स्वच्छ भारत
एक कदम स्वच्छता की ओर

INDIA SANITATION COALITION
BUILD • USE • MAINTAIN • TREAT

BUSINESS OF CHANGE:

Models of Success in
"Solid Waste Management"
and
"Greywater Management" in Urban and Rural India

2022

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Preface

Rapid urbanization and improved standards of living, especially since the beginning of the twenty-first century, have increased the amount of solid waste, and greywater generated across India. As part of its overall Swachh Bharat Mission (SBM), the government has focussed on resolving the issues surrounding Solid Waste and Liquid Waste including Greywater and Black Water Management.

Phase-II of the SBM-Grameen agenda aims at achieving ODF Plus status for the rural India and sustainability of ODF through providing the correct infrastructure to communities for managing both solid waste and greywater as well as engagement with the private sector to ensure that wherever required support is provided through behaviour change programs so that communities can going forward understand the value of a clean and hygienic surrounding as well as learn to manage these facilities themselves.

Further, the Swachh Bharat Mission-Urban (SBM-U) was launched on October 2, 2014, to make all urban local bodies (ULBs) in the country open defecation free (ODF); ensuring scientific management of all municipal solid waste (MSW) generated therein and bring about a change in sanitation behaviour. While there was a perceptible change in behaviour towards Swachhta in urban areas post the completion of phase I of the mission, source segregation of waste emerged as a vital indicator of sanitation that was measured. Today, in over 77% of wards of the country, there is segregation of waste at the source itself, and by 2022, the government has a target to cover all wards numbering 86,000 or more.

They say that “One man's trash is another man's treasure” and this is evident from several initiatives that have been undertaken in waste treatment in the country like incineration, pyrolysis, bio-refining & biogas plants, composting, recycling, etc.

I am glad that phase II of the Swachh Bharat Mission emphasizes on providing adequate facilities for **Solid Waste Management including plastic waste and Liquid Waste Management** both in rural and urban areas of the country. Most importantly, within the sanitation and waste management targets of SDGs 6 and 12, the focus is not only on toilet access, but on managing the entire sanitation value chain, encompassing containment, emptying, transport, treatment, and safe reuse or disposal of solid and liquid waste. This has paved the way for a paradigm shift, where thinking goes beyond piped sewers and collection alone.

The ODF Plus manuals published by Swachh Bharat Mission- Grameen for the last fiscal year, were committed to supporting over two lakh villages in India to achieve solid and liquid waste management (SLWM) arrangements through an investment of over Rs. 40,700 crores. While the central's share was to be around Rs. 14,000 crores, the States were to expend over Rs. 8300 crores. In addition, funds to the tune of Rs. 12,730 crores were to be made available through the Fifteenth Finance Commission and over Rs. 4,100 through convergence with MGNREGS.

If I talk about Phase II of SBM Urban, the broad areas of focus are sustained behaviour change; 100% waste collection & sustainable solid waste management; and 100% safe disposal of wastewater and reuse.

The program (SBM) which commenced in 2014 is moving ahead aggressively supported through government funding as well as renewed interest from the private sector in supporting the initiative with their knowledge and expertise in technology and management. These Public Private partnerships between the government and the private sector aim to bring the right SLWM infrastructure to both urban and rural communities that they live and operate within while at the same time teach them the skills to manage them on their own.

Of particular interest is the growing awareness both in urban and rural India about the need to manage plastic waste. Under SBM (G) 2 the objective is to construct Plastic Waste Management Units in over 2400 Blocks of India, Grey Water Management in around 1.82 lakh villages, and Gobardhan projects in 386 Districts.

Additionally, the SBM ministry has highlighted through various discourses and dialogues besides publications the need for private sector participation and innovative business models. The expertise and resources of the private sector must be leveraged for meeting the growing demand for solid waste management and Greywater Management. The intent, therefore, is to focus on and promote scalable and commercially viable solutions to make the sanitation economy attractive to private businesses and multiple avenues to it have already been identified.

The current compendium is a reflection of all the best practices, both around solid waste management and greywater management, covering urban and rural India

This annual publication of ISC this year carries 21 excellent case studies that focus on important processes and activities related to segregation, collection and transportation, treatment, and disposal of solid waste (both dry and wet). Besides, it highlights various successful technology options like composting techniques both at household and community levels.

The case studies on Greywater Management showcase success in the greywater treatment space using various technologies like community leach pits, waste stabilization ponds, constructed wetlands, Decentralized Wastewater Treatment Systems (DEWATS), etc.

I hope the publication motivates others to replicate these cases of success to achieve scale as we work towards making a cleaner, greener, and healthier India.

Natasha Patel
Chief Executive, India Sanitation Coalition

FOREWORD

150 YEARS OF CELEBRATING THE MAHATMA

सत्यमेव जयते

भारत सरकार
जल शक्ति मंत्रालय
पेयजल एवं स्वच्छता विभाग
4वी., 6वी., 8वी., 9वी., एवं 12वी. मंजिल, पं दीनदयाल अंत्योदय भवन
सी. जी. ओ. काम्पलैक्स, लोधी रोड, नई दिल्ली - 110003
Government of India
Ministry of Jal Shakti
Department of Drinking Water and Sanitation
4th, 6th, 8th, 9th & 12th Floor Pt. Deendayal Antyodaya Bhawan
C. G. O. Complex, Lodhi Road, New Delhi - 110003

Nandita Mishra
Senior Economic Adviser
Department of Drinking Water & Sanitation
Ministry of Jal Shakti

Annie Leonard, creator of the film documentary, The Story of Stuff, once said, "There is no such thing as 'away'. When we throw anything away, it must go somewhere" and I find it so relevant when we talk about waste management. Both solid and liquid waste management (SLWM) are the two most critical components of the Swachh Bharat Mission (SBM) Phase II. I am happy to see that India Sanitation Coalition has curated this publication that talks about best practices in Solid Waste Management as well as Greywater Management.

To give a little perspective, Municipal areas in India generate over 1.60 lakh tonnes of solid waste per day and I am happy to see that in the past few years, the coverage of door-to-door waste collection service has significantly increased, resulting in improved waste management and disposal. As a matter of fact, in FY 2022, 97 per cent of the wards in India had 100 per cent door-to-door waste collection services. It is also encouraging to see that today, over 95 per cent of the waste generated in the country is collected. However, while a little over 50 per cent of this waste is treated, approx. 18% still goes to landfills. People all over the world are experimenting with ways to reduce this very percentage. Some of the most effective ways to combat this problem are source segregation, composting, recycling, reusing, upcycling, generating energy from waste, and so on.

In the rural context, though, solid waste generated is predominantly organic and biodegradable, it is becoming a major problem as the waste generated is not segregated at source and is of the order of 0.3 to 0.4 million metric tons per day, as reported by the Ministry of Jal Shakti, Government of India. Next to becoming Open Defecation Free (ODF) villages, solid waste management has become a practical necessity in rural areas as inconsiderate littering causes poor environmental sanitation resulting in unhealthy quality of living.

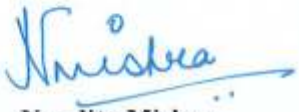
Besides, the Swachh Bharat commitment demands scientific disposal of garbage from rural households too. To tackle this problem, a functional waste management system should be in place at the Gram Panchayats level. The Government of India as well as many State governments are looking up to Gram Panchayats to implement a working system to manage solid waste in rural areas.

