LOTUS

LOW-COST INNOVATIVE TECHNOLOGY FOR WATER QUALITY MONITORING
AND WATER RESOURCES MANAGEMENT FOR URBAN AND RURAL WATER SYSTEMS IN INDIA

Deliverable D1.3

Socio-economic study "Water quality and quantity: satisfaction evaluation from user perspectives, and technology adoption" - Baseline

Lead: TISS

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- Public -

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Project Deliverable

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Abstract

the LOTUS project has a component of socio-economic study of the user community in a used case: tanker-based water distribution system in Bangalore. The socio-economic study will cover: (1) the understanding demographic profile of tanker users, (2) community willingness to pay for the developed technology, and (3) overall change that the adaptation of technology has made in the life of community.

This document covers the detailed background about the proposed methodology to be taken for the socio-economic studies. Once conditions are improving in India, TISS team will proceed to household survey to finalise the report.

Keywords

Socio-economy study; water; users; technology adoption

Disclaimer

LOTUS has been financed with support from the European Commission and the Indian Government, Ministry of Science and Technology.

The LOTUS Project

LOTUS is a project funded by DG Environment under the European Union Horizon 2020 Research and Innovation Programme and by the Indian Government. It brings together EU and Indian prominent organisations with the aim to co-create, co-design and co-develop innovative robust affordable low-cost sensing solutions for enhancing India's water and sanitation challenges in both rural and urban area.

The LOTUS solution is based on an innovative sensor and includes tailor-made decision support to exploit the capabilities of the sensor as well as a specific approach to co-creation. LOTUS aims to be co-designed and co-produced in India, and have a wide, diverse and lasting impact for the water sector in India due to intense collaborations with commercial and academic partners in India.

Based on the low-cost sensor platform, solutions for the early detection of water quality problems, decision support for countermeasures and optimal management of drinking and irrigation water systems, tailored on the functionalities of the new sensor, will be developed and integrated with the existing monitoring and control systems.

This sensor will be deployed in five different use cases: in a water-network, on ground-water, in irrigation, in an algae-based waste water treatment plant and in water tankers. The packaging of the sensor, as well as the online and offline software tools will be tailored for each of the use cases. These last will enable to test the sensors and improve them iteratively.

The project is based on co-creation, co-design and co-production between the different partners. Therefore, an important stakeholder engagement process will be implemented during the project lifetime and involve relevant stakeholders, including local authorities, water users and social communities, and will consider possible gender differences in the use and need of water. Broad outreach activities will take place both in India and in Europe, therefore contributing to LOTUS impact maximisation.

The further development and exploitation (beyond the project) of the novel sensor platform will be done in cooperation with the Indian partners. This will create a level playing field for European and Indian industries and SMEs working in the water quality area.

Table of Contents

List of Figures

List of Tables

Acronyms and Definitions

Acronyms	Defined as
BBMP	Bruhat Bengaluru Mahanagar Palike
BDA	Bangalore Development Authority
BWSSB	Bangalore Water Supply and Sewerage Board
CWSS	Cauvery Water Supply Scheme
DID	Difference-in-Difference
LOTUS	Low-cost innovative Technology for water quality monitoring and water resources management for Urban and rural water Systems
MLD	Million Liters Daily
WTA	Willingness to accept
WTP	Willingness to pay

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1 Executive Summary

the LOTUS project has a component of socio-economic study of the user community in a used case: tanker-based water distribution system in Bangalore. The socio-economic study will cover: (1) the understanding demographic profile of tanker users, (2) community’s willingness to pay for the developed technology, and (3) overall change that the adaptation of technology has made in the life of community. The results will be derived from data collected through a mixed methods approach that derives quantitative data collected through field surveys and focussed group discussions and interviews conducted for multiple stakeholders. Overall, the results would indicate the nature of dependence on tanker water across different social groups while also identifying the monetary limits of the users to contribute towards usage of water.

This document covers the detailed background about the proposed methodology to be taken for the socio-economic study: the baseline study, based on household surveys and the Willingness to Pay approach. The deliverable also presents the research design.

2 Background

Safe and reliable supply of drinking water in India is the main concern among people living in the urban areas in India. Other concerns related to water supply in urban areas in India are: intermittent water supply, water is supplied without sufficient quality treatment, almost no purification done at the household level drinking water supply, poor quality water supply sources, and the possibility of cross-contamination of drinking water supply line with waste water treatment lines due to old layout and pipeline infrastructure. The issue of water supply coverage is also another concern particularly for those living in the new settlements in the city where piped water network is still not in place. These challenges have led to accessibility, reliability, and affordability issues related to water supply system, in addition, many known health problems in the city are attributed to poor water supply and quality issues.

