also of the view that PSP would bring an end to Unionism and bring in more professionalism. Other respondents in some of the middle class colonies and urban villages were not happy as earlier they could get the work done informally by catching hold of the executive or engineer responsible for the area but now that was not possible.

Table 7.12: Respondent's Perception of Change in Quality with PSP in DJB Managed Areas

S.No	Settlement Typology	Improve a Lot	Improve a Little	Same	Deteriorate a Little	Deteriorate a Lot	Total
1	Planned Colony	25.00	40.00	35.00	-	-	100 (40)
2	Urban Village	0.00	42.50	57.50	-	-	100 (40)
3	Unauthorised Colony	20.00	10.00	70.00	-	-	100 (40)
4	Total	15.00	30.83	54.17	-	-	100 (120)

Source: Computed from Field survey, February- April, 2016

A higher percentage of respondents in the DJB areas expected the quality of water to improve if PSP was introduced in their area, more so in the planned colonies where 65 percent of the respondents thought that the quality would improve if O&M was privatised. There were no respondents who thought that water quality will deteriorate with PSP.

Table 7.13: Respondent's Expectation of Change in Quantity with PSP in DJB Managed Areas

S.No	Settlement Typology	Increased a Lot	Increased a Little	Same	Reduced a Little	Reduced a Lot	Total
1	Planned Colony	57.50	25.00	17.50	-	-	100 (40)
2	Urban Village	5.00	45.00	50.00	-	-	100 (40)
3	Unauthorised Colony	10.00	40.00	50.00	-	-	100 (40)
4	Total	24.17	36.67	39.17	-	-	100 (120)

Source: Computed from Field survey, February- April, 2016

While half of the respondents in the urban villages and unauthorised colonies were split over the level of improvement to be expected in water quantity, majority of the planned colony residents expected water quantity to improve. None of the respondents thought that water quantity would reduce if a private company was to take over the O&M of water supply in their area.

Table 7.14: Respondent's Perception of Change in Customer Grievance Redressal with PSP in DJB Managed Areas

S.No	Settlement Typology	Improve a Lot	Improve a Little	Same	Deteriorate a Little	Deteriorate a Lot	Total
1	Planned Colony	30.00	45.00	20.00	5.00	-	100 (40)
2	Urban Village	0.00	0.00	25.00	75.00	-	100 (40)
3	Unauthorised Colony	2.50	0.00	12.50	85.00	-	100 (40)
4	Total	10.83	15.00	19.17	55.00	-	100 (120)

Source: Computed from Field survey, February- April, 2016

It is interesting to note the findings of this table where majority of the respondents in the urban villages and unauthorised colonies thought that the ease of customer grievance redressal would lessen with PSP. This was largely because they perceived the private companies to be less approachable than DJB. On the contrary, only 5 percent of the respondents in the planned colonies thought that the customer care would deteriorate.

7.13 SUMMARY

Introduction of neoliberal policies has significantly changed the water governance of Delhi. There is intense focus on cost recovery and reduction of non-revenue water to be achieved through connection to all households resulting in near elimination of unauthorised connections, 100 percent metering, and increase in tariff etc. The barrier to entry into the formal water system is entrenched in the DJB Act, 1998. It has been addressed in the 2012 regulation by separating ownership from house connections. This is being put into force by the present Government which is implementing the provisions already in the 2012 regulation. The present Government is also trying to simplify the processes to apply for a house connection and at the same time lessen the financial burden by reducing the connection price. The motive behind these initiatives seems to be getting all the households in the revenue net, again to move towards cost recovery. The focus has been particularly on metering as households which have working meters can only avail these schemes. The meters have come under constant criticism by the users for capturing the flow of air as well. This might prove to be an issue with the lower income households who would end up paying more than their consumption. The measures have been partially successful, the low income households still found the connection price prohibitive. Willingness to pay has dominated the present discourse on water pricing. In the survey areas, the willingness to pay among JJ households was found to be influenced by insufficiency of water and the waiting time to fetch water. Water being indispensable in nature and given the inadequacy in supply, every socio-economic group tries to reserve water for itself. While the higher income groups were found to keep the major part of the water for themselves through bargaining power of the RWAs, the JJ dwellers were found to demand water through political patronage. The private companies were found to be equally vulnerable to the existing politico-legal-institutional set up as the public utilities, which affects their working and supposed efficiency as well. Interestingly, the demand and acceptance of PSP in water supply varied among the various socio-economic groups, with the well-educated, higher earning individuals wanting it more than the others. Largely, the reason cited was that PSP would reduce inefficiency and unionism and bring in more professionalism. The overall perception of private companies in water supply is that while they would lead to an improvement in water quantity and quality, they would be less approachable than a public sector utility.