Another important facet of waste management in a water-stressed country like India is greywater management. Rural areas in India are supplied with an average of 55 litres of water per capita per day. As per the SBM-G guidelines, it is estimated that 65% to 70% of potable water used at the household level in rural areas is greywater which is estimated to be 36 litres per capita per day. This primarily includes wastewater from the kitchen, bathroom, and laundry. In urban households, not even 5% of this water is recycled which is rather unfortunate as this water can easily be recycled using simple, low-cost technologies.

Shifting the focus to greywater treatment and reuse is even more important as water as a resource and access to clean water is a central theme to most SDGs. Out of 17 SDGs at least 7 are directly linked to clean water and 5 are indirectly linked to water. Therefore, to achieve the SDGs by 2030, it is essential that water is recycled and reused to the extent possible, particularly urban wastewater. Moreover, public participation needs to be increased for better adoption and use of recycled and treated wastewater.

I feel India Sanitation Coalition has done remarkable work by bringing out this compendium, as this publication highlights 22 successful case studies which are scalable, replicable, and can be implemented across the country by NGOs, and development organizations with support from State and local government bodies.

My best wishes to India Sanitation Coalition as they disseminate these case studies on solidwaste and greywater management across the country to achieve a cleaner, healthier, and prosperous India.



Nandita Mishra
Sr. Economic Adviser, DDWS

Acknowledgments

This compendium is divided into two sections a) Models of Success in "Solid Waste Management in Urban and Rural India" and b) and Models of Success in "Greywater Management in Urban and Rural India" and has contributions from 15 partners: Aga Khan Foundation represented by Dr. Asad Umar and Ms. Niyati Tripathi; Ambuja Cement Foundation represented by Ms. Astrid Pereira; BBC Media Action - India represented by Ms. Reethira Kumar; CEPT Research & Development Foundation represented by Mr. Aasim Mansuri; FINISH Society represented by Mr. Abhijit Banerjee and Ms. Joohi Khusboo; Hasiru Dala represented by Ms. Bianca Fernandes and Ms. Rohini Malur; HCL Foundation represented by Mr. Yogesh Kumar and Ms. Kanika Saini; Hindustan Unilever Limited (HUL) represented by Ms. Kanupriya Rawal; ITC Limited represented by Mr. Giresh Mohan and Ms. Jagriti Singh; Observing I Ecotech represented by Ms. Charmaine Fernandes Sharma; PSI represented by Mr. Sanjay Singh; Saahas Zero Waste represented by Mr. Murthy T; Sampurnearth represented by Mr. Ritvik Rao; UNICEF represented by Ms. Shipra Saxena, Mr. Tejas Deshmukh and Mr. Krishna Kumar; and Water for People represented by Mr. Bishwadeep Ghose and Mr. Wakeel Ahmad Siddiqui.

The secretariat at ISC would like to extend their gratitude to all the above organizations and individuals that contributed to the development of this compendium.


का हैं, ये पिटारा
गीला कचरा
•भूरी सामाग्री
सूखे पत्ते, समाचा
भूरा गत्ता, मोटा
नैपकिन, लकड़ी
माचिस की तिली,
सूती कपड़े
जैसी सड़ने वाली

Preamble

In a recently published book, The Waste of a Nation, the authors Assa Doron and Robin Jeffrey wrote, "Never in history have so many people had so much to throw away and so little space to throw it as the people of India in the second decade of the twenty-first century."[1] Rapid urbanization, industrialization, increase in income, and changing lifestyles have led to an exponential increase in solid waste generation all over the world.

A 2018 World Bank report found that India generated 277.1 million tonnes of solid waste annually. The study revealed that India was the world's highest waste-generating nation.[2] According to a 2016 estimate given by the study, the world's cities generated 2.01 billion tonnes of solid waste, amounting to a footprint of 0.74 kilograms per person per day. With rapid population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tonnes in 2050. India's scenario is no less grim, the annual waste generated is likely to touch 387.8 million tonnes in 2030 and 543.3 million tonnes by 2050.

Over 90% of waste in low-income countries is often disposed of in unregulated dumps or openly burned. These practices create serious health, safety, and environmental consequences. Poorly managed waste serves as a breeding ground for disease vectors, contributes to global climate change through methane generation, and can even promote urban violence[3].

The Swachh Bharat Mission-Urban (SBM-U) was launched on October 2, 2014, to make all urban local bodies (ULBs) in the country open defecation free (ODF); ensuring scientific management of all municipal solid waste (MSW) generated therein and bring about a change in sanitation behaviour. Under the mission, out of 4,372 ULBs across the country, 4,371 were certified as ODF, except for one ULB in Purulia in West Bengal, and processing of MSW increased from 18 percent in 2014 to 70 percent in 2021.

While there was a perceptible change in behaviour towards Swachhta in urban areas post the completion of phase I of the mission, source segregation of waste emerged as a vital indicator of sanitation that was measured.

[1]https://www.ltts.com/blog/zero-waste-india-iot

[2]https://theprint.in/india/pm-calls-for-week-long-garbage-free-country-but-india-is-the-worlds-highest-waste-generator/478889/

[3]https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management

Today, in over 77% of wards of the country, there is segregation of waste at the source itself, and by 2022, the government has a target to cover all wards numbering 86,000 or more.

All cities have begun to practice scientific MSW disposal, including plastic waste as a result of their efforts in the mission. Details of the quantity of treated and untreated waste in urban areas of the country are now available. Besides, the government of India provides additional central assistance for creating infrastructure for the management of solid waste, addressing, inter alia, the processing of MSW, the management of construction & demolition waste, and the bioremediation of all legacy dumpsites.

In the rural context, though, solid waste generated is predominantly organic and biodegradable, it is becoming a major problem as the waste generated is not segregated in-situ and is of the order of 0.3 to 0.4 million metric tons per day, as reported by the Ministry of Jal Shakti, Government of India. Next to becoming Open Defecation Free (ODF) villages, solid waste management has become a practical necessity in rural areas as inconsiderate littering causes poor environmental sanitation resulting in unhealthy quality of living.

Besides, the Swachh Bharat commitment demands scientific disposal of garbage from rural households too. To tackle this problem, a functional waste management system should be in place at the Gram Panchayats (GPs) level. The Government of India (GoI) as well as many State governments are looking up to Gram Panchayats to implement a working system to manage solid waste in rural areas.

Accordingly, through Part-A of the compendium, the India Sanitation Coalition at FICCI is attempting to capture the stories of success in solid waste management, including plastic waste and the success of waste-to-wealth stories across the country, leveraging resources available with its network partners, for lessons to indicate operational approaches & solutions for the planners and sector practitioners who are active in the space.

Greywater describes gently used effluent from showers, sinks, and washing machines, as well as rainwater runoff and condensation from building mechanical equipment. It is distinct from both potable water, which is safe for drinking, and wastewater, which can contain harmful biological material. Greywater can contain traces of dirt, grease, or cleaning products, but is safe for soil irrigation and toilet flushing.

Approximately 50-70% of the water used in households results in greywater generation and not even 5% of this is recycled in urban households. This water is suitable for in-situ recycling using simple, low-cost technologies, and it is rather unfortunate that the concept is not commonplace in a water-starved country like India.