Traditionally, in India, public water supply utility is the main institution that has a mandate for providing safe and reliable water supply in the city. Official statistics show a good coverage of piped water supply for urban residents in India (ADB, 2007). However, good water supply coverage does not guarantee quality, reliability and affordability of the water supply (Amit and Sashidharan, 2019). Further, due to a sharp rise in the population and expansion of the city areas public water supply utilities are not in position to cover all residents. A majority of these people in the city area has to rely on the private water supply more particularly through tanker water supply vendors. Most private vendors in cities are profit driven and stressed with burgeoning demand of water. In order to keep the water demand in track private tanker vendors often neglect the water quality standards and thereby delivering poor quality water worsening the existing challenges. Nevertheless, water tankers are the reality in water supply system, especially they provide accessibility to those who cannot access and afford the piped water system due to various reasons. Keeping these water-related challenges in mind The European Commission and Department of Science and Technology, Government of India has initiated the Low-cost innovative Technology for water quality monitoring and water resources management for Urban and rural water Systems (LOTUS) project, undertaken by a consortium of multiple institutions both in India and Europe. The main objective of the project is to develop innovative sensors and data driven decision support tools to address water supply and quality related challenges in India. The project aims to demonstrate the developed tools and technology in the use cases. **Implementation and demonstration of community adoption of developed technology and tools in takers-based water supply system in Bangalore is one of the important use cases in the project.**

The proposed LOTUS solution for tanker-based water supply in Bangalore involves implementation of chlorine dosage unit with sensor-based monitoring and a software application for a data-driven demand and supply scheduling for tankers. It is envisaged that implementation of these technology will improve the quality as well as ease in community access to water supply, especially in localities water coverage of municipal water supply is low. Adoption of the developed tools and technology by the community will depend upon community awareness regarding availability of tools and technology to the community we all as their understanding about the usage. Understanding this would require a detailed socio-economic study in the area, even done on pilot basis for the

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demonstration purpose. In this context the LOTUS project has a component of socio-economic study of the user community in a used case: tanker-based water distribution system in Bangalore. The socio-economic study will cover: (1) the understanding demographic profile of tanker users, (2) community willingness to pay for the developed technology, and (3) overall change that the adaptation of technology has made in the life of community.

This document covers the detailed background about the proposed methodology to be taken for the socio-economic studies.

3 Approach and Methodology

The socio-economic study is proposed to be conducted in three parts, the first and second part will gather a detailed demographic background of the taker users and a willingness to pay survey. Both first and second part will set the baseline for the study area that will cover the profile of households willing to take the technology, a fair price that the community is willing to pay for the technology, user perception about the difficulties in terms adopting technology, and key issues that are constraining the users towards the adoption of technology. A detailed questionnaire-based survey is proposed that will cover the objectives of this part. The third part of socio-economic study will be conducted once a technology is adopted by a significant size of users in the community. The main objective of the third part would be assessing the community difficulties in terms of use of technology, how use of technology has improved the life and lifestyle of the users in the community. We propose to conduct a difference-in-difference (DID) study for the third part. A detailed questionnaire-based survey will be conducted to gather relevant data, which will be compared by the baseline information as obtained in the first and second part of the study.

3.1 Baseline Study

Baseline study will be conducted to gather the demographic profile of the users in the selected location. The baseline study is background setting for the socioeconomic survey in the study area. The details of the type of information proposed to be captured in the baseline survey are outlined in the table 1 below.

Table 1: Nature of variables captured in the proposed baseline survey

Baseline theme	Variables (Scale of Measurement)	Remarks
Demographic Profile	1. Household members (Size of the household in numbers) 2. Occupational details (Categories) 3. Household income (Rupees) 4. Owner/rented house Social group (Categories) 5. HH members who collects water (Gender) 6. Time taken to collect water (hours per day)	Most questions will be asked using questionnaire survey. Some of the details will be cross-checked using key informants' interview and focussed group discussion.

	7. Amount of storage available (litres / Kilolitres) 8. Daily water demand (litres / Kilolitres)	
Water availability and accessibility	1. Whether pipe connection is available (Categorical) 2. Individual or joint connection (Categorical) 3. Other sources of water supply (Categorical) 4. Time of supply (source wise in hours) 5. Duration of supply (source wise in hours) 6. Whether duration of supply is sufficient (source wise, categorical) 7. How far is the collection point from house premise (source wise, distance in km) 8. Other accessibility issues (qualitative) 9. Seasonal issue with water supply (qualitative) 10. Source wise reliability of water supply (qualitative)	A large part of these questions will be captured by household questionnaire, but some of the details will be cross validated by key informants and focussed group discussion.
Water quality issues	1. Source wise water quality (taste, odour, colour aspects; qualitative) 2. Seasonal issue of water quality (Source wise; qualitative) 3. Other observed quality issues (source wise; qualitative) 4. Whether household filters water or not (categorical) 5. Type of water filtering mechanism (categorical) 6. Other types of treatment to water (categorical) 7. purpose of use of water (source wise) due to quality issues (qualitative) 8. Source wise reliability of water quality (qualitative)	A majority of questions asked to capture water quality will be qualitative in nature, although a sizable section of the enquiry will be captured through household questionnaire using quantitative information. Further, key informants' interview and focussed group discussion will be helpful to capture local issues.

