

Urban Infrastructure

The Problem

India is urbanizing rapidly. The number of metropolitan cities in India with a population of 1 million and above has increased from 35 in 2001 to 50 in 2011 and will further rise to 87 by 2031. India has been on a trajectory of accelerated urban growth and is now poised to more than double its urban population during the next 20 years. However, the pace of urbanization does not match the delivery of services in cities, leading to environmental pollution and deteriorating public health. Further, demographic changes are expected to result in an increase in the number of people in the working age group with high expectations of a better future. It is estimated that inadequate sanitation costs India Rs. 2.4 trillion a year and the national cumulative sanitation market has the potential of Rs. 6.87 trillion (US\$152 billion) over the 2007-2020 period (World Bank, 2011).

As the largest Indian state in terms of area, Rajasthan has a population of 69 million people with an urbanization ratio of 25%, less than the national average of 28%. As an important destination for tourism, the West Indian city of Udaipur witness's significant international tourist footfall. Udaipur's population is expected to rise to about 1 million by 2043, making the delivery of urban development services that affect health and hygiene crucial for future growth. Provisions for 24x7 supply of piped water, sewerage and treatment networks, and solid waste management are, therefore, critical for continued growth and prosperity of the city.

This paper conducts a cost-benefit analysis (CBA) of three urban interventions aimed at providing: 24x7 piped water supply, 100 percent coverage for sewage and wastewater treatment, and 100 percent management of solid waste (collection, transportation and treatment).

Solutions

Interventions	BCR	Benefit (INR Crores)	Cost (INR Crores)
24x7 piped water supply	2.3	5,276	2,320
100 percent coverage for sewerage and waste water treatment	1.1	1,489	1,298
100 percent solid waste management	2.0	906	461

All figures assume a 5 percent discount rate.

The full paper by **Gagan Nigam** from IL&FS and **Priyesh Shukla** and **Manish Gupta** from PDCOR is available on www.rajasthanpriorities.com/urbaninfrastructure

24 X 7 supply of piped water

The Problem

Rajasthan has the lowest availability of water and the least reliable supply in the country with only 162 of its 222 towns receiving water every day (World Bank, 2012). The availability of water varies largely from daily to once every three days. Only 23 towns have a service level above 100 Lpcd. Moreover, the

state's water supply infrastructure is ageing and is badly in need of upgrades and revamping.

It is projected that by 2045, Rajasthan will face a demand-supply gap of 3,037 MLD in both groundwater and surface water. The Rajasthan State Water Policy envisions 24x7 piped water supply with 100 percent coverage and cost recovery by

2025. It also seeks to “encourage private initiative in water sector”.

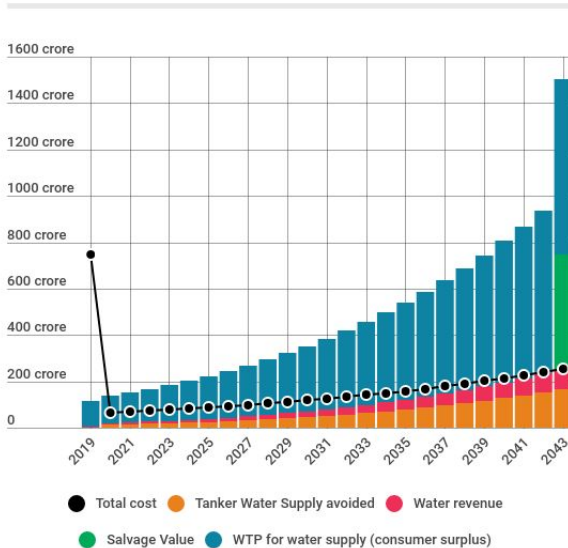
As much as almost 80% of Udaipur is covered by the piped water network. However, more than half of approximately 78,000 connections are old, dilapidated and need replacement, as per the City Development Plan (2041). More than 60% of the pumping station infrastructure needs replacement.

The Solution

This intervention intends to provide 24x7 piped water supply to ensure 100% coverage of all households, with significant improvement in the service quality. The intervention shall benefit more than 1 million residents during the implementation period.

The implementation may be carried out through Public Health and Engineering Department (PHED), Rajasthan. Alternatively, the PHED can implement the same through Public Private Partnership.

Urban 24 X 7 supply of piped water total costs and benefits 2019 - 2041



Costs and benefits in crore rupees from author's estimates

Costs

The project life is assumed to be 25 years. It shall start in the year 2019 and continue through till

2043. The entire capex is planned in the first year. In the subsequent years, additional capex for the incremental population will be incurred.

The net present value of the total cost of the intervention to ensure 24x7 piped water supply at 5% discount rate is approximately Rs. 2,320 crores. This comprises direct costs – capex, opex and cost of water supply through tankers (in year 1), and indirect costs – social costs of traffic disruption and delay due to construction.

Benefits

The net present value of the total benefits of Intervention I at 5% discount rate is approximately Rs. 5,276 crores. The benefits comprise direct benefits – revenues accrued through the tariffs, salvage value and cost of alternate water supply, and indirect benefits – consumer surplus from water supply services.

100 percent coverage for sewerage and waste water treatment

The Problem

On the sewerage and waste water treatment front, it is to be noted that only 24% households have access to closed drainage in Rajasthan. Besides, as few as 11 cities have access to partial sewerage (World Bank, 2012).