Rural areas in India are supplied with an average of 50 litres2 of water per capita per day. 65% to 70% of the total water supplied to rural India is converted into greywater. Based on the quantity of water supplied, rural India on average generates about 31,000 million litres of greywater daily. This primarily includes wastewater from the kitchen, bathroom, and laundry.

As far as treatment and reuse of treated greywater are concerned, it is important to know what level of on-site/offsite greywater treatment is necessary to meet local regulations for the planned use. One needs to articulate these safeguards to ease fears among the stakeholders and rally support for the treatment and reuse of greywater.

Besides, there are two aspects to the said treatment and reuse—one, treated greywater provides an opportunity for decreasing the water stress in the country through its reuse for non-potable purposes and groundwater recharge; and this is particularly important given India's growing need for water. Second, the materials found in greywater become pollutants when they join larger water bodies or are allowed to stagnate, but if integrated with the soil system, they can act as a source of nutrition.

A third, connected however a little less understood aspect is the business opportunity that exists in water treatment in India. It has been estimated to be of the tune of USD 103.31 billion separate from what is estimated in the Sewage Collection, Treatment & Disposal space which is pegged at USD 9.31 billion.

In the above background through Part-B of the compendium, the India Sanitation Coalition at FICCI is attempting to capture the stories of success in greywater management, across the country, leveraging resources available with its network partners, for lessons to indicate operational approaches & solutions for the planners and sector practitioners who are active in the space.

We hope the compendium will be well-received by its prospective readers.

Sanjeev S. Jha
Director, India Sanitation Coalition
Mitali Agarwal Mehta
Sr. Program Manager, India Sanitation Coalition

PART A

Part A: Models of Success in "Solid Waste Management, including plastic in Urban and Rural India: Success around Multi-stakeholderism to Gain Efficiency, Expertise, and Technology

Case study 1

Solid waste management in selected slums of Lucknow city by Population Services International (PSI)

Context

Population Services International (PSI) India is implementing HCL funded Swachh Uday program in Lucknow city in close coordination with Lucknow Municipal Corporation (LMC). Through intervention in 16 wards of Lucknow, PSI India is building a sustainable WASH environment by addressing the critical gaps in 3 major aspects - improved access to potable water supply systems in the city, improved coverage of households either connected to sewer grid or Faecal Sludge Management (FSM) value chain and increased segregation of waste (dry and wet) at the household level as per SBM norms.

Initiation and Planning

A rapid assessment of wards around river Gomti was conducted and 49 mohallas/slums for WASH intervention were identified. Subsequently, a detailed review of each location are done to understand the specific and common issues related to waste management. The intervention strategies used is mentioned below:

a. Community engagement for increased participation in identifying gaps, solutions, and action

b. Activation of Mahila Arogya Samiti (MAS), particularly for Solid Waste Management (SWM) for improved community engagement

c. Formation of Mohalla Swachata Samiti, and its activation

d. Introduction of an adaptable method for demand, requests, or complaints

e. Introduction of Behaviour Change Communication (BCC) through MAS and project teams

The two major components of waste management intervention in Lucknow were:

a. Using door-to-door waste collection services instead of disposing of waste in open places.

b. Source segregation of waste at the household levels

Institutional set-up

The intervention was designed step-by-step, in consultation with team HCL, with a focus on the challenges present, the behaviour of the community, maximizing the reach of the intervention, and ways through which the community may be empowered so that their improved behaviour continues even after the conclusion of the project.

Operations and technology used

The step-by-step implementation of the project is briefly explained below:

a. Assessment of Wards:

A guide was developed and an assessment of all 16 wards was carried out through focus group discussions, interviews, and informal discussions with the community members. 931 group discussions were carried out, and 49 slums that required deep support were identified based on the assessment. The broad gaps identified were;

- Choked sewers and drainages, due to waste dumping on the streets were common.
- Household waste collection services were not available/ or not availed by the households.
- Source segregation of waste at the household level was not being done and waste was being dumped in the open lands, roadsides, etc.
- Waste collection charges were not being paid by the households

The slums were then grouped into clusters and cluster coordinators were appointed to engage with the community and the ward-level LMC officials by --

a. Organizing coordination meetings in the Wards with LMC ward representatives

The PSI India team initiated the monthly coordination meetings headed by ward Parshad and attended by the LMC ward supervisors. The key discussion points in the meeting were (1) how to provide door-to-door waste collection services in the narrow lanes, (2) how to maintain overall cleanliness in the mohalla/slums through periodic cleaning of drains and roads and (3) how to remove the dumped waste from the community on priority.

b. *Formation of Mohalla Swachhata Samiti*

A Mohalla Swachhata Samiti (MSS) was formed in all the project mohallas/slums involving key opinion leaders. Each MSS had 8 to 10 members. The Mohalla Swachhata Samiti meetings were conducted every month. Critical waste management and other sanitation challenges along with the ways to overcome these issues were discussed during the meetings. LMC ward members also attended these meetings. MSS members have now taken the responsibility of coordinating with LMC and dealing with the issues related to lapse/ delay in the door-to-door collection service.

c. *Activation of MAS*

Mahila Arogya Samiti (MAS) was activated for awareness and community action for waste management by integrating the waste management component into their discussions. The MAS members were equipped with the knowledge and skills for conducting IPC activities at the households based on the requirement. Key waste management challenges and solutions were discussed during the MAS meeting with the support of ASHA. MAS members now coordinate with ward-level LMC officials, to deal with the issues related to any lapse in door-to-door waste collection. They motivate the defaulter households to avail door-to-door services.

d. *Promotion of Lucknow one app*

Demand for essential services by the community is the most challenging part due to indifference, ignorance, and inaction. Therefore, through the project, it was decided to create awareness about the Lucknow One mobile application, helping communities in downloading the application on their mobile phones, and educating them on demanding the services through the application. Besides, the team coordinated with the back-end team at LMC to review the complaints and resolve them within 24 hours. Mohall Swachhta Samiti and MAS were trained on the same and now they are actively participating in it.

e. *Development of BCC tools*

BCC tools such as tablets/mobile phones compatible digital flashcards and videos on waste management were developed to motivate individuals to use door-to-door waste collection services, highlight the benefits of source segregation of waste, etc.

Successes and lessons learnt

1. Initially, the community ignored the benefits. There was a lack of willingness to pay the waste collection fee, however, intense engagement through the MAS and Swachhta Samiti brought about the desired change and people started to pay the waste collection fee. It has now become a practice due to its positive results.

2. Door-to-door waste collection services were started in the

community with small waste collection carts being provided by the LMC wherever required. It was done with the active support of ward members, LMC staff, and community participation through MSS and MAS meetings.

3. Earlier, truckloads of waste were being dumped in the mohallas/slums. This waste was removed with the support of LMC staff, and ward Parishad.

4. By conducting coordination meetings in the wards, formation of MSS, and activation of MAS members, positive change was observed in community behaviour. Additionally, 520 MSS and 485 MAS members have come forward for coordinating with LMC representatives on behalf of the slum/community for any lapse in the services.

5. 2500 households have downloaded the Lucknow one app and are willing to register complaints on the app for any issue related to waste management in their Mohalla/slums. During the project period, complaints were raised by 560 people on Lucknow one app.

It is expected that the interventions undertaken through coordination groups and community awareness, during the project by PSI India, would be sustainable beyond the project period.