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CHAPTER VIII

CONCLUSION

8.1 INTRODUCTION

The present research work has emanated out of the need to assess the effect of private sector participation in urban water supply distribution on economically marginalised and vulnerable segments of the society, in the light of intense focus of the Government on introduction of private sector in all spheres of infrastructure development. The profit motive of the private sector has been cited as an antithesis to the concept of a natural resource such as water- a public good. The central problem addressed in the present thesis revolves around studying the influence of the type of management on inequality in household access to water. The present research work is grounded in the urban political ecology (UPE) framework. The study justifies the UPE argument that political processes are central to the environmental changes that are brought about in a city, in this case the introduction of a private company in distribution of water. The study illustrates that society gets forged with nature in such a way that the process benefits some and marginalises the others. In the case study, it is seen how the benefits of private sector operation is channelized towards the areas with existing networked infrastructure inhabited by the middle class and the rich first. With respect to areas with non-networked water infrastructure, households with higher income are found to avail the benefits of paid, clean water.

The significance of the contribution of the present research work lies in drawing attention away from the public-private debate and focussing on the neo-liberalization of water. It is evident from the Delhi case study that the focus is on increasing revenue for DJB through formal water connection to every household, with or without private operator. It is also clear that, although the privatisation efforts initiated in 2005 might have been stalled but the recommendations, are being followed in principle. In the reviewed literature, post-privatisation tariff increase has been the common theme running through most of the global case studies affecting access to water for the poor and one of the main reasons cited for opposing privatisation. The argument presented by the research work deliberates that increase in tariff might be sustained even in the absence of private sector participation in the water sector. It also establishes that the benefits or problems arising out of PSP are determined by the local factors and the PPP model. In the present case study, the private concessionaire was found to be keen on expanding into localities inhabited by the low income groups as well since it was only responsible for reduction of non-revenue water and not revenue collection. The concessionaire was also keen that the connection price be reduced to enable more households to avail their services and reduce unauthorised access. This was in contradiction to studies cited in the literature where private companies had excluded poor neighbourhoods from their services. It was also observed that since the private companies are trying to set a foothold in the Indian urban water sector and there has already been a lot of negative publicity, they are eager to engage positively with the stakeholders. The local political representatives (MLA) were found to play an important role in the determining the distribution of water, both in the private company and public managed areas reiterating the importance of political patronage in water service delivery as mentioned in the literature. In this context, a new aspect came to light that formalising of services as in the case of electricity makes it more difficult for the poor since the political representative is made redundant in this case. The study also challenged the IFI viewpoint of willingness to pay as a justification for introducing highly priced water delivery services in the poor neighbourhoods. It is evident that willingness to pay is not determined by the ability to pay, rather it is a function of helplessness and despair.

The main findings are summarised and discussed in the present chapter. The policy implications of the research study and recommendations for further research have also been discussed in this chapter.

8.2 RESEARCH FINDINGS

The central problem addressed in the present thesis revolves around the hypothesis that private sector participation in the water sector reinforces inequality in household access to water. It has been successfully answered in the present thesis. The introduction chapter forms the foundation of the thesis. It contains the rationale for the study, selection of the study area, literature review, theoretical framework, conceptual framework, objectives, research questions and methodologies along with the sampling framework. Delhi was selected as the study area as it has areas under management of both a public utility and private concessionaire along with the presence of various settlement typologies with their own unique history of relationship with the State with respect to access to formal water.

The review of literature was done in three broad themes pertaining to first, the contemporary concepts and approaches relevant to urban water services; second, research outcomes in literature relevant to present study and third, a brief review of research methods employed in the thesis. The research outcomes in literature focussed on various themes such as the privatisation vs public sector ownership (efficiency), PSP in water supply and the poor, role of regulatory mechanism, absence of clarity in awarding contracts and role of political patronage in water service delivery. Certain concepts emanating out of the theoretical framework and literature review were put into a conceptual framework. The influence of neo-liberal policies, through commodification of water, in the light of prevailing inequalities on household access to clean, affordable water in the various settlement typologies formed the mainstay of the framework. Objectives and the subsequent research questions were formulated on the basis of the conceptual framework. The juxtaposition of PSP scenario on the prevailing inequalities in the state hydraulic paradigm, contextualising the Indian urban water PSP scenario in the global state of affairs and the issues emanating out of neo-liberal policies in urban water are the main themes of the objectives. A mixed method approach involving both quantitative and qualitative data has been used to address the objectives. Pearson's correlation coefficient, cross tabulation, binomial regression, Z score, Principal Component Analysis have been used to assess the field data quantitatively while case studies, anecdotes and interviews with key informants have been used to understand the nuances and shed light on the respondent experiences, further adding to the quantitative analysis. Focus Group Discussions were also conducted to understand the opinions and perceptions of the residents. For the networked areas, the sampling framework was devised taking into account both the focus group (areas with private management of water distribution) and control group (areas under management of DJB). Disproportionate sampling was done for selecting the respondent households for each settlement group within which proportional to population size sampling was done for selecting the households from localities within each settlement category. A total of 400 households were part of the sample. For the non-networked areas (Savda Ghevra), 30 sample households were selected on the basis of stratified random sampling from households using water ATM and 30 were selected from households not using water ATM.

