

Community
Engagement

Planning Tools

Technology

Livelihood Opportunity

Construction Technology

Business Model

Resource
Conservation



WATER



SANITATION



HYGIENE

10

INNOVATIVE APPROACHES TO IMPROVE THE URBAN WA-S-H SECTOR IN INDIA

IHUWASH Project supported by USAID

TITLE

10 INNOVATIVE APPROACHES TO IMPROVE THE URBAN WA-S-H SECTOR OF INDIA

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DISCLAIMER

The Innovation Hub for Urban-Water Sanitation and Hygiene (IHUWASH) project, supported by the United States Agency for International Development (USAID), intends to agglomerate and disseminate knowledge related to various innovations in the WASH sector, in India. It does not support/promote any of the innovations documented in this booklet. The purpose of documentation is only for cross-learning purposes and to raise awareness of different stakeholders in this sector, specifically, the administration of participant cities in the project. Design aspects of innovations and their performance are not endorsed by the publisher of this booklet.

10

INNOVATIVE APPROACHES TO IMPROVE THE URBAN WA-S-H SECTOR OF INDIA

IH UWASH Project supported by USAID



WATER



SANITATION



HYGIENE

ABOUT IHUWASH PROJECT

The IHUWASH project aims to improve performance of the urban WASH sector in India by following a process of agglomeration (compilation of best practices), incubation (supporting innovative solutions) and acceleration (giving momentum to innovations). IHUWASH is a collaborative initiative of the National Institute of Urban Affairs (NIUA), lead partner; and TARU Leading Edge Private Limited, IRC and Ennovent. Yes Bank and Valluri Technologies are strategic partners in the project.

ABOUT STUDY CITIES

Three cities, Faridabad, Mysore and Udaipur from the states of Haryana, Karnataka and Rajasthan, respectively, have been selected. The aim is to improve performance of the urban WASH sector in these cities through innovative solutions. The project duration is for three years beginning 2016.

Faridabad

The city is located in the state of Haryana and is about 32 kms to the south of the state of Delhi. According to Census 2011, Faridabad was the most populous city in Haryana with a population of 1.4 million. The Ministry of Urban Development (MoUD) ranked Faridabad's sanitation status - 33.25. It has been awarded 'Fastest Mover Big City' by Swachh Survekshan 2017, conducted by the MoUD. It achieved a rank of 88 amongst the 434 cities surveyed across India. Faridabad has been selected under the Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Swachh Bharat Mission (SBM): the three missions launched by MoUD.

Project potential

Faridabad is ranked ninth amongst the largest industrial estates in Asia and is still growing. Out of a total of 11,665 registered working factories in Haryana, 2,499 were in Faridabad. Its strategic location within the Delhi-NCR region will allow access to support from numerous government agencies and academic institutions in terms of technical and capacity building. The Smart City Mission, AMRUT and SBM are being implemented in the city. All these factors offer tremendous potential for public-private- partnerships (PPPs).

Udaipur

Located within the State of Rajasthan, Udaipur is famous for its palaces, lakes (Pichola, Rang Sagar, Fateh Sagar, Swaroop Sagar, Badi Talab, Madar and Udai Sagar) and gardens. It is located about 430 km to the south of the state capital, Jaipur, and about 670 km to the south of Delhi. It is the sixth largest city in the state and has been selected under the Smart City Mission. In the context of sanitation the city scored only 31.95 marks out of 100, in

2009. This places it in the red category where immediate attention to public health and the environment is indicated. In the latest Swachh Survekshan 2016 conducted by the MoUD for 73 cities, Udaipur was not included. However, in Swachh Survekshan 2017, the city is ranked to 310 out of 434 cities. The city has now prepared its City Sanitation Plan (CSP) under the National Urban Sanitation Policy (NUSP). The city has also been selected under SBM and AMRUT.

Project potential

Udaipur has a high influx of tourists. This floating population poses a challenge to the city administration in terms of toilets, solid waste management and water supply. The Udaipur Chamber of Commerce and Industry (UCCI), a not-for-profit, industry led and industry-managed organization has supported development of an environment park covering 100,000 sqft in the city. Apart from UCCI, there is a marble industry association and many other private industries, which can support implementation of innovative sanitation solutions. Udaipur has been identified as a smart city based on a competitive proposal submitted to the MoUD and, therefore, has demonstrated willingness to increase the existing infrastructure in the city.

Mysore (Mysuru)

The city is the second largest in the state of Karnataka, and an educational, commercial and administrative hub. It is an important tourist and heritage centre located only about 135 km from the state capital, Bengaluru. It is located in the foothills of the Chamundi Hills and stretches over 128.42 sqkm. Census 2011 reports a population of 893,062 living in 209,527 households in the city. Mysore (Mysuru) was ranked first in Swachh Survekshan 2016, however, it was downgraded to number five in Swachh Survekshan 2017. The city is not included in the Smart City Mission but is part of AMRUT and SBM.

Project potential

Mysore (Mysuru) had a ranking in Swachh Survekshan 2016 that indicated satisfactory sanitation services. The city leads in sanitation management and can be a model for other cities. As it has already reached an advanced stage in providing basic services, there is scope to pilot other innovative sanitation models, establish a WASH park, set up WASH laboratories, under the city administration.

PROJECT SITES





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ABOUT INNOVATIONS DESCRIBED IN THIS BOOKLET

The goal of the IHUWASH project is to improve performance of the urban WASH sector in the country through agglomeration, incubation, and acceleration of innovations to address WASH issues. The first stage of this process, agglomeration refers to compiling the existing key innovations which have significantly influenced the WASH sector, ideally from across the globe. Nevertheless, to sensitize local stakeholders, innovations which have significantly improved the WASH sector in India are documented in this booklet. To do this, innovations which have gained popularity in the past decade, and which have also improved living conditions of the urban poor were examined, before documenting them in brief. A set of criteria were used prior to selection of the innovation.

Criteria To Select Innovations

1. Served to fundamental requirement of Water, Sanitation or Hygiene aspect
2. Addressed specific issue
3. Added Value in terms of quality of life, opportunity cost, safety and security
4. Conserved resources (e.g. water, energy, cost)
5. Delivered quality services
6. Are sustainable in terms of life cycle cost, business model and livelihood opportunity

Innovations are grouped under three broad categories – water, sanitation and hygiene. To specifically highlight which aspect the innovation addresses, sub-categories were formed.



SUB-CATEGORIES

Technology: Innovations that improved the treatment of water as well as wastewater.

Livelihood opportunity: Implementation allowed the urban poor to engage themselves in activities that improved livelihood opportunities.

Community engagement: Innovations that developed community ownership of WASH projects.

Resource conservation: Innovations that conserved water resources and encouraged use of wastewater.