Case study 2

Urban solid waste management by FINISH society

Context

Dungarpur is one of the fastest-developing cities in southernmost Rajasthan and is also the administrative headquarter for the Dungarpur district. It is also a predominantly tribal belt with an approximate population of 51,000 from 10,500 families. The city is divided into 40 administrative wards. Like many other growing small towns, there was no formal system of garbage collection in Dungarpur, and it was a common practice to dispose of household waste on street corners or near vacant spots. After being declared the 1st ODF city in Rajasthan, solid waste management was the next big problem grappling with the city's environment.

However, things changed after the Dungarpur Nagar Parishad (DNP) started putting a system to address the solid waste management challenge. With demonstrated results of FINISH Society in achieving ODF, they partnered with the Nagar Parishad to set another example in Solid Waste Management (SWM).

Initiation & planning process

The main objective of the project was to ensure 100% door-to-door collection, source segregation, and waste processing, to reduce the waste going to the landfill while maximizing resource recovery. An ambitious target for zero waste disposal was set.

A preliminary assessment of the quantity and composition of waste generated in Dungarpur revealed that around 16 Tonnes per Day (TPD) of Municipal Solid Waste was generated without any source segregation leading to very poor resource recovery. Average waste generation per capita per day was estimated to be 0.314 grams out of which around 60% was wet waste (organic) and 40% was dry waste (inorganic).

The first step was to start a regular door-to-door waste collection program. Intensive awareness generation activities were conducted by FINISH and local mohalla committees were formed.

Institutional set-up

DNP partnered with three organization to address the issue of Solid Waste Management. FINISH society started the door-to-door waste collection from 10 wards in the beginning and expanded it to cover 15 wards. 18 vehicles with GPS connections appointed for the segregated waste collection were deployed.

A dedicated team was formed for each vehicle, which included a driver, a helper, and a supervisor. Grievance redressal is a critical part of solid waste management systems, therefore, a complaint redressal mechanism through a helpline number was initiated by FINISH society. DNP also appointed a sanitation worker for each ward and one supervisor for every five wards to support the green workers and monitor the progress.

For those who were not segregating the waste, the helper and supervisors started separating the waste in front of them so that they can learn by watching. These initiatives were further supported by sanctions in the form of a fine by the Nagar Parishad for littering in open. For commercial areas and public places, 46 community bins were installed and garbage vulnerable points were removed with community participation. All collection vehicles have GPS systems and follow consistent route plans every day. A separate team of green workers is now engaged in the daily sweeping of the roads.

To manage the solid waste, a Material Recovery Facility (MRF) of 15 TPD capacity was set up with a composting facility, dry waste separation, storage, and a biogas unit. Green workers at the MRF center were trained on different waste streams and secondary segregation. The commitment from Nagar Parishad, local officials, the mobilization team, and residents together started showcasing promising results after a year. The entire system kept improving and upgrading with the expansion of the MRF center and continuous community sensitization. A sanitary landfill of 2.5 tons/day capacity was set up as per the present requirements of Dungarpur Municipality along with the biogas plant which can process 7 TPD.

Through advocacy efforts from FINISH society and other community-based organizations, a user fee is collected from the households, and segregated dry waste is sold to recyclers generating revenue from solid waste collection and treatment. Nagar Parishad has invested in the MRF center, collection services, biogas unit, and sanitary landfill. It also provides safe working space to green workers.

Operations and technology used

The entire solid waste management system of Dungarpur includes the following key activities:

a. *Solid waste segregation and collection*

- Awareness on types of waste and source segregation at the household level.
- 100% daily door-to-door waste collection in each ward. In the wards where the big vehicles cannot go for waste collection, E- rickshaws are deployed to collect the waste.
- Separate roti compartment in door-to-door waste collection vehicles for local Gaushala collecting around 5,000 rotis every day for 200 cows.

b. *Waste processing and resource recovery*

- Decentralized waste management with citizens' participation by promoting community and household-level composting to produce manure for their home gardens.

- The centralized composting facility processes the remaining wet waste into manure which is tested, demonstrated on agricultural plots, packed, and sold in local markets. The biogas plant has a treatment capacity of 7MTD.
- Composting of garden waste in 28 parks of the city to promote in-situ treatment and reuse.
- Wire meshes were installed in drains for preventing solid waste from entering the water bodies.
- Secondary segregation of dry waste into 12 different categories was started at the MRF facility (capacity: 15 TPD). 24 ragpickers were engaged in this task.
- A C&D waste collection &distribution centre was also established. On-call C&D waste collection service was set up. This waste is also used in Municipal works such as filling. Non-recyclable waste is being used as RDF at Cement Factories.
- Biomedical waste is sent for disposal to Udaipur's biomedical waste incineration facility.
- Inert waste is disposed of through scientific landfill.

Strengthening Institutional Setup

- Fast responsive grievances redressal mechanism was set up with a helpline number integrated with mobile-based tracking. INR 100/- was taken from people who littered and a prize money of 50/- was given to the person who informed about the violator.
- Capacity building of green workers, helpers, and supervisors about the program and their roles and responsibilities was undertaken.
- 10 Swachh Brand Ambassadors were nominated for the promotion of the Swachh Bharat Mission among citizens.


Times Of India | e-Edition

Dungarpur among 4 cities to be chosen as sanitation model

Bill & Melinda Gates Foundation To Study Waste Mgmt

Public fund spent only on welfare works: Raje

शहर में 5 महीनों में घटी 50 प्रतिशत मौसमी बीमारियां


NGT calls for replication of district waste mgmt model


स्वच्छता के मापदंडो में डूंगरपुर निकाय प्रदेश में अग्रणी : दीपक माहेश्वरी

डूंगरपुर भास्कर

डूंगरपुर. भांडल सिटी के रूप में विकसित होने के लिए मिलेगा फंड

Financial and business model

Nagar Parishad has made provisions for a user fee from the households for the waste collection services - 50 rupees per household, 100 rupees per shop, 200 rupees per small restaurant, and 500 rupees per hotel on monthly basis. Approx. INR 2,00,000/- is collected every month from the user fee and approx. INR 2.4 lakh revenue is generated monthly by selling recyclable materials from the MRF center. DNP is also selling compost (vermicompost and city compost) at an average price of INR 4 per kg and on an average 15,000 kg of compost is produced per month, providing revenue of around INR 60,000. Revenue from these avenues helps the Nagar Parishad in meeting part of its operational cost.

Successes and lessons learned

Dungarpur city is a model for growing small towns where concerted efforts from key stakeholders have created robust, reliable, and responsive solid and liquid waste management systems. It also highlights that a strong will and commitment of the urban local bodies along with investment into infrastructure and resources are critical in the initial journey. Civil society agencies further help with their technical support in the effective utilization of these resources and community sensitization, without which solid waste management systems cannot succeed. The results of Swachh Sarvekshan instill a sense of pride and encourage not only the local administration but also residents for sustainable results.

Challenges and possible resolutions

Forward linkages of recycled waste in a consistent manner have been a challenge. FINISH society with support from the Nagar Parishad is trying to improve resource recovery. Besides, FINISH society also connects with Farmer Producer Groups (FPOs) engaged in practicing organic farming for the consumption of this manure. Other than organic manure, FINISH Society collaborates with the network of apex dealers and recyclers for forward linkage of dry (inorganic) waste.