The main empirical findings are chapter specific and have been summarised at the end of each chapter. This section seeks to synthesise the findings and understand the answer to the research questions stated at the beginning of the study.

a) What are the levels of existing inequalities in access to urban water supply between states, urban size classes, million plus cities and income classes in the backdrop of the present hydraulic state paradigm

The present research question is addressed in chapter two entitled "Urban Water Supply and Distribution: A Background". Be it the states, urban size classes, million plus cities or income classes, households in the lowest order of the hierarchy are in the worst situation with respect to access to water. For states, the level of development plays a key role. On the positive side, the less developed states have shown improvement in the last few decades. The inequality between the states with respect to access to safe drinking water has declined from 1981 to 2011, a result of the less developed states catching up with the more developed states. The benefits of development seem to be skewed in favour of the big cities, also because of the focus of the programmes on the big cities and the stronger municipal capacity. The disparity between the million plus cities is also striking, more so in terms of per capita water availability and continuity of water supply. Thus, even at the higher levels of administration, inequality is entrenched and often reinforced by Government programmes. With respect to inequality at the household level, the lowest income classes are the most disadvantaged with respect to access to water with a large percentage of households depending on sources outside the premises. Subsequently, a higher percentage share of low income households also has to spend more time to fetch water. Similar is the case for slum households. Considerable disparity exists between slum and non-slum households with respect to access to treated tap water. The disparity between slum and non-slum households was found to be less in the developed states as compared to the less developed ones.

b) Does the type of agency responsible for water supply influence the adoption and implementation of water sector reforms in the million plus cities of India

The present research question is addressed in chapter two entitled "Urban Water Supply and Distribution: A Background". A discussion on private sector participation in the water sector in India is incomplete without understanding the water reforms that have been introduced. The service level benchmarking indicators were analysed vis a vis the institutional set up in the 53 Million plus cities of India. Water utility in majority of the cities was still a municipal responsibility followed by parastatal organisations. Household coverage of treated tap water was the highest in cities with municipal corporations followed very closely by cities with parastatal organisations. Cities with multiple agencies fared the worst. Cities with parastatal organisations also had higher share of households with metered water connection as compared to other types of agencies. With respect to non-revenue water, cities with less than 20 percent NRW largely comprised cities with PHED, private companies and parastatal organisations. The type of agency seemed to have a direct effect on the implementation of telescopic volumetric tariff. All the cities with parastatal organisations and private companies had implemented the telescopic volumetric tariff system unlike the cities with municipal corporations. Special tariff and connection prices for the poor have been introduced in some cities. The initial institutional reforms in the form of setting up of parastatal organisations have had an effect on the pursuing of the reforms which were later articulated as the service level benchmarking. The political interference in the municipal set up might have also prevented the urban local bodies from adopting the reforms wholeheartedly.

d) What are the factors influencing the award and the continuation of PPP projects in urban water supply in India

The research question has been addressed in chapter three entitled "Private Sector Participation in Urban Water Supply-Post 1990". Water and sanitation forms a miniscule portion of the total infrastructure sectors, in terms of the number of projects and the project cost. PPP in urban water supply has taken more time than other sectors to be introduced in the states. There has been an increase in the number of PPP projects in the urban water supply and distribution in India in the last five years. Projects launched in the initial phase ran into trouble and many were scrapped. There were civil society protests also during this time. There was a spurt in the number of projects post JNNURM (2006) as there was focus on getting in private companies in the urban water sector. During this time, many projects were launched in the less developed states. The next phase of 2011-2015 was a more mature phase, with less number of projects getting stalled. There has been a slow withdrawal of the State from urban services, also reflected in the reduction in budgetary allocation for water supply. Some of the developed states with low percentage of budgetary allocation witnessed the introduction of PPP in urban water supply in the period 2000-2005. The presence of international financial institutions has played an important role in the introduction of PPP projects, especially in the earlier phase. There has been a decline in the direct involvement of IFIs over the years. Institutional capacity of the implementing agency is an important factor in the introduction of PPP projects, the reason for dominance of parastatal organisations in the initial phase. There has been a shift from bulk water projects to operation and management of water distribution projects with less or no private investments.