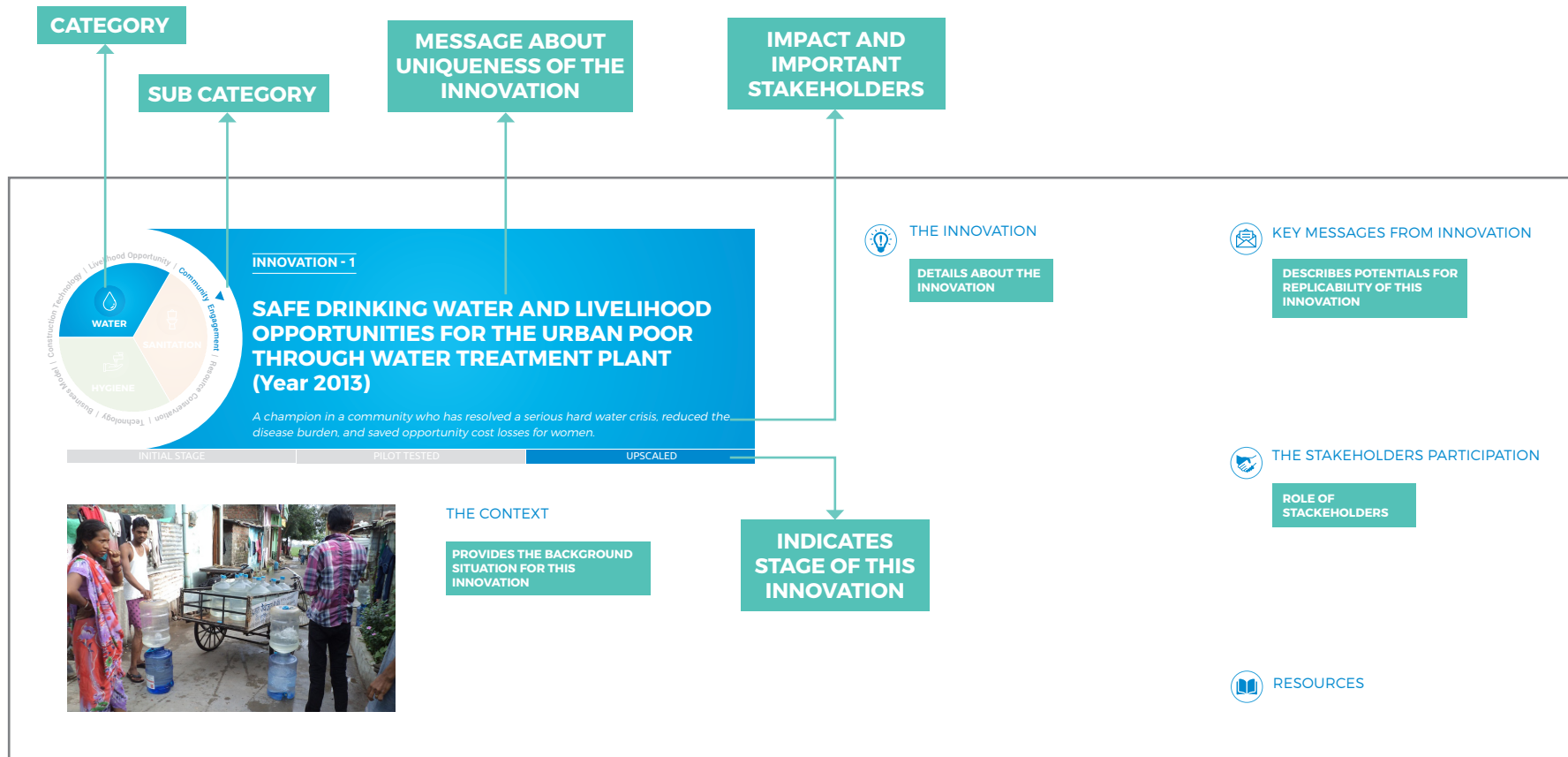
Construction technology: Innovations that improved the shelf life of products used in WASH projects.

Innovations documented in this booklet are at different stages since they were first introduced. Some have still not been accepted widely and are in the initial (incubation) stage. Some are pilots, that have been tested in different parts of India and which have gained some momentum, while others have been scaled up, but are not yet recognised, particularly, by the government for inclusion in existing policies and programs of relevant ministries. Purpose of this booklet

Objectives of documentation

The main purpose of documenting innovations in the WASH sector is to sensitize important stakeholders in the three participant cities– Faridabad, Mysore and Udaipur. The innovations are expected to encourage potential stakeholders to adopt, either these innovations or introduce similar innovations to improve WASH performance in their cities. Apart from this, understanding ongoing innovations would enable the IHUWASH team to appreciate factors that determine, both, success as well as failure. The documentation will be used as an example in workshops, lecture series, etc. to stimulate discussions on various thematic areas among stakeholders.

KEY TO READ THE INNOVATIONS



INTRODUCTION

The WASH sector demands increasing attention as cities are growing at a rapid pace, without enhancement of infrastructure. Habitable conditions of the urban poor are harsh, and this makes them more vulnerable. Inadequacy of WASH services has serious implications on health and socio-economic conditions of poor urban populations.

National missions like Swachh Bharat Mission (SBM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Smart Cities Mission – launched by the MoUD have set targets for improving WASH in Indian cities. To achieve these targets, it is imperative to consider innovative approaches along with conventional systems.

The project on IHUWASH solutions in India, aims to incubate, accelerate and scale up innovations in the WASH sector in three Indian cities – Faridabad, Mysore and Udaipur.

WHAT ARE INNOVATIONS?

'Innovation' is commonly understood to be a "new method, idea, product etc."¹ Further researching reveals it to be "The process of translating an idea or invention into a good or service that creates value or for which customers will pay. To be called an innovation, an idea must be replicable at an economical cost and must satisfy a specific need. Innovation involves deliberate application of information, imagination and initiative in deriving greater or different values from resources, and includes all processes by which new ideas

are generated and converted into useful products. In business, innovation often results when ideas are applied by the company in order to further satisfy the needs and expectations of the customers".²

The landscape for innovations in India is vast. Attempts have been made at various levels (both government and non-government) to promote innovative ideas. Primarily innovations have remained part of novel approaches in the scientific arena to address specific problems. Engineering solutions have been developed mostly in the form of technologies. However, with time, the concept of innovation has expanded to include wider dimensions like socio-economics and has also found space in national policies and programs. The Government of India (GoI) has created various platforms to disseminate innovations, covering a wide spectrum of issues.

GoI initiatives on innovations

Recognizing the importance and also the need to increase quality and quantity of innovations, the GoI established the National Innovation Foundation (NIF)³ in the year 2000, with assistance from the Department of Science and Technology (DST). It strived to strengthen grassroots technological innovations and outstanding traditional knowledge. Recently, in the year 2015, the National Institution for Transforming India, known as NITI Aayog⁴ was established as the principal think-tank of the GoI, replacing the Planning Commission of India. To drive this institution, two hubs were created – Team India Hub and Knowledge and Innovation Hub. Essentially, the latter builds the capacity of NITI Aayog.

¹Google

²<http://www.businessdictionary.com/definition/innovation.html>

³<http://nif.org.in/aboutnif>

⁴<http://niti.gov.in/>

Atal Innovation Mission (AIM)

To escalate innovations and entrepreneurship, the GoI launched the AIM⁵ with the aim to promote innovations, grand challenges, startup businesses, and other self employment activities, particularly in technology driven areas.