Collecting user fees from 100% of households is another challenge and some households refuse to pay the charges. On average only 34% of households and 60% of commercial shops are currently paying the user charge. To improve this FINISH society organizes awareness campaigns, individual conversations, and group meetings with community members to change their behaviour towards user fee payment as a contribution towards their city's cleanliness.

Quotes

Dungarpur happens to be the first ODF city in Rajasthan in 2016. It was awarded as the *"Cleanest City" in West Zone* in the 25,000 -50,000 population category in Swachh Sarvekshan (SS) 2021 and twice in a row became the "Best City in Citizen Feedback" in SS 2019 and SS 2020 in the West zone.

"We could achieve all this only because of the continuous support and sustainable intervention methods implemented by FINISH Society," says the Chairman of Dungarpur Nagar Parishad, Mr. Amrat Kalashuaa.

Case study 3

Strengthening ULB's capacity in peri-urban Patna to promote sustainable and inclusive decentralized solid waste management (SWM) practices - Aga Khan foundation (AKF)

Context

In Bihar, one of India's most populous and least developed states, the situation of solid waste management in urban areas is particularly grave. With increasing rural-to-urban migration, the state capital and its adjoining towns are experiencing severe difficulties managing their solid waste, which according to Patna's City Development Plan is expected to grow from 680 tonnes every day to 1,537 tonnes per day by 2030. Patna's local authorities are constrained by capacity and institutional limitations and difficulties in sustainable management of urban service delivery. The absence of mechanisms to recycle or treat solid waste in these areas has led to large-scale littering of public spaces and in turn unhygienic public spaces. Such critical challenges have resulted in the city being continuously declared the dirtiest state capital in India[4].

Initiation and planning process:

The three ULBs of Danapur, Khagaul, and Phulwarisharif comprises of 96 wards and are a mixture of urban and peri-urban areas. Although the ULBs do not fall under the jurisdiction of the Patna Municipal Corporation (PMC), they dump all their solid waste at the PMC's landfill site in Bairiya, which is 35km outside of Patna and is the district's sole landfill. Due to their proximity to Patna city, the ULBs are meant to work closely with the PMC to effectively manage their solid waste, but due to their significant capacity constraints, this is not currently taking place.

Given the current Solid Waste Management (SWM) challenges of the three ULBs as well as the focus of the Government on improving SWM and the recent SWM Rules, the project was designed considering this clear need for the ULBs to engage more intensively with the PMC to establish sustainable and holistic SWM systems. Additionally, since the State government's Department of Urban Development and Housing (UDHD)

[4]Union Ministry of Housing and Urban Affairs' annual cleanliness surveys 2020 and 2021

has the overall responsibility for the management of Bihar's urban development, the project integrated the need for the direct engagement of PMC and the three intervention ULBs with UDHD.

On the other hand, the fact that Indian cities and towns do not charge for SWM services (unlike many other countries), has led to a significant financial burden on their ULBs. The case of Patna is based on the same premise as validated by the cleanliness annual survey which revealed the absence of any ward-level associations or community groups in the city for tackling civic matters including waste management. Consequently, the project identified community participation/engagement as an integral component of the project and prioritized their engagement with the ULBs for improved service delivery, prevention of waste being dumped by the citizens/ households/businesses at the designated dumping sites and public spaces, while establishing a model of decentralized solid waste management in Patna.

Recognizing the instrumental role of our rag or waste pickers (including women, men, and even children) in the country's waste collection and recycling processes, the project also planned for the integration of these human resources from the intervention geographies within the SWM model. While ensuring the sustainability of improved SWM practices has been one convincing argument, the protection, and welfare of these waste pickers has been the more compelling inducement, given the fact that this workforce belongs to the most marginalized communities, is highly vulnerable to health risks owing to dangerous work conditions and faces a high degree of social discrimination and low job and income security. At the same time, to ensure that this pilot SWM model is financially sustainable and that the target ULBs can scale it up, the project envisaged the involvement of innovative start-ups engaged in the waste-to-resource sector within its model, whose expertise would lend technical support to the PMC and the ULBs, generate new livelihoods in the waste sector and help them achieve scale and sustain their business activities while creating an enabling environment.

Institutional set-up

Funded by the European Union (EU), the project has been planned by the Aga Khan Foundation (in consultation with the EU). Its on-ground execution is being undertaken by the AKF field team along with its local implementing partner, the Gram Swarajya Samiti Ghoshi (GSSG). AKF India's Bihar state unit team has been acting as the lead implementer, applying approaches and knowledge acquired through its years of experience in implementing large-scale education, early childhood development, governance strengthening, SHG promotion, and water and sanitation (including solid waste management) programs in the administered areas of the selected ULBs. On the other hand, GSSG, a Bihar-based NGO with extensive experience in community mobilization, water and sanitation, solid waste management, and state-level processes, has been co-implementing the project and mobilizing communities to adopt waste segregation and management behaviours, while utilizing its experience of working with ULBs and UDHD to introduce participatory planning approaches.

Operations and technology used:

The overall objective of this project has been to improve the governance of the selected Urban Local Bodies (ULBs) to enable the effective delivery of public services around solid waste management (SWM) that facilitates inclusive, safe, resilient, and sustainable urban settlements. Its specific objectives are to:

- Build the capacity of the three ULBs on decentralized governance and strengthen their technical expertise for effective SWM
- Demonstrate an effective and financially sustainable model for decentralized SWM that can be replicated and scaled up by other local authorities
- Promote citizens' engagement in planning and public monitoring of SWM to improve transparency, accountability, and responsiveness of ULBs

The project has been designed by integrating tried and tested approaches to develop the capacity of urban local authorities, enhance local governance, and increase the efficiency and sustainability of solid waste management. AKF India has been working in the areas administered by the three target ULBs since 2010 and has, through its continued presence, identified SWM strengthening, improvements in water and sanitation, and access for citizens to government schemes and entitlements as the key areas of improvement, The same was acknowledged by both citizens and the ULBs in the preparatory phase, wherein AKF held discussions with the ULBs and conducted a survey on the current SWM practices - this activity provided a basis for developing a blueprint for the intervention.

To strengthen the governance of municipal solid waste for improved planning and implementation of SWM strategies and to ensure their alignment with national policies, schemes, and rules, the project has cumulatively trained 3600 (Women: 2880, Men: 720) executive members, elected representatives and staff of ULBs on their roles and responsibilities and how to carry these out; their ability to develop, execute and operate SWM plans drawing on SWM best practices; gender-sensitive planning; development of budgets for decentralized action and their technical understanding around SWM.

Cognisant that for the governance of ULBs to be improved, the demand side of SWM has to be strengthened, the project has identified and trained 4000+ citizen leaders on SWM, who in turn have been enlisted to raise awareness in their communities and support community-level campaigns on improved SWM practices.

Building public-private partnerships by supporting ULBs to develop linkages with innovative Indian start-ups working on SWM has been another significant project constituent. This has been helping bridge the existing gap in Bihar between the public and private sectors, making SWM more sustainable, efficient, and effective.

At the same time, the Material Recovery Facility (MRF) center established by AKF in the Danapur ULB has been a technological input to process and separate recyclable municipal solid waste using manual and mechanical methods. A model segregation center incorporating waste to resource income generation activities for replication by the government, the center has been ensuring better management of waste through the promotion of source segregation, home composting (by 21,750 households), and establishment of forward linkages by disposing of waste to authorized recycling centers.