A large share of PPP projects which have continued include projects which were introduced after 2006. The environment for PPP became more conducive after the launch of JNNURM with an official recognition and support for PPP from the State. Projects funded by JNNURM or the utility were found to have a less chance of being stalled. The conditions applicable for private operators have also eased with lowering of revenue risk. Civil society protests have played an important role in the hindering the continuation of PPP projects in the urban water sector. It was also seen that civil society protests had become less effective in the cancellation of projects in the later stages.

e) What are the causes of the inequalities in water service provisioning in Delhi and the justifications for introducing PSP in water supply and distribution in Delhi

This particular research question has been addressed in chapter four entitled “Water Governance and Private Sector Participation in Public Water Supply in Delhi: A Macro Analysis”. Besides the inequalities arising from geographical differences and technological challenges, policies biased towards the planned and approved colonies inhabited by the rich and the middle class have played an important role in depriving the others from formal water supply. The 2012 regulation delinked tenure status from water connections and the present State Government has taken it a step forward and is implementing this by allowing water connections in all unauthorised colonies and JJ clusters in Delhi.

Despite the city having one of the highest per capita water availability at source, the inequitable distribution is jarring. Less than three-fourths of Delhi's households had access to tap water within premises in 2011. Reflecting the overall scenario of the other states, the percentage share of budgetary allocation for water and sanitation has also been declining in Delhi. DJB has been unable to generate funds for capital expenditure and is dependent on loans and grants. There is considerable variation in the number of hours for which water is supplied across the city, forcing households to store water in storage tanks and mimic a 24x7 water supply. Revenue management has been an issue for DJB, like most other water utilities in India. The revenue deficit has increased as a result of the waivers on arrears and free water till 20 kl. The non-revenue water has also been high mainly because of the transmission and distribution losses and several unauthorised connections. The water tariff was low till 2004, after which there was an abrupt increase followed by incremental increase every year since 2010. It has been argued that the tariff has been increased in Delhi to make it more viable for private player entry, mirroring the global cases, since tariff was increased abruptly both times just before PPP was initiated. Private companies were brought in to rehabilitate the existing network and manage water distribution, largely in order to reduce non-revenue water and thus increase the revenue of the utility. Recognising the importance of water metering in lowering non-revenue water, there has been a focus on metering in the new schemes launched by DJB.

f) How does inequality in access to clean, sufficient and affordable water among the settlement categories differ between the private and the public managed areas.

The research question has been addressed in chapter five entitled "Inequalities in Networked Water Supply: A Micro Study". Delhi provided a setting in which the DJB co-exists with the private companies for operation and management of water distribution in different areas. It allowed a comparison of the distributional inequalities among the settlement categories in each of the areas under public and private management. The findings revealed that inequalities existed between the settlement categories, driven by discriminatory policies, in both the public and the private management areas. The planned colony households in the private management areas were found to be in a much better situation with respect to water supply indicators as compared to the other three settlement categories. Although, the planned colonies in the DJB managed areas were also in a better situation than the other three settlement categories, the inequality was less. The planned colonies were the first to benefit from the private company intervention despite the other settlement categories being in much worse condition.

g) What are the various factors acting as barriers against/or resulting in acceptance of private sector innovative measures in water provisioning in non-networked areas.

The research question has been addressed in chapter six entitled "Private Sector Participation in Non-Networked Water Supply: A Case of Savda Ghevra". The efforts of DJB was found to be commendable in trying to provide clean, affordable water to the settlements without networked supply, at least it also meant recognising that such a need exists. In Savda Ghevra, ground water was being extracted and then treated through Reverse Osmosis. This would further aggravate the ground water problem in the area. The use of water ATMs increased with increase in household income, decrease in distance between the ATM and residence and decrease in household size. One of the major barriers to using the water ATMs was found to be the use of new technology and the disinterest in getting cards recharged once the money in the card got over.

h) What are the key factors responsible for distributional inequity among the settlement categories