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Water affordability	1. Unit cost of water (source wise; Rupees) 2. Monthly water bill of household (Rupees) 3. Mode of payment (Daily, weekly or monthly) 4. Other cost incurred in treating water (Rupees) 5. Initial cost for installing water supply (source-wise in Rupees) 6. Cost concerns and perception (qualitative) 7. Is the cost volumetric or block (source wise terrif also)? 9. Other cost for storing or transporting water 10. Implication of cost of water in household budget (qualitative)	Most of the questions are quantitative in nature and will be captured through household questionnaire

Sources: Author's illustration

3.2 Willingness to pay (Willingness to accept) study

In a microeconomics term, willingness to pay (WTP) or willingness to accept (WTA) is an approach to evaluate the adoption of goods that are not traded through price either directly or indirectly. For technology adoption related to better supply of water WTP or WTA is an appropriate method to gauge the community willingness for the adoption of technology. WTP study is an important step to gauge how far the technology will be accepted for the sustainable use to its applicability. There are two measures for WTP study: revealed preference and stated preference. In revealed preference, consumer preference is deduced using actual expenditure, whereas in the stated preference consumer is asked about the values they place on a hypothetical improvement (Amit and Sashidharan, 2019). We propose to use stated preference for WTP study since the actual technology and expenditure is not available. The WTP study will also be contingent upon better understanding about two key aspects: strategies employed by the households to deal with issues of water supply, and existing water quality treatment behaviour of households. Both these aspects are covered in the baseline study either quantitatively or qualitatively. WTP for the new technology will be compared with respect to existing strategies of the households. We propose to conduct a technology information session with the households or a group of households with details about the new technology, its functioning and service and maintenance related issues. These information sessions will help the households to make an informed choice for the WTP and the price the household is willing to pay. The information session will also cover specific questions related to household choice options and their willingness. For this, we propose to employ household survey, focussed group discussion and key informant interview. Keeping long-term applicability and impact on the household lifestyle two category of consumers will be chosen from WTP study: one who are willing to accept and has implemented the technology and the other is who has not implemented the technology. Based on the information obtained from the baseline study and post-technology adoption survey, we

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propose to conduct the difference-in-difference (DID) analysis to understand how far the adoption of technology has improved the lifestyle of the people.

4 Research Design

The following section provide a preliminary background for research design of the socio-economic study that will cover the implementation of baseline study as well as WTP survey.

4.1 Study Area

As noted earlier, the study is designed for the use case on tanker-based water distribution in Bangalore. As noted earlier, the study is designed for the use case on tanker-based water distribution in Bangalore. Bangalore is located in the Deccan plateau, towards the south east of Karnataka state with the GPS coordinates of 12° 58' 20.7912'' N and 77° 34' 50.3148'' E. In post-independence the colonial cities were merged in 1949 and then Bangalore was retained the capital of Karnataka state. Gradually Bangalore continued to grow and became 6th largest city with a population of 1,207,000 by 1961. In 1976, the Bangalore Development Authority (BDA) as a regulatory body was formed under the Karnataka Town and Country Planning Act, 1961 with the responsibility to prepare a comprehensive development plan in a prescribed manner. Due to the irregularities by BDA, Bruhat Bengaluru Mahanagar Palike (BBMP) was created in 2007 by merging 100 wards of Bengaluru Mahanagara Palike with seven City Municipal Councils, one Town Municipal Councils and 111 villages around the cities. For smooth functioning of BBMP, it has divided into 8 zones and the number of wards has increased from 198 ward to 243 wards in 2020. See figure 1 for the geographical setup of zone and ward of Bangalore.

Based on the 2011 census, the population of Bangalore urban is 8.7 million constitute of 2.1 million no. of household spread across 804.83 square kilometre. Currently, the main source of water supply to the Bangalore city comes from the Cauvery river under the Cauvery Water Supply Scheme (CWSS). In addition, the city draws a large volume of water from groundwater through borewell and supplied through the water tanker. The water drawn up by CWSS is supplied to the core area of BBMP, covering 575 sq. Km. For another 110 villages of BBMP amounting to 225 sq. Km, water is supplied from borewell sources (BWSSB, n.d.). Figure 2 shows the ward wise sources of drinking water availability in BBMP. It shows that, only periphery wards of Yelahanka Zone are connected through Bangalore Water Supply and Sewerage Board (BWSSB) piped connection where tanker supply is not exist. Otherwise, most of the periphery wards get drinking water through both pipe water supply and tanker supply including both BWSSB tanker supply and private tanker supply. Mahadevapura zone is situated near Bangalore Rural mostly dependent on tanker supply and BWSSB Tanker supply. The present supply from the Cauvery source is 1350 MLD,

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which covers approximately a population of 8.5 million, and the water supply served over an area of 570 sq. Km. The duration of the water supply by BWSSB is 4-12 hr. However, the duration and frequency of BWSSB water supply vary from ward to ward. Due to the irregularities of water supply and insufficient water supply to the periphery wards causes the increase in private tanker supply day by day. Table 2 gives a detailed scenario of the duration of the water supply through BWSSB.