Cross-cuttingly, the project has strongly supported equal opportunities for women from weaker sections by mainstreaming women waste pickers within the overall process of collection, transportation, and treatment of waste at the MRF center and by linking them to the various social welfare schemes In parallel, ULB Danapur has introduced gender budgeting, women-led waste entrepreneurship, with a commitment to improving living conditions of frontline sanitation workers and in turn their right to lead dignified lives.

Financial and business model:

While the core financial support for the implementation of the project has been provided by the European Union, stakeholders across the three ULBs are acquiring the necessary capacities at the technical, economic, social, and policy levels to ensure the longevity of the overarching project goals.

At the technical level, these capacities refer to improved governance mechanisms and practices for SWM and better knowledge of how to manage municipal solid waste. This combined with the propulsive role of the UDHD will secure the technical sustainability of the project.

The sustainable benefits at the economic level include improvements in the income of 2,500 waste-pickers and marginalized communities integrated into the formal SWM, revenue generation from collection fees, and the treatment/processing of solid waste which is being sold to enterprises and start-ups that turn waste into a resource. At the social level, sustainable benefits are significant improvements in the quality of life of waste pickers and poor and marginalized communities, especially women

(better work environments, access to basic services, curbing child labour, safety, security, and integration of women). The efforts of GSSG that will continue beyond the project period would sustain endeavours to include learnings/models from the intervention in state policies, standards, codes, and guidelines, thus ensuring policy-level sustainability. Lastly, improvements in the physical environment of the targeted urban and peri-urban areas, particularly poverty pockets will create a sustainable environment.

Success and lessons learnt

By adopting a dual-pronged approach, this intervention has not only strengthened the capacity of ULBs for improved planning and implementation of SWM strategies but also effectuated large-scale citizen engagement to develop a circular economy for reducing waste. Working within the broader framework of government-led interventions supporting decentralized waste management policies and institutional development, the effort has garnered the attention of UDHD, which is promoting this unique community-owned model among other ULBs while recognizing its strong potential for state-level scaleup. Some of the lessons to keep in mind for developing a similar project or in case of replicating and scaling up the model are chalked out below:

a. *Need to focus on community participation RCCE approaches:* The intervention by categorically focussing on community participation has portrayed it as a long-term and sustainable solution to the issues of SWM. The sensitization drives by citizen leaders have delivered in the form of better source segregation. The workshops conducted for citizen leaders have enabled them to map their work areas and, identify discrepancies and the way ahead. The citizens and ULBs have a sense of accountability and are willing to make themselves adept at adhering to norms associated with SWM.

b. *Waste management models for a conducive environment:* The adoption of decentralized waste management practices in the form of the Materials Recovery Facility (MRF) center (with an installed capacity of 5 tonnes per day (TPD) and currently functioning at 2.5 TPD) has exhibited itself as a best practice in the sector. Following its success, the facility has been replicated at Khagaul and is soon to become operative at Phulwari Sharif. A Mini Segregation Centre has been set up at Khagaul to mitigate wet waste. Other than facilitating in-situ waste management, these practices have had a positive impact on

air quality while reducing instances of groundwater contamination.

c. *Economic growth & Inclusiveness:* The integration of waste management models in collaboration with the start-ups has triggered resource recovery and Waste to Wealth creation under the project. The establishment of such plausible linkages could be further explored within the sector to tie them up with industries and enable the seamless availability of raw materials for manufacturing. Such activity has also assured a regular income to the waste pickers, resulting in the formalization of the economy that is pertinent in a country with an extensive informal economy like India.

d. *System Strengthening through capacity building of ULBs:* The initiative has facilitated capacity building for ULBs in the form of increased human resources and the availability of mechanized vehicles for waste collection. The steady process of engagements with the community resulted in a three-fold increase in Frontline Sanitation Workers (FSWs) and ensured a cent percent collection of waste, increasing incrementally to more than 65% today.

This model of SWM provides a technology-backed, participatory waste management solution, from waste segregation at source to its final treatment. By bringing together the government and communities as equal partners, the model has further prioritized community participation, equity, gender equality, and good governance.

Challenges and possible resolutions

This project has endeavoured to promote waste segregation at source, home composting and treatment at the MRF and segregation centers, to ultimately minimize the waste in the already overflowing landfills. However, the experience of implementing this project has revealed the challenges of the SWM sector, despite it being a profitable and ecologically friendly business. While the existence of gaps in waste management infrastructure including a shortage of compartmentalised vehicles and segregation centers in the city, macro-level challenges related to collection, transport, transfer, treatment, and appropriate disposal of waste continue to pose themselves as sore points that call for action. Some of the possible solutions to tackle these include:

- Introducing technology-enabled innovative tools for tracking the door-to-door collection of household waste
- Galvanizing citizen engagement through the introduction of robust citizen feedback mechanisms and tools
- Building forward market linkages for treating/recycling/upcycling waste through collaborations with start-ups/social enterprises
- Developing an MIS system providing an update on the status of waste collection, transport, and treatment
- Designing measures to increase public and commercial sector accountability as well as community involvement at various levels
- Homogenising well-organized waste pickers in the formal SWM sector, while guaranteeing their dignity of life

Thus, the solution lies in institutionalising households and communities, strengthening the system, building public-private-partnerships, raising public awareness, and infusing technological enhancements to foster a culture of SWM.

Case study

4 Zero waste 177 by Hasiru Dala

Context

Ward 177, J P Nagar Bangalore, Karnataka has 12,700 households and approximately 530 commercial establishments. There was a small women's group, Women of Wisdom (WoW), which worked in their lane of 69 households to make it a zero-waste lane. They encouraged in-house composting and street leaf litter composting on the street before HasiruDala started working with them. They had the passion to carry out the project but did not have the capacity to take it beyond their lane. The local elected representative was also very keen to leverage the enthusiasm of the WoW group and include other volunteers to reach the whole ward. This project was implemented between June 2019- March 2020.

Zero Waste Ward 177, J P Nagar in Bangalore was chosen to pilot this strategy and create an implementation program that could be replicated across the city. Before the intervention, the status of the ward were as mentioned below:

- The residents were not aware of the waste management system and only pushcarts were operative to collect the waste. Moreover, majorly mixed waste was collected.
- There was no scheduling and collection procedure.
- Majority of the lanes in the block were littered with waste as it was adjacent to a mini forest park and commercial establishments and waste was dumped by passers-by.
- Residents were not aware of the roles and responsibilities of the Pourakarmikas Street sweepers or supervisors.
- They were unaware of the concept of waste segregation and had no clue about the destination points.

Initiation and planning process

a. Planning:

- Mapping the properties for creating a micro plan.
- Block-level mobilization of citizens for action.
- Setting citizen vigilance groups for collection of waste and vehicle attendance through WhatsApp groups.
- Understanding the roles and responsibilities of the officials/workers and advocating with them to stabilize operations further with the citizens' groups and volunteers.

- Upgradation and building of decentralized waste processing infrastructure.
- Street campaigns for awareness and sensitizing residents.
- Awareness campaigns at all schools with a special session for the teachers on 'Trashonomics', a methodology to teach children about waste management.
- Training of Pourakarmika Street sweepers on the importance of single-use plastic ban, segregation, and garbage burning. In addition, information on the usage of personal protective gear, accessing Employees' State Insurance (ESI), and benefits of Provident Fund (PF), social benefit schemes, etc. were also told to increase their financial literacy.
- Working on slum waste management, which comprised a population of 2,000 low-income groups.