This research question has been addressed in the seventh chapter "Political Ecology of Neo-liberalised Water". There is a need to go beyond the technocratic solutions in the urban water supply and focus on the social, political and governance factors which influence the distributional equity among the settlement categories. Commodification of water is embedded in the policies and Acts framed after 1998, a result of neo-liberalisation of water. The emphasis on cost recovery has dovetailed policies, initiatives and schemes into interventions which can generate revenue for the utility, irrespective of public or private management. The barriers to entry into the formal water system for the low income groups and the population inhabiting the informal spaces and further continuation in the system is entrenched in the State interventions. Although, the present Government has introduced schemes and has relaxed rules with an eye on reduction of non-revenue water, it is still prohibitive as most of it has to be paid in lumpsome. These schemes also do not have a legal status and when withdrawn shall be detrimental for the low income households. Not only does the apathy of the State play a role in the inequality between the settlement categories, even the exertion of power by the rich and the middle class to corner more of a scarce resource was evident. On the part of the poor, they have established a relationship with the political parties on the basis of a give and take of votes and services. In the recent past, willingness to pay for basic services has superseded the ability to pay in the development discourse. The willingness to pay among the JJ households was found to be determined by perceived insufficiency of water and waiting time for fetching water rather than the household income (ability to pay). The findings of the study on the effect of privatisation of electricity revealed the excess financial burden that the poor have to bear for having access to electricity in their homes and a similar situation for water connections would have deep repercussions pushing them deeper into the debt burden. PSP in water services has been suggested as a panacea for urban water supply problems by the IFIs and is being pursued by the National and the State Governments alike. The present study showed that private companies do not operate in isolation and are equally vulnerable to the governance issues. The findings also revealed that higher education and income influenced the preference for private sector participation in the water supply as groups with these characteristics perceived PSP to bring in more professionalism and efficiency.

8.3 POLICY IMPLICATIONS

8.3.1 Governance Challenges

PSP in the water sector operates within the ambit of the governance system and not in isolation. The private vs public debate has diverted attention from the need of good water governance. Inequality in household access to water can be partially addressed by bringing in change at the policy level where every household, irrespective of its location and tenure status is given an equal right to water by the State. The commitment of the State is paramount and it cannot evade its responsibility in providing clean, affordable water to its citizens.

8.3.2 Neo-liberalisation of Water vis a vis PSP

Overt focus on public-private partnership in the urban water supply has taken away attention from the effect of the neoliberal policies on water provisioning at the household level. Neoliberal policies followed by public utilities are as exclusionary for the low income groups as PSP in water. Conventional models of both Government and private sectors have their respective flaws. Both have been unsuccessful in serving the poor neighbourhoods. Emphasis on technocratic solutions without paying adequate attention to the socio-political factors would not address the issue of inequality as it is entrenched in the policies and the social system. Urban water supply is not only an environmental component but a social and economic one as well.

8.3.3 Localising PSP Interventions

The success of implementation of PPP projects is dependent on the local conditions, thus defying ‘one size fits all’. Several cities in the Indian context might not even be ready for PPP due to their weak institutional and financial capacities. A large number of cities where PPP was introduced have been struggling due to the lack of availability of basic network data. PPP in the water sector has been treated as the panacea for all water problems and it is assumed that a private company would be able to solve all problems that have not been resolved in the past 60 years. PPP has been advocated in the policies and promoted in the important Government programmes, thus it is inevitable that it would be in the Indian urban space for a while before another paradigm shift occurs. For every city which opts for the PPP route, it is important that a base is prepared with full information and all the permissions are taken beforehand, in order to avoid delay in execution of the project work. PPP should not be treated as the reform itself but only a small component of the reform directed towards good governance.

Besides, the PPP model is also important for the successful implementation of the project. Projects where the role of private companies have been limited to basic upgradation of network, operation and management have been more successfully executed as compared to projects which also had revenue collection. Private Operators bring technology and skilled expertise which might be expensive for a public utility to procure. The appropriate PPP model backed by policies and schemes targeted at the poor has the capability to address the technological constraints faced by public utilities in the urban water sector.

A strong enforcement agency is critical for getting a balanced result out of PPP. Under a strong regulator, private sector participation might actually be beneficial but the fear of being held ransom over water and arm twisting by the private company would always be there.

8.3.4 Safeguards for the Low Income Groups

In the present scenario in Delhi, DJB supplies the first 20 kilolitres of water free for households. This is not necessarily targeted only at the low income households as many middle class households with small household size would also be getting billed for zero amount. Since the intention of this particular scheme of the State Government mainly seems to be motivating households to install new meters, the scheme might be withdrawn after a large percentage of household metering is achieved. This scheme has also been the brainchild of the present Government and is thus subject to AAP being in power. Safeguards for the lower income groups should not be at the mercy of any political party but rather should be embedded in acts and regulations.

8.4 RECOMMENDATIONS FOR FUTURE RESEARCH

The Indian cities are at an interesting juncture, where it has been a little more than ten years since large scale reforms were introduced through JNNURM. PPP has been promoted from all quarters and at all levels, not even leaving the public good alone. In such a scenario, the regulator has a very important role to play. In most cases, there has been a transformation of the public utility from a provider to a regulator. There is also some conflict of interest as the public utility is also the organisation which has contracted the private company. This was seen in the case of DJB but could not be delved into detail. This can prove to be exciting research work that would shed light on the changing role of the public utilities and their emerging regulatory nature.