Variants of Innovations

Apart from initiatives at the national level, there are many attempts by private institutions, organisations and individuals to promote innovations, in India, in different sectors including WASH. Many philanthropic foundations of corporates in India use their Corporate Social Responsibility (CSR) activities to support innovations.⁶

Variants of Innovations



GLOBAL INNOVATION INDEX (GII)¹

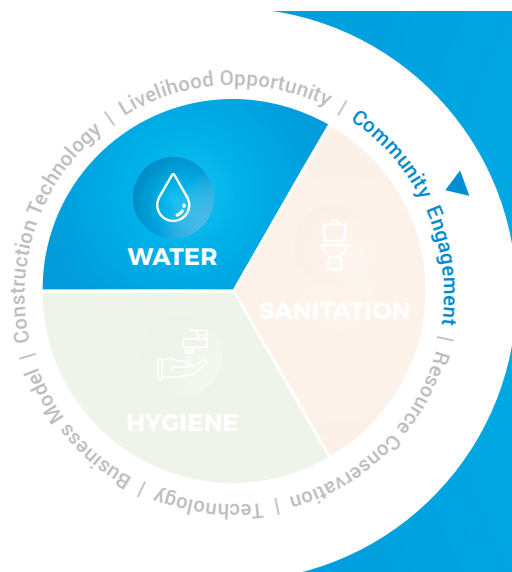
1. Co- published by World Intellectual Property Organization (WIPO), Cornell University and INSEAD.
2. The GII aims to capture multi-dimensional facets of innovation and provide tools that can assist in tailoring policies to promote long-term output growth, improved productivity, and job growth.
3. The core of the GII Report consists of a ranking of world economies' innovation capabilities and results.

INDIA INNOVATION INDEX (III)

1. NITI Aayog launched III on 2nd February 2017.
2. It is a collaborative effort of NITI Aayog, Department of Industrial Policy and Promotion (DIPP) and Confederation of Indian Industry (CII).
3. The objective of III is to rank Indian states on innovations and provide an enabling environment to build an ecosystem for these innovations.

⁵<http://niti.gov.in/content/atal-innovation-mission-aim>

⁶http://niti.gov.in/writereaddata/files/NITIAYog_Presentation.pdf



INNOVATION - 1

SAFE DRINKING WATER AND LIVELIHOOD OPPORTUNITIES FOR THE URBAN POOR THROUGH WATER TREATMENT PLANT (Year 2013)

A champion in a community resolved serious hard water crisis, reduced the disease burden, and saved opportunity cost losses for women.

INITIAL STAGE

PILOT TESTED

UPSCALED



Personal collection of Dr. Uday Bhonde

THE CONTEXT

In the city of Indore, situated on the Malwa Plateau in Madhya Pradesh, water is supplied by an 80 km distant reservoir. The Malwa region is covered by hard rock, the groundwater is deep, and it is depleted in summer. Many low socio-economic clusters in the city are supplied groundwater through public stand posts that are connected to community bore wells. In Rahul Gandhi Nagar, a notified slum developed under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in the north of the city, water was supplied by community bore wells. There were high levels of total dissolved solids (TDS), far above permissible limits, and E-coli issues in this supply. Water quality affected the life of people who suffered; diarrhoea and gastroenteritis were common. Water quality also affected their daily cooking: milk was curdling and cooking time for pulses increased. People wished to have safe drinking water supply at their doorstep so as to improve their quality of life.



THE INNOVATION

An institution named 'Amrut Pey Jal' under the leadership of a champion was formalised for decentralised water management in this poor urban community. A reverse osmosis



plant with a capacity of 3,000 LPH was installed to improve quality of water supplied through municipal bore wells. In addition, a rainwater harvesting structure was constructed for recharging bore wells. Rejected water from this plant was used for flushing in community toilets. Further, installation of the rainwater harvesting structure ensured groundwater recharge.

A very important component of this project was the innovative business model that took care of all monthly operation and management costs of the RO plant. This included the salary of a water supplier and replacement of membranes. The residents of the community were encouraged to buy 20 liter water bottles with a dispenser by paying Rs. 150 (~US\$2.5) for membership in this initiative to ensure hygienic conditions for water storage at the household level. A nominal amount of Rs.5 was charged for 20 liters of water compared to the market rate of Rs. 60 (~US\$1). A tricycle was purchased from the pooled fund. Water was supplied to households by employing youth in the community. This innovation has crossed the incubation stage and is now in a pilot testing mode. Many similar innovative approaches for providing safe drinking water are evident in urban areas of India. However, scaling up by incorporating them in policies or programs is yet to be done. This innovation has great potential in unserved peri-urban areas.



KEY MESSAGES FROM INNOVATION

1. Identification of a champion in a community is key to success of urban WASH projects.
2. Integrating livelihood opportunities within a project for people in the community could be the unique selling point (USP) of WASH projects.
3. Safe water availability can substantially change lifestyles of the urban poor by reducing the disease burden, save opportunity cost losses, and provide livelihood opportunities.
4. Resource conservation could be a co-benefit in a WASH project. This includes reuse of rejected water from RO plants in low water quality demand activities such as flushing of community toilets and washing roads; and rainwater harvesting for groundwater recharge.
5. Urban local bodies can be approached to provide support in kind.



THE STAKEHOLDERS PARTICIPATION

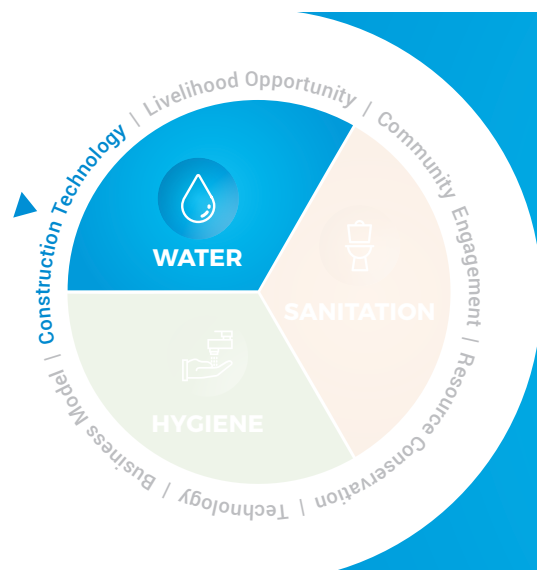
This project lasted for about two and half years and involved a number of stakeholders. The Indore Municipal Corporation (IMC) and the community were key stakeholders. Rockefeller Foundation, under the Asian Cities Climate Change Resilience Network (ACCCRN) program, supported the 'Conjunctive Water Management' project. TARU Leading Edge Pvt. Ltd. provided technical support for implementing the project. IMC provided land within the community to construct the RO water treatment plant, and a bore well to supply raw water. The Basti Vikas Samiti (community committee) was involved in the decision making process and the awareness campaign.

Local non-governmental organizations (NGOs) were instrumental in executing the project.



RESOURCES

<http://www.taru.org/index.php>
<https://www.acccrn.net/country/india>
<https://www.acccrn.net/video/conjunctive-water-management-indore>
<http://www.urbanwaterindore.org/>



INNOVATION - 2

POROUS PAVEMENTS IN THE URBAN LANDSCAPE PROVIDES SOLUTION FOR IMPROVING GROUNDWATER RECHARGE CONDITIONS (Year-2012)

Jaipur Development Authority (JDA) supported construction of porous pavements in the parking area of Gandhinagar railway station to harvest rainwater.