The principles for the implementation of a zero-waste project across the ward were:

- Implement the Micro plan made by BBMP (Bruhat Bengaluru MahanagaraPalike).
- Three-way segregation of waste at source - wet (organic), dry (inorganic), and domestic hazardous (reject) waste.
- Collection of all streams of waste in two different vehicles: dry waste to be collected twice a week, and organic and domestic hazardous waste to be collected every day.
- Facilitate or create decentralized waste management infrastructure for wet waste: lane composting, leaves litter composting, etc.
- Promote in-situ composting at the home, institution, and other waste generators at the site of generation.
- Efficient management of dry waste.
- Integration of waste pickers.
- Citizens' engagement.

b. Ward committee meetings:

After Hasiru Dala started the project, a ward committee meeting was held for the first time in the presence of the Corporator and ward committee members on 18th September 2019. All civic issues of the ward were discussed in this meeting by the members as well as the citizens and their grievances were addressed. Two members of the citizens' group were invited as representatives.

c. *Action Plan was* designed by the citizens of Ward 177 to plan the activities and set up the timelines.

Institutional set-up & stakeholders involved:

- Elected Representatives (MLA, Corporator)
- Citizens Groups (RWA) / Volunteers
- BBMP Officials
- BBMP resources - Contractors, Supervisors, Auto Drivers, Link Workers, Asha Workers, Pourakarmikas, etc.,
- Hasiru Dala Staff
- Media / Celebrities (where needed)

- College students
- Religious Heads
- Experts / Organisations from related fields whenever required
- Creative heads for advertisements
- Pollution control board
- Labour inspectors, Labour Department representatives
- Technical support by SWMRT:

At the city level, Hasiru Dala engaged with a citizen group called "Zero Discharge Wards" ("Zero waste ward" is referred to as "zero discharge ward" in Bengaluru) to exchange notes and replicate the efforts in other wards of the city. The group is facilitated by a citizen think tank called Solid Waste Management Round Table (SWMRT). SWMRT also provided technical support to Hasiru Dala. Through the efforts of this partnership, positive results were seen in source segregation and processing of organic waste within the ward. A document that outlines the methodology, finance involved, and technology used was also prepared. For the initial pilot, 8 wards were identified and many more are expected to be identified in the years to come.

Operations and technology used

Activities during the period June 2019-March 2020

- A basic survey of the ward and waste audit was undertaken along with citizens and health Inspector.
- Regular meetings with elected representatives, BBMP officials, and citizens were conducted to plan, implement, and undertake follow-ups.

- Identification of blocks in the ward and active citizen participation through WhatsApp groups.
- Undertaking door-to-door surveys and creating awareness on segregation of waste, plastic ban, and home composting with BBMP officials, Supervisors, and citizen volunteers.
- Streamlining the waste collection process by engaging 2 staff on the field to accompany the wet/dry waste vehicles during collection and disposal.
- Clean-up of blackspot areas with the help of NGO organizations
- With support from the MLA of Jayanagar Constituency, Hasiru Dala facilitated an event for making sanitation workers aware about PPE kits, contributing to their financial literacy, and supporting their social security activities.
- Conducted training of trainers on 'Trashonomics' for the teachers of Ward 177 and conducted awareness workshops at all the schools of Ward 177.
- Installation of lane composter which can compost an average of 25 kgs of organic waste/day from 70

households, managed by Pourakarmikas (PKs)of that street with local citizen group WoW. In the first batch, 365 kilos of compost was harvested. The lane composter was sponsored by Hasiru Dala

- Awareness activities like cycle rallies of children, children's visits to the dry waste center along with their parents and others in the community to understand the process of recycling, learning visits by students of the University of Washington and Wastepickers from Alliance of Indian Wastepickers (AIW) were also conducted.
- To promote source segregation and storage of dry waste, Hasiru Dala donated dry waste bags with S hook to 200 residents of a low-income group locality.

Measures that were taken to work to bring the desired changes:

- PKs were made aware by the citizens' groups in the presence of the supervisors and health inspector. The wet waste collectors were asked to collect only the wet waste and street sweepers were instructed to do only street sweeping.
- IEC activities were conducted in the locality to make the residents aware and to educate them about their roles and responsibilities.
- Early morning awareness campaigns were conducted continuously for 3 days to cover the entire block when the wet waste vehicle collected the waste. These campaigns were repeated at frequent intervals. The campaigns had participation from citizens, BBMP officials, and health department staff.
- The citizens worked with the Marshall and Marshall supervisor during the late evenings and early mornings on the blackspot areas.
- Parallelly the dry waste collection was scheduled for twice a week.
- Regular meetings of the citizens at public places with the officials helped to understand the issues and resolve them.
- Awareness regarding Solid Waste Management was given at school assemblies of the block.
- Cycle rally by children of the Block helped to advocate further.
- Visit of the children and the community to the DWCC further helped them to understand the processing of waste

Case study 5

Mohalla Committees Driving Decentralized Solid Waste Management in Saharanpur by ITC

Context

Improper solid waste management is one of the most serious environmental challenges confronted by cities in India. Typically, problematic areas in Solid Waste Management (SWM) inter-alia include, i) inadequate service coverage and operational inefficiencies of services; ii) limited utilization of recycling activities, and iii) indiscriminate landfill disposal. The focus on merely waste collection rather than waste management, and the often observed "**Not in my backyard**" approach of communities has led to piling of waste at landfill sites or on roadsides that results in serious health and environmental hazards.

According to the 2011 Indian census, Saharanpur had a population of over 7 lakhs with 1.29 lakh households in 70 wards. Saharanpur generates more than 1,16,000 MT of waste in a year, out of which, wet waste is over 70,080 MT1. Saharanpur is a city and a Municipal corporation in Uttar Pradesh and is also the administrative headquarters of Saharanpur district.

Like most municipalities, Saharanpur Municipal Corporation started waste management with open community bins in different localities. Subsequently, the dumped waste from these bins was collected by municipal workers and transported in trucks to landfill sites.

To address the issue of solid waste and promote a clean and safe environment, ITC's Social Investment Programme through its brand "Mission SunehraKal" developed four, context-specific solid waste management models for large cities, small towns, rural catchments, and temples. The desired outcome of the ITC's solid waste management program is '**Minimal waste to landfill**' in a sustainable manner. The program is in partnership with Municipal Corporations/ Panchayati Raj Institutions and is largely based on the principle of '**treatment close to the generator**' to reduce transportation and associated costs, whilst minimizing waste load at the landfill.