8.5 SUMMARY

PPP should not be seen as the panacea to all problems in the urban sector rather there is an urgent need to focus on the prevailing inequalities and adopt strategies to minimise them through policies, programmes and schemes. The key to an inclusive society lies in not letting PSP becoming an end itself but rather a means to an end.

APPENDICES

APPENDIX CHAPTER TWO

Appendix 2.1

Table 1: Million Plus cities -2001 and 2011

S.No.	City	Population (2011)	Population (2001)	AAGR (Percent)
1	Greater Mumbai UA	184,14,288	164,34,386	0.011
2	Delhi UA	163,14,838	128,77,470	0.024
3	Kolkata UA	141,12,536	132,05,697	0.007
4	Chennai UA	86,96,010	65,60,242	0.029
5	Bangalore UA	84,99,399	57,01,446	0.041
6	Hyderabad UA	77,49,334	57,42,036	0.030
7	Ahmadabad UA	63,52,254	45,25,013	0.035
8	Pune UA	50,49,968	37,60,636	0.030
9	Surat UA	45,85,367	28,11,614	0.050
10	Jaipur (M Corp.)	30,73,350	23,22,575	0.028
11	Kanpur UA	29,20,067	27,15,555	0.007
12	Lucknow UA	29,01,474	22,45,509	0.026
13	Nagpur UA	24,97,777	21,29,500	0.016
14	Ghaziabad UA	23,58,525	9,68,256	0.093
15	Indore UA	21,67,447	15,16,918	0.036
16	Coimbatore UA	21,51,466	14,61,139	0.039
17	Kochi UA	21,17,990	13,55,972	0.046
18	Patna UA	20,46,652	16,97,976	0.019
19	Kozhikode UA	20,30,519	8,80,247	0.087
20	Bhopal UA	18,83,381	14,58,416	0.026
21	Thrissur UA	18,54,783	3,30,122	0.188
22	Vadodara UA	18,17,191	14,91,045	0.020
23	Agra UA	17,46,467	13,31,339	0.028
24	GVMC (MC)	17,30,320	13,45,938	0.025
25	Malappuram UA	16,98,645	1,70,409	0.259
26	Thiruvananthapuram UA	16,87,406	8,89,635	0.066
27	Kannur UA	16,42,892	4,98,207	0.127
28	Ludhiana (M Corp.)	16,13,878	13,98,467	0.014
29	Nashik UA	15,62,769	11,52,326	0.031
30	Vijayawada UA	14,91,202	10,39,518	0.037

31	Madurai UA	14,62,420	12,03,095	0.020
32	Varanasi UA	14,35,113	12,03,961	0.018
33	Meerut UA	14,24,908	11,61,716	0.021
34	Faridabad (M Corp.)	14,04,653	10,55,938	0.029
35	Rajkot UA	13,90,933	10,03,015	0.033
36	Jamshedpur UA	13,37,131	1104713	0.019
37	Srinagar UA	12,73,312	9,88,210	0.026
38	Jabalpur UA	12,67,564	10,98,000	0.014
39	Asansol UA	12,43,008	10,67,369	0.015
40	Vasai Virar City (M Corp.)	12,21,233	2,93,324	0.153
41	Allahabad UA	12,16,719	10,42,229	0.016
42	Dhanbad UA	11,95,298	10,65,327	0.012
43	Aurangabad UA	11,89,376	8,92,483	0.029
44	Amritsar UA	11,83,705	10,03,917	0.017
45	Jodhpur UA	11,37,815	8,60,818	0.028
46	Ranchi UA	11,26,741	8,63,495	0.027
47	Raipur UA	11,22,555	7,00,113	0.048
48	Kollam UA	11,10,005	38,00,91	0.113
49	Gwalior UA	11,01,981	8,65,548	0.024
50	Durg-Bhilainagar UA	10,64,077	9,27,864	0.014
51	Chandigarh UA	10,25,682	8,08,515	0.024
52	Tiruchirappalli UA	10,21,717	8,66,354	0.017
53	Kota (M Corp.)	10,01,365	7,03,150	0.036