Figure 2 shows the dominant sources of water supply in different wards in Bangalore. It is clear from the figure that wards in the periphery of the city has more dependent upon tanks rather than conventional sources (or municipality connection) for water supply.

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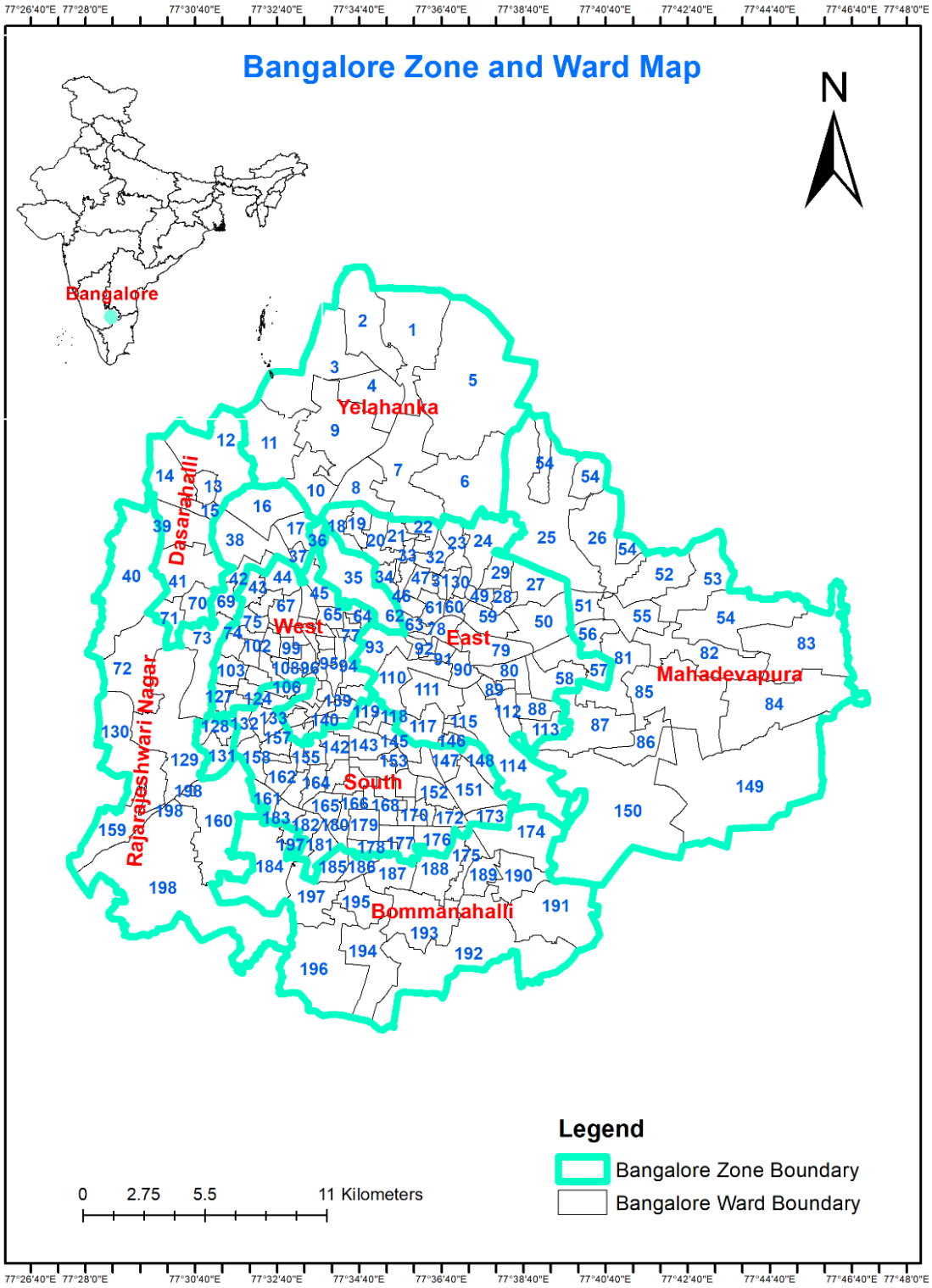
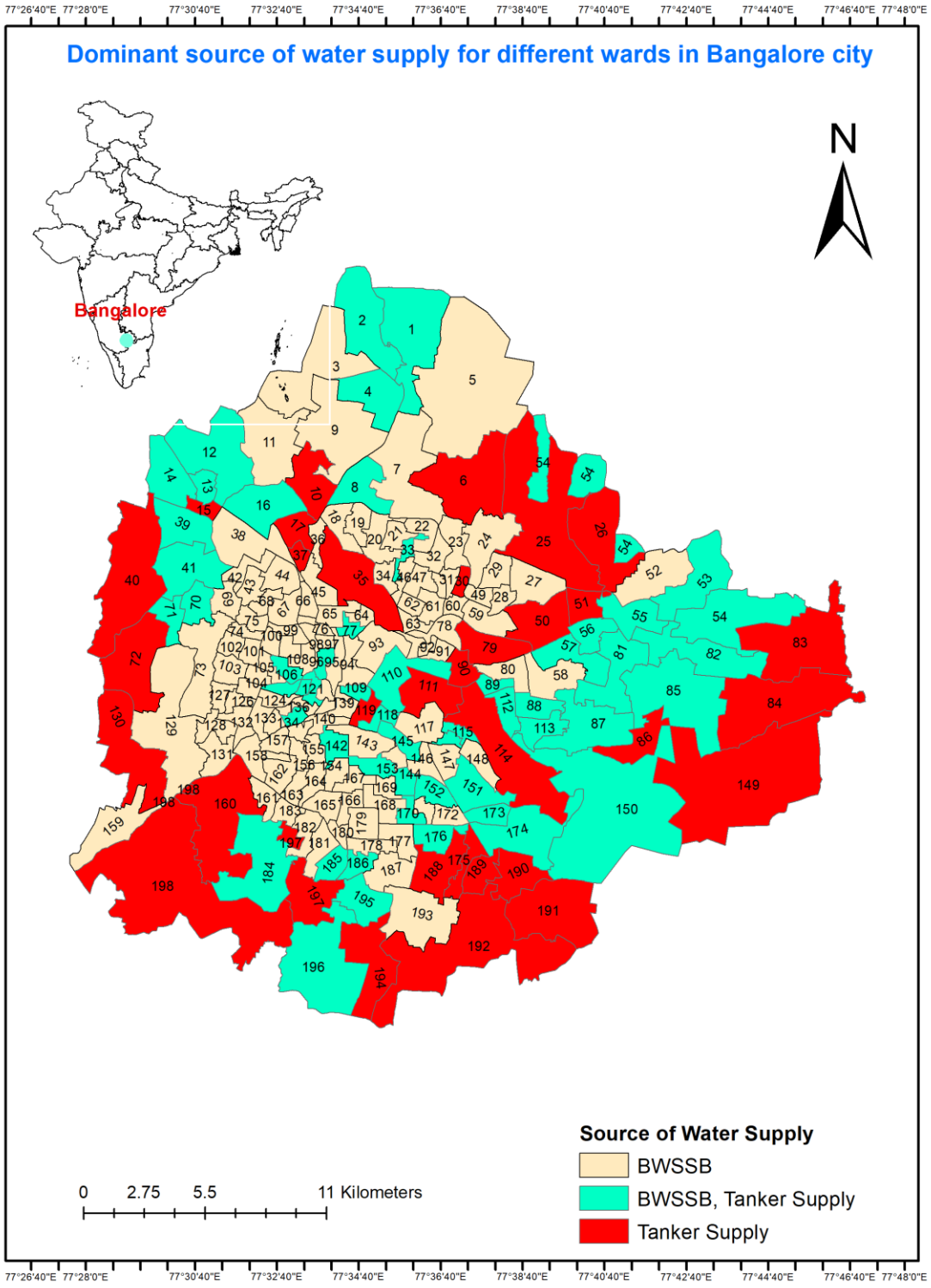