INITIAL STAGE

PILOT TESTED

UPSCALED



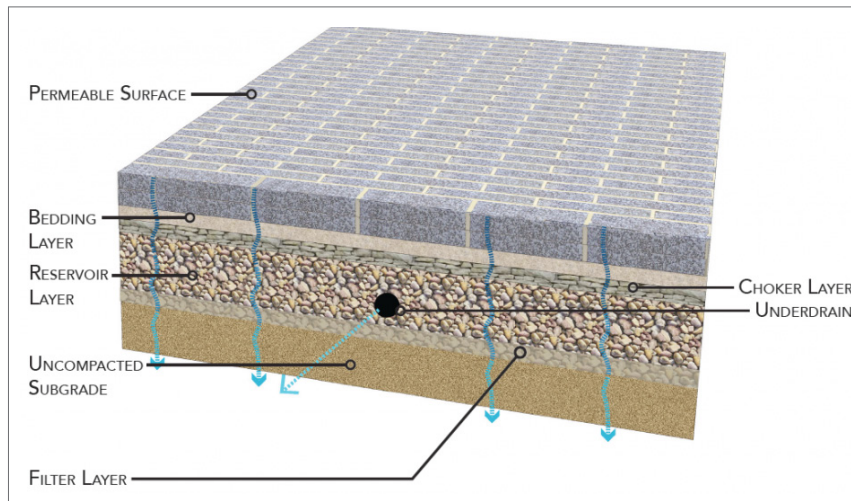
THE CONTEXT

In cities, land use and land cover changes, alter open/green spaces. Concretization of open spaces for road construction, flyovers, parking areas in commercial places, etc. increases surface water runoff that not only reduces possibilities of water percolation from rain during the monsoon season, but also affects micro-climatic conditions. At the same time, extraction of groundwater is on the rise to meet increasing domestic and industrial demands, particularly in unserved areas in peri-urban stretches. The Central Groundwater Board of India has already warned that there has been serious groundwater depletion across Indian cities and recommends recharge. Rainwater harvesting at the household level is not sufficient to improve groundwater conditions. Porous pavements are an ideal option for regional groundwater recharge.



THE INNOVATION

This innovation follows the principles of a sustainable urban drainage system. Porous pavements allow storm water to move through it to a subsurface reservoir or base by improving runoff water quality. There are different varieties of porous material that may be used such as permeable asphalt, permeable concrete, permeable interlocking concrete, concrete grid pavers, etc. In Jaipur, the porous asphalt technology was used. This innovation costs Rs. 605 per sqm (~US\$10) against conventional surfacing costs of Rs. 400 per sq m (~US\$7) during its pilot testing. This innovation is not yet widespread and is limited to only one experiment in India. It has immense potential to fit in to the urban landscape.



<http://pavementcorporation.com/wp-content/uploads/2015/07/permeable-pavement.png>



KEY MESSAGES FROM INNOVATION

1. Conventional concrete can be replaced with porous paving material at several places in urban areas.
2. Rain water runoff in urban areas can potentially be diverted to storage reservoirs through porous pavements.
3. Parking areas (at commercial places) occupy large spaces. Vehicles are not in movement and porous pavements are ideal for static loads. This will augment groundwater recharge.
4. This innovation not only addresses water quantity but also water quality.
5. This innovation demands regular maintenance with a pressurised cleaning process for its efficient functioning.



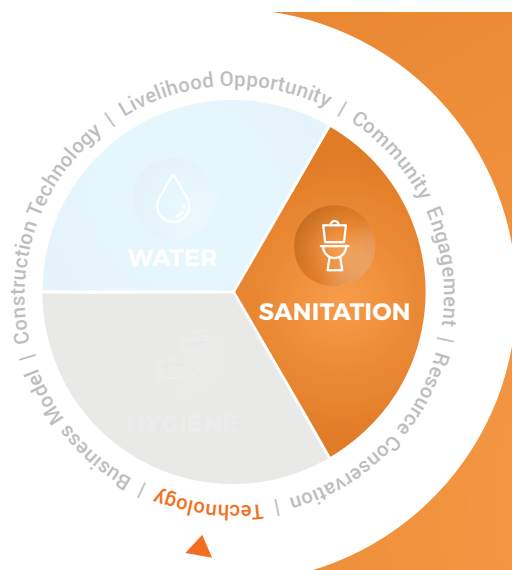
THE STAKEHOLDERS PARTICIPATION

The Jaipur Development Authority and the Indian Railway, Jaipur Division, encouraged pilot testing of the innovation. The innovation was designed and implemented by Prof. Prithvi Kandhal, based in the United States.



RESOURCES

<http://www.indiawaterportal.org/articles/porous-pavements-save-concrete-jungles>
https://www.civil.iitb.ac.in/tpmdc/TPMDC_2014/PAPERS/15.pdf



INNOVATION - 3

CREATION OF A URINE BANK AND COLLECTION BY A SPECIAL VEHICLE AND ITS UTILIZATION AS FERTILIZER (2011)

The Society for Community Organization and People's Education (SCOPE), a Trichy based NGO, has experimented with this concept in Musiri town of south India which works on the principle of closing the loop between sanitation and agriculture (urban?). Diversion of urine and its dilution before usage as fertilizer can reduce dependency on chemical fertilizers.

INITIAL STAGE

PILOT TESTED

UPSCALED



THE CONTEXT

India is primarily an agrarian country. Dependency on chemical fertilizers is increasing and this affects the environment - soil conditions and water bodies- due to high nitrogen and potassium content in fertilizer. Algal blooms and eutrophication conditions are common in urban ponds due to transportation of fertilizer from agriculture fields nearby. This also affects groundwater, which is a source of water supply. Presently millions of tons of urine are going out as waste from toilets, as there are no efforts made to separate and collect urine. ECOSAN toilets are designed to separate the excreta and waste.



THE INNOVATION

ECOSAN toilets have been in use for some time in the southern states of India. They are designed and constructed to separate human excreta from urine. Urine is a good organic fertilizer. However, its systematic diversion from individual households, institutions, schools and their collection was not attempted. Pure urine is collected through a specially designed van. It is appropriately diluted and applied to agricultural practices. In this experiment, 400 liters of urine per week were collected in Musiri town. Tamil Nadu Agriculture University and National Research Centre for Banana have successfully tested it and found it a cost effective fertilizer for increasing crop yields.



KEY MESSAGES FROM INNOVATION

1. The utilization of urine as a natural fertilizer has tremendous potential to reduce dependency on chemical fertilizers.
2. The concept of urine diversion toilets can be applied in peri-urban areas for fertilizing horticulture crops and vegetables, which are grown on the outskirts of the city.
3. It is a natural fertilizer and saves energy and fuel used in the manufacture of chemical fertilizers.
4. Urine-diverting dry toilets (UDDTs) can be incorporated in housing schemes for the urban poor (e.g. RAY).
5. Urban agriculture is an emerging concept and UDDTs can provide natural fertilizer for this.



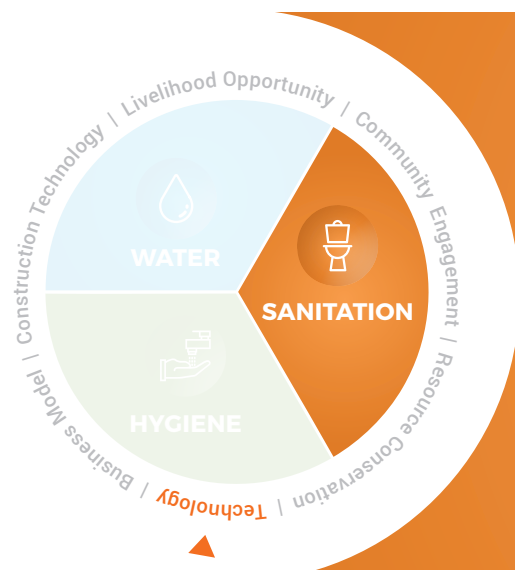
THE STAKEHOLDERS PARTICIPATION

The concept of a urine bank was encouraged by the Musiri Village Panchayat. The Rural Development Department and the Planning Commission of India promoted this concept. SCOP Ealong with WASTE, a NGO based in Netherland implemented it in Trichy.