Note: The cells of the cities highlighted in grey were added in the 2011 Census

Source: Census of India, 2001 and 2011

Appendix 2.2

Table 2: Household Access to Tapwater- Within and Near Premises (2001 and 2011)

city	HH Access to Tapwater_2001	HH Access to Tapwater_2011
Hyderabad	89.89	93.62
Vijaywada	69.32	88.04
Vishakapatnam	61.57	67.93
Faridabad	57.18	60.35
Delhi	73.95	79.19
Agra	62.45	62.17
Allahabad	88.17	90.97
Kanpur	45.38	45.20
Lucknow	75.23	73.42
Meerut	62.22	69.34
Varanasi	75.69	74.15
Patna	66.28	58.69
Asansol	76.87	74.37
Kolkata	73.10	84.53
Dhanbad	38.65	47.38
Jamshedpur	68.08	72.00
Ahmadabad	87.44	85.69
Rajkot	69.69	89.23
Surat	80.26	85.77
Vadodara	86.91	90.31
Greater Mumbai	95.81	94.69
Nagpur	77.44	83.77
Nashik	90.12	94.85
Pune	90.72	97.38
Bangalore	79.37	78.27
Kochi	84.70	94.68
Bhopal	75.33	68.13
Indore	66.24	57.55
Jabalpur	61.80	67.12
Amritsar	66.71	74.28
Ludhiana	68.57	91.34
Jaipur	80.15	83.37
Chennai	43.80	82.63
coimbatore	87.86	96.13
Madurai	72.53	88.67
Kozhikode	28.38	39.69
Thrissur	35.08	34.79
Malappuram	32.74	34.83

Kannur	37.31	36.98
Vasai Virar City	71.78	70.89
Aurangabad	83.51	82.33
Jodhpur	92.42	95.74
Ranchi	34.22	37.58
Raipur	59.13	59.59
Kollam	29.70	39.07
Gwalior	75.83	71.59
Durg-Bhilainagar	63.05	66.99
Tiruchirappalli UA	77.38	86.46
Ghaziabad	68.00	63.26
Thiruvananthapuram	62.86	73.82
Kota	84.47	81.48
Srinagar	95.74	96.99
Chandigarh	90.20	95.17

APPENDIX 2.3

Table: Rank of Cities: Water Supply Status on the Basis of Composite Index

City	Continuity (Hrs)	LPCD	HH Access to treated tap water (Percent) 2011	Zscore_Cont.	Zscore_LPCD	Zscore_Treated tap water	Zscore_Total	RANK
Hyderabad	1	122	91.43	-1.00	0.16	1.14	0.3	20
Vijaywada	4	147	82.85	-0.27	0.82	0.71	1.26	10
Vishakapatnam	1	112	64.80	-1.00	-0.10	-0.18	-1.28	28
Faridabad	6	180	50.92	0.22	1.68	-0.87	1.03	12
Agra	4	93	56.55	-0.27	-0.59	-0.59	-1.45	32
Allahabad	10	133	86.62	1.20	0.45	0.90	2.55	6
Kanpur	6	78	40.65	0.22	-0.99	-1.38	-2.14	37
Lucknow	4	150	68.16	-0.27	0.89	-0.01	0.61	18
Meerut	8	84.8	61.41	0.71	-0.81	-0.35	-0.45	23
Varanasi	10	100	69.88	1.20	-0.41	0.07	0.86	13
Patna	8	71	47.15	0.71	-1.17	-1.06	-1.51	33
Asansol	1.5	75	69.70	-0.88	-1.06	0.06	-1.88	35
Kolkata	8	130	81.83	0.71	0.37	0.66	1.75	8
Jamshedpur	6	203	67.92	0.22	2.28	-0.03	2.47	7
Ahmadabad	2	150	77.46	-0.76	0.89	0.45	0.58	19
Rajkot	0.33	124	85.98	-1.17	0.21	0.87	-0.08	22
Surat	3	147	75.28	-0.51	0.82	0.34	0.64	17
Greater	2.5	135	92.56	-0.64	0.50	1.20	1.06	11

Mumbai								
Nagpur	12	135	81.90	1.69	0.50	0.67	2.86	5
Nashik	3	140	93.46	-0.51	0.63	1.24	1.36	9
Pune	5	194	96.67	-0.02	2.04	1.40	3.42	4
Bangalore	5	96	69.72	-0.02	-0.52	0.06	-0.48	24
Kochi	18	130	92.95	3.16	0.37	1.21	4.75	1
Bhopal	2	126	62.00	-0.76	0.27	-0.32	-0.81	26
Indore	0.8	73	53.40	-1.05	-1.12	-0.75	-2.92	40
Jabalpur	3	96.8	59.95	-0.51	-0.50	-0.42	-1.43	31
Jaipur	1.5	114	77.36	-0.88	-0.05	0.44	-0.49	25
Chennai	1.5	81	78.42	-0.88	-0.91	0.49	-1.3	29
coimbatore	4	109	94.00	-0.27	-0.18	1.27	0.82	14
Madurai	4	103	85.65	-0.27	-0.33	0.85	0.25	21
Kozhikode	7	100	35.60	0.47	-0.41	-1.63	-1.57	34
Thrissur	3	37	28.47	-0.51	-2.06	-1.98	-4.55	42
Malappuram	7	94	32.29	0.47	-0.57	-1.79	-1.9	36
Kannur	5	7	34.60	-0.02	-2.84	-1.68	-4.54	41
Vasai Virar City	2	100	65.52	-0.76	-0.41	-0.15	-1.32	30
Jodhpur	1.3	135	93.11	-0.93	0.50	1.22	0.79	15
Ranchi	3	100	33.73	-0.51	-0.41	-1.72	-2.65	38
Kollam	4	90	33.64	-0.27	-0.67	-1.73	-2.67	39
Ghaziabad	4.5	109	58.05	-0.15	-0.18	-0.52	-0.84	27
Thiruvananthapuram	18	165	72.16	3.16	1.29	0.18	4.63	2
Kota	4	135	78.87	-0.27	0.50	0.52	0.75	16
Chandigarh	10	158	92.67	1.20	1.10	1.20	3.51	3