Source: LOTUS-TISS study team

Figure 1: Administrative Boundary of Bangalore city



Source: Bangalore Water Supply and Sewerage Board (n.d.)

Figure 2: Dominant source of water supply for different wards in Bangalore city

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The BWSSB extracts water from surface sources such as lakes and rivers in the city, and additionally, it also hauls out water from a number of borewells within the city. Of the total supply of BWSSB, groundwater contributes about 70 MLD of the 900 MLD. In addition, there are number of private water tankers supply operating to meet individuals demand particularly in the periphery region of the city. BWSSB is responsible for providing licence and permit for the private water tanker supply. According to the BWSSB, it has not given any licence and permit to the private water tanker. So, the legality of private tanker supply is still in question mark. One of the major sources of water for private tanker is private borewell. But there is no proper evidence for extraction of water for private water tanker which results the degraded quality of water. Table 2 shows the details of BWSSB Water Supply in Bangalore city.

Table 2- Details of BWSSB Water Supply in Bangalore

Zone Name	Ward No.	Main Source of Water	Duration of BWSSB Water Supply
West	35	Tanker Supply	NA
	36,66,76,97,120,	BWSSB	8hr on daily basis
	44,45,64,100,103,104,107, 125,127,128,131,135,137,140,141	BWSSB	7.2hr on alternative days
	43,105,94,95,108,126,139	BWSSB	7.5hr on twice in a week
	77,109,121,136	BWSSB, Tanker Supply	7.5hr on alternative days
	65,67,68,74,75,98,99, 101,102,138	BWSSB	Data not available
	96,106	BWSSB, Tanker Supply	Data not available
South	157,177	BWSSB	2.5hr on daily basis
	124,132,134,147,154,156,161-165,171,181-183	BWSSB	7.5hr on alternative days
	155,178	BWSSB	5hr on twice in a week
	133,143,144,146,148,158,166-169,172,179	BWSSB	Data not available

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	142,151,153,170,173	BWSSB, Tanker Supply	6hr on alternative days
	123	BWSSB, Tanker Supply	5hr on daily basis
	119	Tanker Supply	NA
	118,122,145,152,176	BWSSB, Tanker Supply	Data not available
East	18,19,48,63,92,93,117	BWSSB	8hr on alternative days
	61	BWSSB	4hr on daily basis
	20-24,27-29,31,32,34,46,47,49, 58,59,60,78	BWSSB	Data not available
	62,80,91	BWSSB	6.5hr on once a week
	89,110,112	BWSSB, Tanker Supply	9hr on alternative days
	33,57,88,113,115,116	BWSSB, Tanker Supply	Data not available
	30,50,79,90,111,114	Tanker Supply	NA
Yelahanka	7	BWSSB	8hr on alternative days
	9	BWSSB	8hr once a week
	3,5,11	BWSSB	8.5hr on twice a week
	1,4	BWSSB, Tanker Supply	6hr on once a week
	2	BWSSB, Tanker Supply	12hr on alternative days
	8	BWSSB, Tanker Supply	4hr on twice a week
	6,10	Tanker Supply	Data not available
Mahadevapura	52	BWSSB	6hr on alternative days
	55,82	BWSSB, Tanker Supply	4hr on once a week
	54,56,81	BWSSB, Tanker Supply	9hr on twice a week

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	85,150	BWSSB, Tanker Supply	8hr on thrice a week
	53,87	BWSSB, Tanker Supply	Data not available
	25,26,51,83,84,86,149	Tanker Supply	Data not available
Bommanahalli	193	BWSSB	18hr on once a week
	187	BWSSB	7hr on twice a week
	174,185,195	BWSSB, Tanker Supply	6hr on alternative days
	186	BWSSB, Tanker Supply	8hr on thrice a week
	184,196	BWSSB, Tanker Supply	5hr on twice in a week
	175,188-192,194,197	Tanker Supply	Data not available
Raja Rajeshwari Nagar	73,159	BWSSB	2hr on alternative days
	38	BWSSB	5hr on daily basis
	129	BWSSB	4hr on once a week
	69	BWSSB	7hr on thrice a week
	42	BWSSB	12hr on twice a week
	16	BWSSB, Tanker Supply	7hr on thrice a week
	17,37,40,72,130,160,198	Tanker Supply	Data not available
Dasarahalli	70	BWSSB, Tanker Supply	8hr on alternative days
	39	BWSSB, Tanker Supply	Data not available
	13,14,41,71	BWSSB, Tanker Supply	9hr on once a week
	12	BWSSB, Tanker Supply	3hr on thrice a week
	15	Tanker Supply	Data not available

Source: Bangalore Water Supply and Sewerage Board (n.d.)

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The charges from private water tankers vary from location to location. For example, in Kalyan Nagar, a tanker of 5000 liters capacity comes for INR 550. Similarly, a 5000 liters capacity tanker comes for INR 800 for Benson town. The cost of water tanker lorries provide by BWSSB is INR 540 for 6000 liters (George, 2019). As of 2016, approximately 908,000 service connections are registered in BWSSB, whereas 865,000 connections are metered connections (JICA, 2017). Table 3 shows the pricing details of tanker water supply in different areas in Bangalore city.

Table 3- Details of Private Water Tanker Supply in Bengaluru

Details of Private Water Tanker Supply in Bengaluru			
Sl. No	**Area Name**	**Tanker Capacity (in Litre)**	**Price (in INR)**
1	HSR layout	5,000	1,200-1,500
2	Horamavu- Agara	5,000	700
3	Kalyan Nagar	5,000-7.000	550-650
4	Yashwanthpur	6,500	800
5	Benshon Town	5,000	800
Source: George (2019)			

4.2 Sample and sampling design

As discussed above, we will focus ward no. 86 and ward no. 150 for socio-economic study. Being in the periphery of the city, ward no. 86 does not have better access to piped water supply and is depended upon the other sources. Whereas ward no. 150 is chosen due to its larger coverage of piped water supply in the area and part of the requirement of water supply is augmented by tankers supply. The rationale for choice of these wards is to check how far the improvement in technology is accepted in wards that has larger tanker water supply based (i.e. ward 86) and taker water is used as augmented supply (as in ward 150). This will help our understanding in terms of differential pattern of acceptance of technology in a location of varies background and will be useful for generalization of our understanding from the use case.