RESOURCES

http://www.scopetrichy.com/urine_bank_struvite.php



INNOVATION - 4

WATERLESS URINALS CONSERVE FRESH WATER, SAVE ENERGY AND REDUCES MAINTENANCE COSTS (Year-2010)

Indian Institute of Technology, Delhi (IITD) incubated a startup to upscale waterless urinals, particularly for institutions, kiosks and public places.

INITIAL STAGE

PILOT TESTED

UPSCALED



THE CONTEXT

One of the reasons for the reluctance to use public toilets, in cities, is due to their inadequate water supply and lack of maintenance. Ideally, a conventional urinal requires 4-15 liters of water per usage to flush out urine. Considering an individual's average need to urinate four or five times in a day, the consumption of water per urinal per year could range between 57,000–170,000 liters per urinal. The consumption of water to flush out urinal unnecessarily increases the load of discarded water in sewage lines due to the constituents of urine. When hard water is used to flush out urine, there are additional challenges like scaling of the plumbing assembly.



THE INNOVATION

The key concept of the waterless urinal is avoiding usage of water for flushing by understanding the constituents of urine and using an odor-trapping mechanism in the pan. The odor control mechanism like the sealant liquid, membrane trap and biological blocks alternatively reduce freshwater consumption for flushing the urinal after it is used. Three innovative variations were developed and installed in waterless urinals. The waterless 'Public Urinal Kiosk' is one of the three. It is a standalone concrete reinforced pre-fabricated urinal kiosk, cheap and robust. The estimated cost of such a kiosk ranges between Rs. 10,000 (US\$165) to Rs. 30,000 (US\$500). The second variation is termed the 'Green Waterless Urinal'. This variant requires more space and is convenient where the number of users is low. The estimated cost remains between Rs. 500 - 10,000 as per design. The third variant is a self-constructed urinal, very simple in nature and constructed with locally available resources. One of the innovative products incubated by IIT-D is named as Zerodor. It does not require any replaceable parts and consumables, thereby reducing cost of maintenance. Zerodor is designed to be retrofitted in standard urinals at a minimal cost.



KEY MESSAGES FROM INNOVATION

1. This innovation addresses issues of operation and maintenance of public toilets in cities.
2. It ensures a possibility of saving 151,000 liters of water per urinal annually.
3. Urine can be potentially harvested to reduce dependency on chemical fertilizers
4. Water (rivers, local water bodies, ponds) pollution is preventable through innovations like waterless urinals.
5. Reduces liquid waste load in sewage lines.



THE STAKEHOLDERS PARTICIPATION

The Indian Institute of Delhi incubated Ekam Eco Solutions to develop the waterless urinal, Zerodor. The technology is proprietary and patented by IIT-D and Ekam.



RESOURCES

Waterless Urinals – A Resource Book prepared by IIT-Delhi and Vigyan Vijay Foundation
<http://ekameco.com/zerodor-waterless-urinals/>



INNOVATION - 5

VANDAL PROOF, EASY TO MAINTAIN AND DURABLE TOILETS (Year-2016)

The GARV toilet is a pilot tested innovation in Faridabad, Haryana. Six variants have been designed to suit different requirements, including one having a sanitary pad vending machine.

INITIAL STAGE

PILOT TESTED

UPSCALED



<http://www.ennovent.com/garv-toilets-innovation-meets-sanitation/>

THE CONTEXT

Public utilities have always remained vulnerable to vandalism. This leads to cumulative economic losses to the government, further adding to the financial burden of urban local bodies. One example of vandalism is destruction of a public toilet and is evident in the city of Pune in Maharashtra. A company maintaining the public toilet in city was spending approximately Rs.13,000 (\$US 200) every 2-3 months for replacing broken toilet pans.⁷

⁷(<https://sanitationupdates.wordpress.com/2016/10/10/indestructible-and-smart-public-toilet-innovation-in-india/>).



THE INNOVATION

A GARV toilet utilizes stainless steel for constructing the superstructure of the toilet pan and wash basin, instead of conventional material like china clay or porcelain. This not only increases the life of various utilities in public toilets, but also reduces maintenance cost and conserves water needed for cleaning. Apart from the construction material, added features like smart monitoring of users, such as the use of soap for hand washing, helps behavioral understanding for hygiene promotion. Features like automatic washing of the floor and pans after usage and auto-on/ off for LED lights and exhaust fans, makes the GARV toilet unique and ideal for the urban environment.



KEY MESSAGES FROM INNOVATION

1. This innovation has the potential to involve a skilled workforce (IT sector, manufacturing, plumbing, etc.) in the manufacturing process, thereby creating employment opportunities.
2. These toilets could be used to gather critical data related to user behavior for better design of public toilets.
3. Smart technology has potential for automation in maintenance of public toilets.
4. Urban local bodies can significantly reduce expenditure on retrofitting, repairing public toilets and also in operation and maintenance by adopting the concept of the GARV toilet.
5. In urban poor communities and slums, the installation of GARV toilet can significantly improve living conditions.



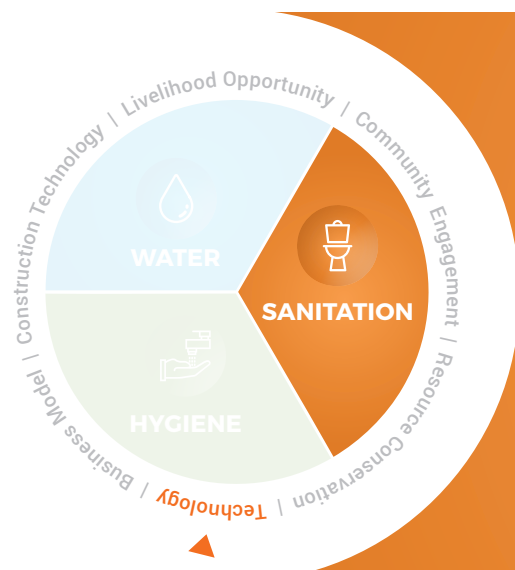
THE STAKEHOLDERS PARTICIPATION

The GARV toilet was born out of an initiative of a producer's need to utilize unused stainless material in his manufacturing unit.



RESOURCES

<https://sanitationupdates.wordpress.com/2016/10/10/indestructible-and-smart-public-toilet-innovation-in-india/>
http://sulabhenvis.nic.in/Database/sanitation_TT_2130.aspx



INNOVATION - 6

PERSONAL HYGIENE PROMOTION, SAFETY FOR WOMEN AND A UNIVERSAL DESIGN CONCEPT AT PUBLIC TOILETS (Year-2012)

The Commissionerate of Municipal Administration (CMA), Tamil Nadu introduced the concept of the Namma Toilet with a universal design to eliminate open defecation in the state.

INITIAL STAGE

PILOT TESTED

UPSCALED



THE CONTEXT

In Tamil Nadu, public toilets remain in filthy conditions due to poor maintenance. They are not user friendly, particularly for children, elderly and the physically challenged. The main constraints are availability of adequate space, good ventilation and scientific disposal of liquid and solid waste. These conditions force urination in public places and open defecation in cities. Privacy during usage, safety of women and provisions for adequate hygienic conditions are additional challenges. The CMA decided to tackle this issue with an innovative universal design concept.