APPENDIX CHAPTER THREE

Appendix 3.1

Table: List of Selected PPP Projects (Urban Water Sector) in India

S.No	Project Location	Project Type	Status	State	Year of Award
1	Sonia Vihar	Bulk Water	Ongoing	Delhi	2000-2005
2	Chandrapur	Bulk Water And Distribution	Ongoing	Maharashtra	2000-2005
3	KUWASIP	Distribution	Ongoing	Karnataka	2000-2005
4	Salt Lake	Distribution	Ongoing	West Bengal	2006-2010
5	Nagpur Pilot	Distribution	Ongoing	Maharashtra	2006-2010
6	Nagpur Whole City	Distribution	Ongoing	Maharashtra	2011-2015
7	Latur	Bulk Water And Distribution	Abandoned	Maharashtra	2006-2010
8	Mysore	Distribution	Ongoing	Karnataka	2006-2010
9	Khandwa	Distribution	Ongoing	Madhya Pradesh	2006-2010
10	Shivpuri	Distribution	Ongoing	Madhya Pradesh	2006-2010
11	Bijapur	Distribution	Ongoing	Karnataka	2011-2015
12	Iisc	Distribution	Ongoing	Karnataka	2011-2015
13	Ilkal	Distribution	Ongoing	Karnataka	2011-2015
14	Pench I	Bulk Water	Ongoing	Maharashtra	2006-2010
15	Nangloi	Bulk Water And Distribution	Ongoing	Delhi	2011-2015
16	Tk Halli & Extn.	Bulk Water	Ongoing	Karnataka	2006-2010
17	Bhandup	Bulk Water	Ongoing	Maharashtra	2006-2010
18	Chennai Chembarambakam	Bulk Water	Ongoing	Tamil Nadu	2000-2005
19	Malviya Nagar	Distribution	Ongoing	Delhi	2011-2015
20	Vasant Vihar And Mehrauli	Distribution	Ongoing	Delhi	2011-2015
21	Jamshedpur	Bulk Water And Distribution	Ongoing	Jharkhand	2000-2005
22	Tiruppur	Bulk Water And Distribution	Ongoing	Tamil Nadu	2000-2005
23	Mango	Bulk Water	Ongoing	Jharkhand	2006-2010
24	Dumka	Bulk Water	Ongoing	Jharkhand	2006-2010
25	Gwalior	Bulk Water	Ongoing	Madhya Pradesh	2011-2015
26	Nuzvid	Bulk Water	Ongoing	Andhra Pradesh	2011-2015

27	Jangaon	Bulk Water	Ongoing	Andhra Pradesh	2006-2010
28	Aurangabad	Bulk Water And Distribution (Stalled)	Abandoned	Maharashtra	2011-2015
29	Kota	Bulk Water And Distribution	Ongoing	Rajasthan	2011-2015
30	Ajmer	Bulk Water And Distribution	Ongoing	Rajasthan	2011-2015
31	Bharatpur	Bulk Water And Distribution	Ongoing	Rajasthan	2011-2015
32	Bangalore (2 Pilot)	Bulk Water	Abandoned	Karnataka	2000-2005
33	Delhi (2 Pilot)	Distribution	Abandoned	Delhi	2000-2005
34	Mumbai K-East	Distribution	Abandoned	Maharashtra	2000-2005
35	Sangli	Bulk Water And Distribution	Abandoned	Maharashtra	2000-2005
36	Pune	Bulk Water And Distribution	Abandoned	Maharashtra	1995-2000
37	Hyderabad	Bulk Water	Abandoned	Andhra Pradesh	1995-2000
38	Goa	Bulk Water	Abandoned	Goa	1995-2000
39	Cauvery Bulk Water	Bulk Water	Abandoned	Karnataka	1995-2000

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