Over 50% of the population in Udaipur is yet to be connected to the sewerage network and treatment infrastructure. As a result, a significant share of wastewater generated in Udaipur flows in to pollute the Ahar river (CRISIL, 2014) which is now akin to an open drain. This has resulted in loss of aquatic life due to low levels of dissolved oxygen and severe groundwater contamination.

The Solution

The intervention aims to ensure 100% coverage of the city's sewerage network and provisions for waste water treatment. The intervention shall benefit more than 1 million residents of Udaipur during the implementation period. This would also help maintain the cleanliness of the Ahar river, which is currently polluted by the sewage that flows into it. The implementation may be carried out

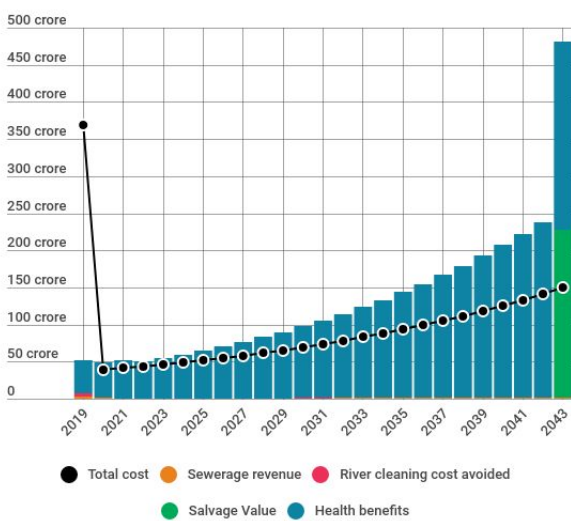
through the Udaipur Municipal Corporation (UMC) or PPP mechanisms.

Costs

The project life is assumed to be 25 years. It shall start in the year 2019 and continue through till 2043. The entire capex is planned in the first year. In the subsequent years, additional capex for incremental population will be required.

The net present value of the total cost of this intervention is approximately Rs. 1,298 crores. The cost comprises direct costs – capex and opex, and indirect costs – social cost of traffic disruption and delay due to construction.

Urban sewerage and wastewater treatment total costs and benefits 2019 - 2043



Costs and benefits in crore rupees from author's estimates

Benefits

The net present value of the total benefits for Intervention 2 is approximately Rs. 1,489 crores. The benefits comprise direct benefits – sewerage revenues accrued through the tariffs, salvage value of the project, cost avoided for cleaning river and indirect benefits – avoided disability adjusted life years (DALYs).

100 percent Solid Waste Management

The Problem

Rajasthan lags in municipal solid waste (MSW) management, as no city from the state has managed to make it to the list of top 150 cities as per Swachh Survekshan 2017, the country's Swachh Bharat Abhiyan survey.

Though Udaipur generates approximately 120 MT of municipal solid waste every day (Udaipur Municipal Corporation and Janaagraha Centre for Citizenship & Democracy, 2017), the city lacks facilities for waste segregation, processing and treatment. Door-to-door collection services cover only approximately 20%; moreover, segregation and processing are not carried out.

The entire bulk of MSW generated is dumped in the Titri landfill, located about 15 km away from the city. Udaipur has been ranked 310 among 434 cities for sanitation, as per Swachh Survekshan 2017.

The Solution

This intervention targets 100% collection, transportation, and management of solid waste with minimum landfill use (as per MSW Rules 2016). This shall benefit more than 1 million residents of Udaipur during the intervention period. The intervention will lead to reduction of environmental impacts and outbreak of vector-borne diseases. The initiative may be undertaken by the Udaipur municipal corporation directly or in a PPP mode.

Costs

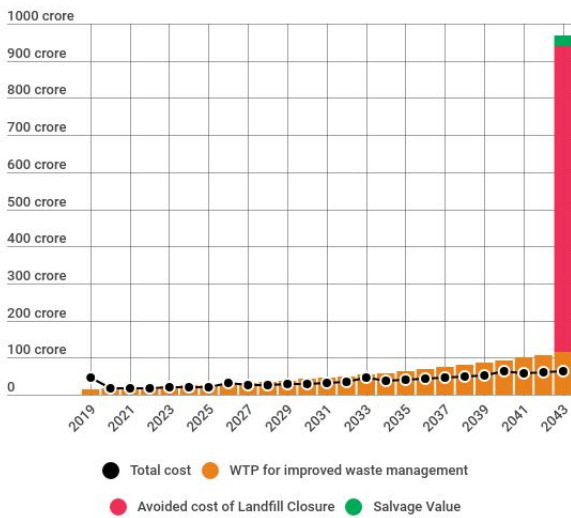
The project life is assumed to be 25 years. It shall start in the year 2019 and continue through till 2043. The capex is planned to be 100% in the first year. In the subsequent years, additional capex for the incremental population is required.

The net present value of the total cost of for this intervention is about Rs 461 crores. This comprises direct costs – capex and opex. The collection and transportation infrastructure will need to be replaced multiple times during the project life given that the life of vehicles in this application is on an average about 8 years.

Benefits

The net present value of the total benefits of this Intervention is about Rs 906 crores. This comprises direct benefits – revenues accrued through the sale of compost and Refuse Derived Fuel (RDF), salvage value of the project, savings in land value due to the intervention, and indirect benefits – landfill closure cost avoided and willingness to pay for improved waste management.

Urban waste collection 100 percent total costs and benefits 2019 - 2043



Costs and benefits in crore rupees from author's estimates