THE INNOVATION

The key idea behind the Namma Toilet was introduction of a modular design for quick assembly and fitting of the required number of units, within the available space, in a short time. The design of the Namma toilet has provisions for enough natural light during daytime with using specific material - fiber sheets: and at night, solar powered LEDs are used for lighting. The right placement of louvers make it odor free. Most importantly, the material used to prepare the Namma toilet ensures that odor-generating bacteria do not survive on inner walls. The design particularly addresses privacy for women and has provision for hygienic disposal of sanitary napkins. There is provision of a stand-alone washbasin for promoting hand washing after using the toilet. Many municipal corporations including South Delhi Municipal Corporation (SDMC) in India have adopted the Namma toilet design in public toilets. This innovation is poised for scaling up and has been identified as a total sanitation solution for urban areas.



KEY MESSAGES FROM INNOVATION

1. The innovation informs that partnership between government-academia-private industry can successfully address challenges of sanitation.
2. In many Indian cities, the floating population is high and space is a constraint. Thus, the innovative modular design meets the requirement of cities.
3. Public toilets can convey hygiene awareness in cities.
4. The concept of the Namma toilet is ideal for tourist spots and public places (e.g. bus stands, markets).
5. The requirements for elderly and physically challenged needs to be considered while planning public and community toilets.



THE STAKEHOLDERS PARTICIPATION

The CMA, Tamil Nadu initiated a drive to eliminate open defecation in urban areas of the state by setting the target year as 2015 and introducing the Namma toilet concept. The project was jointly implemented by the CMA, National Institute of Design (NID), Ahmedabad, and importantly, with support from Urban Industries Ltd. NID studied cultural aspects from the users' viewpoint in the Ankaputhur, Trichy and Kanchipuram cities of Tamil Nadu, and identified need for toilet for all (men, women, children, elderly and the disabled). The universal design of the toilet provides a complete sanitary solution and was developed within six months time.



RESOURCES

<http://cma.tn.gov.in/cma/en-in/Pages/Sanitation-and-Solid-Waste-Management.aspx>
<http://www.thehindu.com/news/national/tamil-nadu/namma-toilets-in-poor-shape/article7107513.ece>



INNOVATION - 7

TEMPORARY HYGIENE MANAGEMENT NEEDS WITH INNOVATIVE MODELS FOR SANITATION

3S, a Pune based enterprise offers simplified, innovative solutions with a planning tool and a variety of products for effective sanitation management for mass gatherings. The innovation is ideal for fecal sludge management in small and medium towns of India.

INITIAL STAGE

PILOT TESTED

UPSCALED



<http://www.3sindia.com/products/portable-toilets-restrooms/standard-restroom/>
<http://www.3sindia.com/products/portable-toilets-restrooms/wheel-chair-accessible/>

THE CONTEXT

The construction industry is rapidly growing as it endeavors to meet the demand for accommodation of India's rising urban population. Sanitation facilities at construction sites are a serious issue, since the industry employs large numbers of migrants. As a result migrants resort to open defecation. The situation demands cost-effective, affordable, hygienic sanitation solutions for these workers and their families. Installing and maintaining portable toilet units at construction sites could improve hygiene and increase productivity of laborers. Similarly, at oil fields, refineries, mining sites and manufacturing units where pre/post development phases require a labor force, adequate sanitation facilities are needed. In India, there is a lack of access to sanitation facilities at marriage functions and social gatherings. These factors result in pollution in the surroundings. During emergencies like natural and man-made disasters, sanitation services are critical.



THE INNOVATION

This innovation impressively demonstrated sanitation management that covers the entire value chain. It offers affordable sanitation solutions at gatherings such as construction sites, events/functions, and during emergencies; where populations are concentrated in small areas, and where poor sanitation could result in disease outbreaks and environmental pollution. Toilet/rest room units are: ergonomically designed, manufactured with recyclable material, water efficient, consume minimum energy, and lightweight for easy portability. Automated cleaning, evacuation and disposal of waste are ensured by vehicle mounted vacuum and high-pressure machines. Trucks are also equipped with mobile phones and GPS for optimizing routing/tracking. Waste collected is disposed at the municipal sewage treatment plants (STPs). The concept of a waste treatment plant is being examined, for water recovery and reuse for cleaning, or selling to construction sites.

Pilot testing of these toilets is being done in urban slums of Delhi, Mumbai and Pune by creating entrepreneurs/self-help groups who can run a community/public toilet, with external technical support, by charging users. Revenue is derived from services offered along with the toilets.



KEY MESSAGES FROM INNOVATION

1. Sanitation management for temporary gatherings (construction sites, events, emergencies) is ignored at present and needs attention, with guidelines from government.
2. The innovation has potential for reliability at pilgrimage sites.
3. The model suggests charging organizers of activities and not the users.
4. Underutilised sewage treatment plants in cities could be optimised with such innovations.
5. Employment generation: Jobs offered to women and self-help groups to maintain these services will add to their dignity.



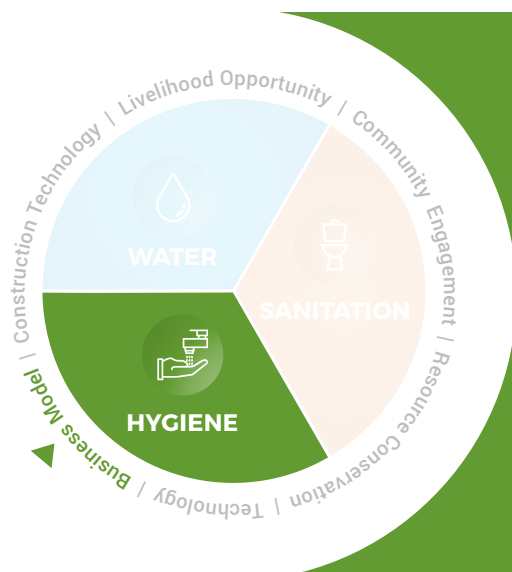
THE STAKEHOLDERS PARTICIPATION

3S conducts awareness campaigns at construction sites on open defecation and good hygiene practices such as hand washing, toilet usage, community hygiene, etc. using audio-visual tools. It has also installed free toilets in various schools and uses children as medium to spread awareness on sanitation and hygiene. 3S also launched a 'City 100% Sanitation Campaign' in Pune for citizens and other stakeholders.



RESOURCES

<http://www.3sindia.com/>
<http://www.thesmartceo.in/magazine/starting-up/a-solution-for-public-hygiene.html>
<http://www.inclusivebusiness.org.zw/case-study/3s-shramik-portable-sanitation-and-waste-management-india>
http://readinghour.in/content.php?ctype_id=Njc=
<https://www.scribd.com/document/33230872/Company-Profile-Saraplast-3S>



INNOVATION - 8

THREE INNOVATIVE WAYS TO MAINTAIN DIGNITY OF WOMEN IN INDIA

Manufacturing of compostable sanitary pads, using discarded cotton clothes, and their easy availability through vending machines, are three innovative approaches to address hygiene issues of urban poor women.

INITIAL STAGE

PILOT TESTED

UPSCALED



THE CONTEXT

Poor menstruation care has remained an important aspect of hygiene for women. Negligence of this most common phenomenon faced by women results in loss of their dignity, girls dropping out of schools, agony and frustration, particularly for poor women. Non-affordability of costly products available in the market, forces poor women to rely on unhygienic practices. Also, disposal of non-compostable material used in making sanitary pads results in environmental degradation. Increased usage of compostable sanitary pads could substantially reduce the solid waste load.



THE INNOVATION

Eco-friendly sanitary pads made from discarded cotton cloth provide dignity to women. They are affordable and benefit both consumers and manufacturers. Vending machines that dispense these sanitary pads ensure round the clock availability. This innovation has multiple benefits. It promotes hygienic practices, removes fear in women and school girls, and allows them to retain their dignity. These sanitary pads also prevent environmental pollution since the pads decompose within 100 days.