Background information about tanker water users in the wards are taken from JustPaani, an active organization working on water supply issues in the regions. JustPaani has a good reputation among tanker water suppliers as well as tanker water users in the area. Our sampling frame will be based upon the information collected from JustPaani. Tanker water users in the ward will represent the population for study. At the moment, based on our discussion with representatives of JustPaani, we are promised to get basic information about tanker users in the selected wards. Exact details will be framed once the information will be available that will refine our sampling frame. Sample for the baseline as well WTP study will be taken from the sampling frame, derived from the list of information provided by JustPaani. At the moment, we propose stratified random sampling for the

study, but we keep a provision revise our sampling contingent upon the information collected from JustPaani. The stratification will be based on the criteria defining two labels: one who are using piped water supply as the main source and taker as an augmented source, and others who are using taker supply as the main source. Details of sampling will be decided after the information of water tanker users received from JustPaani.

From a policy perspective, it is essential to know how much people are willing to pay for clean and safe drinking water. Further, it is also imperative to examine whether better informed people are willing to pay more for access to better quality of water than the uniformed people. Stated preference methods use survey techniques to elicit willingness to pay for a marginal improvement. These methods are typically of two types, contingent valuation surveys (WTP) and choice experiments. Contingent valuation, the most direct approach, provides a means of deriving values that cannot be obtained in more traditional ways. The simplest version of this approach merely asks respondents what they would be willing to pay for a change in environmental quality (such as an improvement in water quality) or on preserving the resource in its current state. The responses reveal wither a lower bound or an upper bound to pay for an improvement in the quality of the environmental commodity in question. The contingent valuation survey approach creates a hypothetical market and asks respondents to consider a WTP question contingent on the existence of this market. It should also be noted at this stage that contingent valuation questions come with their own set of challenges and present many biases. Efforts in the actual survey should aim to reduce these to as much minimum as possible.

4.3 Expected outcomes

The following are the expected outcomes from the survey exercise conducted in the urban locations of Bengaluru.

- Quantitative data on how much people are willing to contribute for enhanced water quality in the urban region
- Important factors that influence people's willingness to pay for cleaner water
- Locational differences in willingness to pay for improved water quality and variability of these differences across different groups of sample
- Impact of having better water quality on livelihood outcomes

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6 Appendices

6.1 Annex 1

A semi structured questionnaire for focus group discussion and interview.

1. Water availability and accessibility

1. What are the primary sources of water supply to your area?
2. Is your area connected through the pipe line water supply?
3. If yes, which year did you get pipeline water supply?
4. Before pipe line water supply what was the source of water supply to your area?
5. What is the duration of pipe line water supply to you area?
6. Is it sufficient for you? If no what are the alternatives you use to get water?
7. What are the seasonal issues of water supply in your area?
8. How do you cope up with the seasonal issues?
9. Is tanker water supply available in your area?
10. What is your opinion on tanker water supply?
11. Do you know the sources of tanker water supply in to your area?

2.Water quality issues

1. Do you know the quality of water you are getting?
2. How do you know the quality of water?
3. Is there any seasonal issue with respect to the quality of water?
4. What are the technology you use to treat the water?
5. Do you get the water quality before delivery of tanker water?

3.Water affordability

1. How much do you pay for the pipeline water and tanker water? (ask source wise)
2. What are the other cost to get pipeline connection in your area?
3. Is there any additional cost you need to spend on storing and transporting of water to your house?
4. What is the implication of cost of water on your household budget

6.2Annex 2

Household survey questionnaire

Questionaries Filled By:

[0] Descriptive identification of household					
Questionnaire No.		Filled by:		Date	
GPS Coordinate					
Zone name		Ward No		Ward name	
Respondent Name		Relation with the HoH			

Date:

[1] Household characteristics							
1	Household size	Male			6	Domicile status	
		Female			7	Do you have separate kitchen? (code)	
		total			8	Do you have separate bathroom? (Code)	
2	Gender of head of household (code)						
3	Age of head of household				9	Do you have separate latrine? (Code)	
4	Owner status (code)				10	Contact number (if available)	

5	Social group (code)				

Code for household characteristics:

Item 2- **Gender of head of household**: male-1, female-2

Item 4- **Ownership status:** owned-1, ranted-2, others-9

Item 5- **Social Group**: SC-1, ST-2, OBC-3, General-4, Others-5

Item 7,8,9- yes-1, no-2

[2] Family members information							
1	Name	Sex (M/F/others)	Years of education (years completed)	Age	Relationship to HoH**	Main Occupations***	Monthly average income (Rs.)