KEY MESSAGES FROM INNOVATION

1. Multiple innovations can be combined together to address one issue related to WASH. The disposal of sanitary pads, use of discarded cloths and sanitary pad vending machines are three different innovations that improve hygienic conditions of poor women.
2. Disposal of non-compostable sanitary pads can be reduced, thus preventing environmental degradation.
3. Reduction of the disease burden of urban poor women due to better menstrual hygienic practices.
4. It generates multi-pronged livelihood opportunities for the urban poor.
5. This innovation has potential to substantially reduce school girl drop outs.



THE STAKEHOLDERS PARTICIPATION

Goonj, a Delhi based NGO's innovation of 'not just piece of cloth' (NJPC) and Aakar, a Maharashtra based NGO's innovation for manufacturing compostable sanitary pads addresses two problems. One is hygiene of poor women for whom costly sanitary pads are unaffordable, and the other is protection of the environment through compostable sanitary pads. These two NGOs have particularly improved hygienic conditions of rural women in India. The NIF has also promoted cheap, easy to manufacture sanitary pad making and vending machines.



RESOURCES

http://nif.org.in/innovation/mini_sanitary/10
<https://www.aakarinnovations.com/anandi-pad>
http://goonj.org/wp-content/uploads/2016/06/Press_Note_Dil_Ki_Suno_Kuch_Karo_jgw_2016_basic.pdf



INNOVATION - 9

PREVENTION OF RIVER POLLUTION WITH GREEN BRIDGE TECHNOLOGY USING A PPP APPROACH (YEAR- 2010)

Jheel Sanrakshan Samiti (JSS) - Udaipur based civil society organization and UCCI prevented pollution of a surface water supply source.

INITIAL STAGE

PILOT TESTED

UPSCALED



<http://www.thehindu.com/sci-tech/energy-and-environment/a-lake-rejuvenated/article3436472.ece>

THE CONTEXT

Udaipur, an important tourist destination, depends on the lake system for drinking water. The Ahar river, while flowing through the city, peri-urban areas, and surrounding villages, receives 100-150 MLD of domestic and industrial wastewater. The river ultimately drains into Udai Sagar lake located to the east of Udaipur. The river is non-perennial, and flows only during the four monsoon months. For the rest of the year, it essentially remains a wastewater drain. The wastewater flowing into water bodies results in surface and groundwater pollution. These are important water supply sources. In addition to water supply source contamination, river pollution affects the food chain as farmers in the area use the same water to irrigate their crop and vegetables that they supply to the city.



THE INNOVATION

This innovation uses a unique PPP approach. Udaipur District Administration facilitated all statutory permissions related to this project. Urban Improvement Trust, the local development authority, constructed a road to the project site. JSS led the awareness campaign on sanitation, hygiene, water pollution and protection of green spaces involving local NGOs, educational institutions, communities and, importantly, local industries. Singhal Foundation, the philanthropic arm of a local industry provided seed capital for the campaign. UCCI facilitated donations from Hindustan Zinc Limited, Rajasthan State Mines and Minerals Limited, Maharana Mewar Charitable Foundation, other public trusts, organizations, industries and individuals. UCCI also took the responsibility of providing manpower, machinery for technology installation, maintenance, and water quality monitoring. The green bridge technology was planned, designed and implemented by the Shrishti Eco-Research Institute (SERI), a Pune city based NGO. Post installation, monitoring was done for water quality improvement over time. The total capital cost of this project was about Rs. 500,000/MLD (US\$ 8,333) and operation costs about Rs. 200,000-300,000 (US\$5,000) per year, which is very low compared to conventional wastewater treatment technologies.

The green bridge technology: The treatment system consisted of six trapezoidal shaped green bridges of varying length. The bridges had screens installed on the up-stream side to trap solid waste before its entry into the system. The riverbanks were planted with local grasses, lemon grasses, the typha plant, etc. to facilitate the treatment process. Wastewater passed through the green bridge filter mechanism. The structure was strengthened by stones and sand. All float able and suspended solids are trapped in this biological bridge. The dissolved oxygen improved from 0.7 to 6.9 and biochemical oxygen demand (BOD) reduced by 52 percent and chemical oxygen demand (COD) by 44 percent.



KEY MESSAGES FROM INNOVATION

1. It was a unique partnership model of civil society, industry and the government coming together to restore and rejuvenate water bodies of Udaipur.
2. A low cost and easier-to-maintain alternative to conventional wastewater treatment.
3. It generated livelihood opportunities for local farmers in terms of non-contaminated agricultural produce and fishermen were able to get better catches.



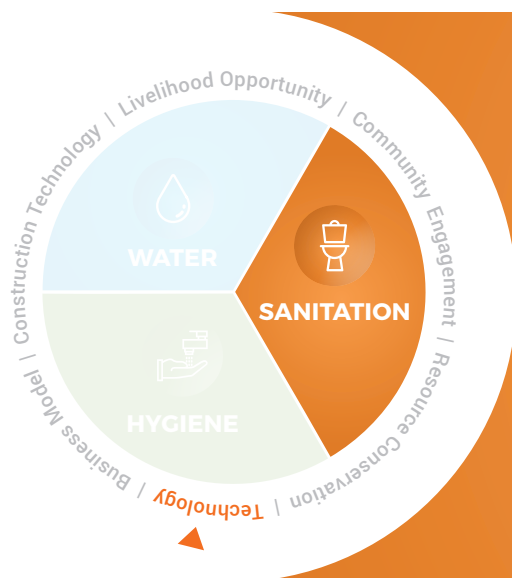
THE STAKEHOLDERS PARTICIPATION

This project was conceptualised on around a PPP model where different organizations – JSS, local NGOs, UCCI, academia, village panchayats and Hindustan Zinc Ltd. were involved. SERI was the key designer of the green bridge technology. All stakeholders played vital roles in the project to prevent surface and groundwater contamination.



RESOURCES

http://rcse.edu.shiga-u.ac.jp/gov-pro/plan/2010list/10/indian_lakes/ilbm_impact_story-udaipur%27s_ecological_restoration_of_ahar_river_using_green_bridge_technology__2_.pdf
<http://iced.cag.gov.in/wp-content/uploads/C-05%20PPT%20anil%20mehta.PDF>
<http://www.deccanherald.com/content/191649/rejuvenating-river-green-technology.html>
<http://timesofindia.indiatimes.com/city/jaipur/Udaipur-river-model-for-Narmada-revival/articleshow/45715887.cms>