**** 1.Self, 2.Spouse/partner, 3.Son/daughter, 4.Son-in-law/daughter-in-law, 5.Stepson/stepdaughter, 6.Grandchild, 7.Brother/sister/, 8.Brother-in-law/Sister-in-law, 9.Father/Mother, 10.Father-in-law/Mother-in-law,11.Grandparent, 12.Other family member, 13. Household help/maid, 14.Lodger, 15.Friend, 16.Others**

***** 1. Household work, 2. Wage earner, 3. Regular employment, 4. Self-employment, 5. Student, 6. Un-employment, 7. Child up to 4 years, 8. Not going to school, 9. Infirm or disabled, 10. Others**

[3] water supply and access information						
SN	Sources of water	1.principal sources of water (record against the applicable sources in priority basis(1-9)	2.frequency of the sources of water. (daily-1 alternative day-2 weekly once-3 weekly twice-4 weekly thrice-5 don't know-99)	3.distance to the source of water	4. time taken, in a day, to reach the source of drinking water and back (in minutes)	5.who fetches drinking water? See code
1	Bottle water					
2	Piped water into dwelling					
3	Piped water into					

	yard/plot					
4	Public tap					
5	Tube well/borewell					
6	Private tanker					
7	Rainwater collection					
8	Surface water (tank or pond)					
9	Others					

SN	Sources of water	6.waiting time, in a day, at the source of drinking water (in minutes)	7.purpose of use Drinking/cooking only-1, bathing-2, All purpose-3	8.dowes time changes seasonally? 1.Monsoon-June to Sept 2. Summer March to June 3.Winter Dec-Feb 4.Post monsoon-October and November	9.Is the water enough for your household requirements? 1.Yes, 2. No 3. Don't know	10. Do you pay for water? 1.Yes, 2. No
1	Bottle water					
2	Piped water into dwelling					
3	Piped water into yard/plot					
4	Public tap					
5	Tube well/borewell					
6	Private tanker					

7	Rainwater collection					
8	Surface water (tank or pond)					
9	Others					

SN	**Sources of water**	**11.** How much-on average-you use daily (in liters)	**12.** If yes, how much? (Rs. /month) - by source	13. Is there any problem with the pressure of water supply? 1.Yes, 2. No 3. Don't know	14. If yes for 11, Specify which season you face the problem 1.Monsoon-June to Sept 2. Summer March to June 3.Winter Dec-Feb 4.Post monsoon-October and November	15.how do you cope with the problem? (adjustwith less water-1, buy from tanler-2, bring water from nearby place-3,buy water from nearby place-4, others-5
1	Bottle water					
2	Piped water into dwelling					
3	Piped water into yard/plot					
4	Public tap					
5	Tube well/borewell					
6	Private tanker					
7	Rainwater collection					

8	Surface water (tank or pond)					
9	Others					

SN	**Sources of water**	**16.** What is the cost of new connection? (in Rs.)	**17.** How much time does it take to get the connection? (in days)	18. How difficult is it to get a connection? (indicate whether:1. Easy,2. Difficult, 3.Very Difficult, 4.can't say)	19. How is the sanitary condition around source? 1.Clean 2. Average 3. Dirty, but can be cleaned 4. Very dirty, will require significant effort to clean 5.Cannot say	**20.** During a water supply problem, how quickly do the service providers respond**? (indicate whether: 1. Prompt, 2. takes some time, 3. Delayed, 4. never responds)**
1	Bottle water					
2	Piped water into dwelling					
3	Piped water into yard/plot					
4	Public tap					
5	Tube well/borewell					
6	Private tanker					
7	Rainwater collection					
8	Surface water (tank or pond)					

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9	Others					

[4] Water quality information						
SN	**Sources of water**	**1** How is the water quality (drinking water) in the area? Sweat-1,Salty-2, Muddy-3,Insects in water-4,Others-5	**2** Odour in water (1. Yes,2. No,3. Can't say)	**3** Colour of water No colour-1 Yellowish-2 Blakish-3 Reddish-4 Can't say-5	**4** Are there any seasonal issues in quality? (1. Yes, 2. No, 3. Can't say)	**5** What do you usually make water safe to drink? Nothing-1 Boil water-2 Use alum-3 Strain through cloth-4 Let it stand and settle-5 Add bleach or chlorine tablet-6 Other (specify)-7
1	Bottle water					
2	Piped water into dwelling					
3	Piped water into yard/plot					
4	Public tap					
5	Tube well/borewell					
6	Private tanker					
7	Rainwater collection					
8	Surface water (tank or pond)					

9	Others					