INNOVATION - 10

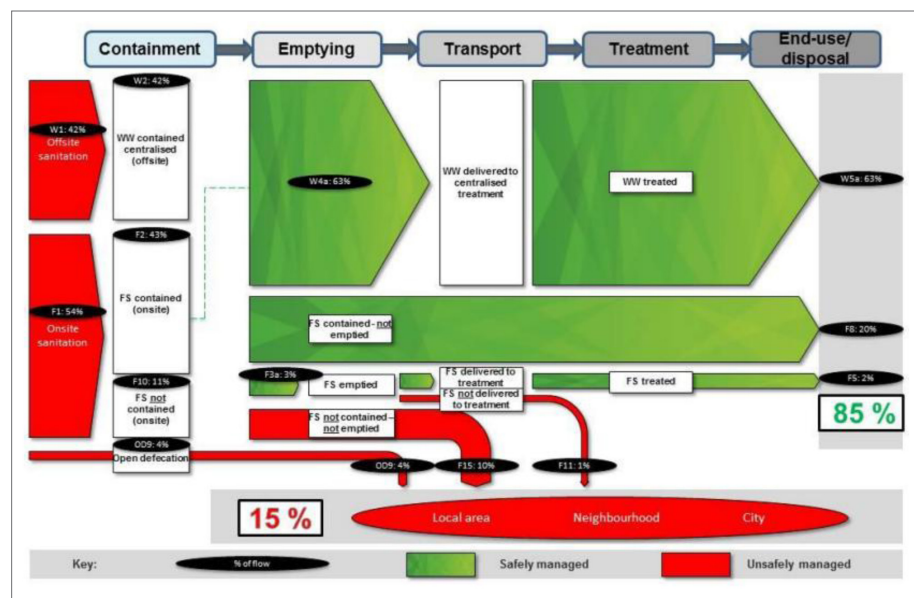
SFDS: A TOOL FOR DECISION MAKER FOR FAECAL SLUDGE MANAGEMENT PLANNING (2012-13)

A simple yet powerful tool was developed by the Water and Sanitation Program of the World Bank which offers visual representation of excreta flow through cities (particularly small and medium sized cities) for improved sanitation management.

INITIAL STAGE

PILOT TESTED

UPSCALED



THE CONTEXT

Though a large population (about 38.2%) in urban India depends on onsite sanitation systems (OSSs), very limited attention has been given to management of the sanitation chain, related to OSSs starting from containment to scientific disposal of sludge/septage. Lack of adequate treatment facilities, in terms of availability, infrastructure and efficiency, are issues facing existing STPs. There are also legal issues relating to untreated waste discarded in an open environment as laws are not enforced. All these factors adversely affect surface/groundwater quality and public health. In cities, the flow of waste (excreta) starting from its origin to its final destination is not recorded in a scientific manner. Broad data/information is available to urban local bodies but precise quantified information is always a key for decision makers and planners in policies and program design for effective excreta management, particularly in small and medium sized cities.



THE INNOVATION

The SFD is an innovative way to visually represent excreta flow in a city. This innovation graphically represents quantified information from the origin to the final destination. The tool is simple yet powerful enough to convey information in a simple way to decision makers, planners and designers to prepare effective management plans for sanitation management.

The production of SFDs involves desk based research, compilation of all available secondary data related to offsite and onsite wastewater management, field based data collection, and dialogues with important stakeholders in a city.

The compilation of all the above vital information by a systematically designed tool produces the SFD which simply conveys the quantum of safely and unsafely managing excreta. It covers different stages of the sanitation management chain and uses percentages. The thickness of arrows in RED and GREEN colors in the SFD easily and quickly conveys the degree of severity of the state of sanitation in a city. Ultimately, it supports decision makers (administrators and politicians) to understand the seriousness of the situation: it helps planners and designers to target intervention areas. This innovation is pilot tested in India and needs to be promoted for wider acceptance.



KEY MESSAGES FROM INNOVATION

1. Tools with step by step instructions for informed decisions are necessary for quick and effective sanitation management.
2. Simple visual tools like SFD can guide decision makers, politicians and planners to prepare effective and targeted action plans to improve sanitation.
3. Semi-quantitative information provided by an SFD could be more useful in small and medium towns and cities, rather than in metropolitan cities where the sanitation scenario is complex
4. Tools should be flexible, with scope for fine tuning and refinement of data, over time



THE STAKEHOLDERS PARTICIPATION

The SFD was prepared from the study of excreta management by the Water and Sanitation Program of the World Bank. The concept was further promoted with funding from Bill and Melinda Gates Foundation (BMGF) in the Sustainable Sanitation Alliance (SuSanA) forum.



RESOURCES

<http://sfd.susana.org/about/the-urban-sanitation-crisis>
<http://www.susana.org/en/forum/96-shit-flow-diagrams>

POTENTIAL AREAS FOR INNOVATIONS IN THE INDIAN URBAN WASH SECTOR

- There have been many innovations, over the years in the country, but most were in the agriculture sector, such as mechanization of harvesting processes, etc.
- Most of the innovations of the WASH sector currently emphasize on technologies. There is a need to broaden the scope of innovation and not restrict to only technology.
- Innovation is required in data collection, validation and representation (e.g. visualization); service delivery mechanisms, business models and community engagement.
- In the water sector, the innovations required are: source augmentation in cities (e.g. groundwater through porous

pavements); leakage/water loss control; drinking water quality improvement, particularly for the urban poor; and small sized cost effective water treatment options.

- In the sanitation and hygiene area, innovations are required to change behaviors of users, particularly migrant laborers and the urban poor, by sensitizing them through awareness products.
- Sewage infrastructure is poor in urban areas, and therefore, onsite sanitation systems prevail. Fecal sludge management by the urban local bodies is poor and innovative ways to manage it are needed, along with business models.
- Hygiene is mainly restricted to washing hands and sanitary menstruation practices. There are other areas, like habitation/livability conditions of communities, especially the urban poor, health aspects of floating population etc, which needs innovations.



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www.usaid.gov/india



Lead Implementing Partner:

→ **NIUA** is a premier institute for research, capacity building and dissemination of knowledge of the urban sector in India and the lead implementing organisation of this initiative. It conducts research on urbanisation – urban policy and planning; municipal finance and governance; land economics; transit-oriented development; urban livelihoods; environment, climate change; and smart cities.

www.niua.org



Consortium Implementing Partners:

→ **Taru Leading Edge** is a leading development advisory and think-tank that delivers innovative, transformative solutions and insights in the development space. Incorporated as a private limited company, TARU's mission is to 'bridge the science-institutions-society interface with a core agenda of providing transformative solutions to development challenges'.

www.taru.co.in



→ **IRC** is an international think-and-do-tank that works with governments, non-governmental agencies, entrepreneurs and people around the world to find long-term solutions to the global crisis in WASH services. At the heart of its mission is the aim to move from short-term interventions to sustainable WASH services.

www.ircwash.org



→ **Ennovent** is a business innovations catalyst for sustainability. We believe sustainable solutions for low-income markets can create long-term business value. We partner with the private, public and third sectors to take novel business ideas to these markets in developing countries.

www.ennovent.com



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→ **Yes Bank** is a private sector bank in India. Over last 2 decades, it has steadily built a Corporate, Retail & SME Banking franchise, Financial Markets, Investment Banking, Corporate Finance, Branch Banking, Business and Transaction Banking, and Wealth Management business lines across the country.

www.yesbank.in



→ **Valluri Technology Accelerators** focuses on building solutions in the areas of Energy, Water, Environment & Pollution, Sanitation & Waste, Healthcare and Transportation & Mobility through convergence of multiple high-end domain technologies by partnering with leading global and national organizations.

www.vallurita.com/

City Partners:



Faridabad is an important industrial hub, the most populated city in Haryana and part of the National Capital Region (NCR). It is being developed under the Smart Cities Mission, Swachh Bharat Mission and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT).



Mysore is the second largest city in Karnataka and an important educational, commercial and administrative hub. Since the city is a tourist and heritage centre, it is covered under Swachh Bharat Mission and the AMRUT.



Udaipur, 'The City of Lakes' in the state of Rajasthan and is known for its picturesque surroundings and royal past. Its rich architectural heritage and beautiful lakes fascinate tourists worldwide and encourage them to visit the historic city. It is being developed under the Smart Cities Mission, Swachh Bharat Mission and AMRUT.

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