Initiation and planning process:

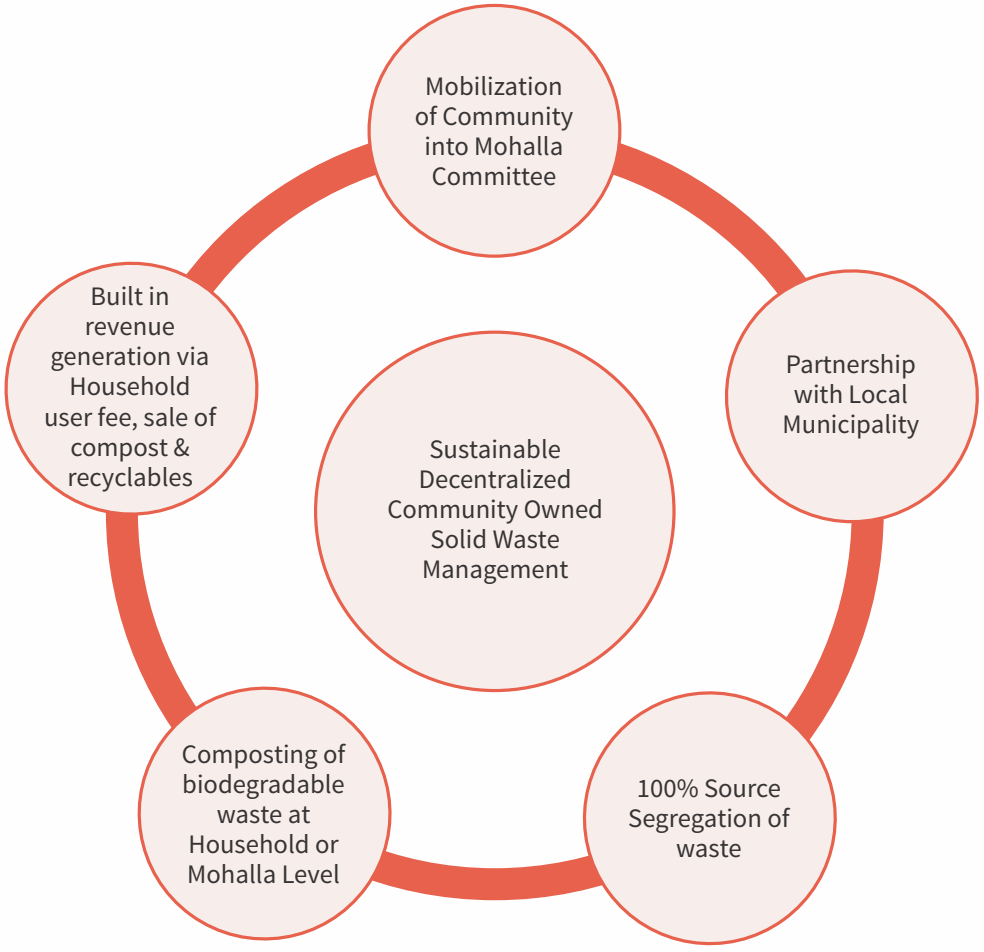
ITC initiated its community-led decentralized Solid Waste Management (SWM) program in one ward of Saharanpur around its factory in the year 2006. However, in 2015-16, ITC's Social Investments Programme conducted a need assessment using Rapid Rural Appraisal, Focus Group Discussions, and Household Surveys to understand the major challenges faced by the community. Among all identified problems, solid waste was rated the highest. Accordingly, ITC's '**Community-led waste management programme**' was planned to be scaled up in the entire Saharanpur city in collaboration with Municipal Corporation with the following objectives:

- Empower the community to own and develop clean and hygienic habitations;
- Ensure **100% source segregation** and treatment of waste as a resource near generators; and
- Drive community-led solid waste management (SWM) initiative sustainably- to '**minimize waste going to landfill**'.

The model focused on community ownership with decentralized waste management. Hence, the team initiated mobilizing the community to form Mohalla Committees (MC) that could take responsibility for the cleanliness and monitoring waste management. The community nominated 10-12 office bearers to their Mohalla Committee who would take the lead role. These commintees were responsible for the monitoring of segregated waste collection, service charge collection, wages payment to waste collectors, and overall cleanliness of the area. These office bearers coordinate with various departments for cleanliness and other support required for their area.

While ensuring source segregation at the household level, the decentralized model of composting was emphasized and discussed with community members for adoption, to reduce the load at the **centralized waste processing unit** and also **minimize transportation** and other associated costs. The sustainability of a cluster was observed after providing **handholding support** by the project team for 4-5 months as the MC starts managing the waste collectors and learns to mobilize households for source segregation and decentralized composting. Each household **contributed a fee** towards waste management services and the funds so collected were kept in a separate account to pay the waste collector. The surplus amount was retained with the committee for other developmental activities in the area like cleaning the street, drain, park, and plantations, etc. Two decentralized composting methods were promoted i.e., "**Home Composting**" and "**Cluster Composting**", depending on the availability of space and acceptance.

Mohalla Committee plays an active role in mobilizing households to adopt source segregation and home composting. The waste- collectors/ rag pickers also own the recyclables, which further adds to their monthly income. Sustainability of the model is driven through **revenue generation** including a household levy for waste management, **sale of recyclables and compost**. Both biodegradable and non-biodegradable waste gets managed such that there is minimal waste reaching landfill/dumps



At the start of the project, the bio-degradable component of the waste was composted at a centralized site through windrow composting methods. Subsequently, with **strong IEC efforts**, an approach of "**My Waste, My Responsibility**", decentralized management of bio-degradable waste through home composting and cluster-level bio-composters was encouraged to minimize costs, multiple handling, and associated environmental impacts. Till date, 296 composters have been installed for managing biodegradable waste from 73,608 Households. Households are encouraged to segregate and manage wet waste preferably at the household level for maximum resource recovery, and currently, 8,716 households are practicing home composting.

The compost generated is used by the households and community for the **kitchen gardens** and to develop greenery in local parks and common areas, and the **surplus compost is sold**. The waste collectors are attached and supervised by the respective MC for SWM work in their area and are paid a monthly remuneration from the collected user fee.

Institutional set-up:

The Waste Management Model of ITC is designed on the principle of partnership with local bodies (Municipal Corporations) and community-based organizations (CBOs) to encourage **participatory planning, and ownership, and to drive scale and sustainability**. The SWM intervention in Saharanpur was initiated by forming an implementation partnership with two Non-Governmental Organizations (NGO) - Umang SunehraKalSewa Samiti and Forum for Organized Resource Conservation and Enhancement (FORCE). The Model was recognized by Saharanpur Municipality and an **MoU was signed** in December 2017 to scaleup the model to the whole city. The waste collection activities commenced with a focus on formation of Mohalla Committees with about 250-300 Households clustered together in each area for decentralized self-management of waste.

So far, 433 Mohalla Committees (MC) have been formed comprising 1.36 lakh Households in Saharanpur SWM Programme. **Women members play a primary role** in household waste management, hence an IEC Campaign on source segregation and management of waste with a focus on women was rolled out. Women of the city are playing leadership roles in this program ensuring clean households and surroundings. In these 433 Mohalla Committees, out of a total of 3,557 executive members 1,896 (> 53%)2 are women and 34 Mohalla Committees comprise only female members. Besides Mohalla Committees, waste collectors who are from **marginalized sections of society** are also the prime drivers of the program and are responsible for door-to-door waste collection and management of the waste. They also earn from the sale of recyclable waste, which they collect from the households, thus have a strong stake in the program. MCs have proactively linked waste collectors to various social security schemes.

Operations and technology used:

ITC Mission SunehraKal works in partnership with CBOs for participatory planning, the government for driving scale, and civil society organizations for the implementation of the program. Community partnership drives **contributions from beneficiaries** for **ownership & sustainability** and is focussed on the **inclusion of the most marginalized communities** including women in the initiative. Community members participate in solid waste management by showing proper sanitation behaviour, paying user charges in cash or kind, participating in consultation, management, and administration of the program, and liaising with **urban local bodies and communities.**

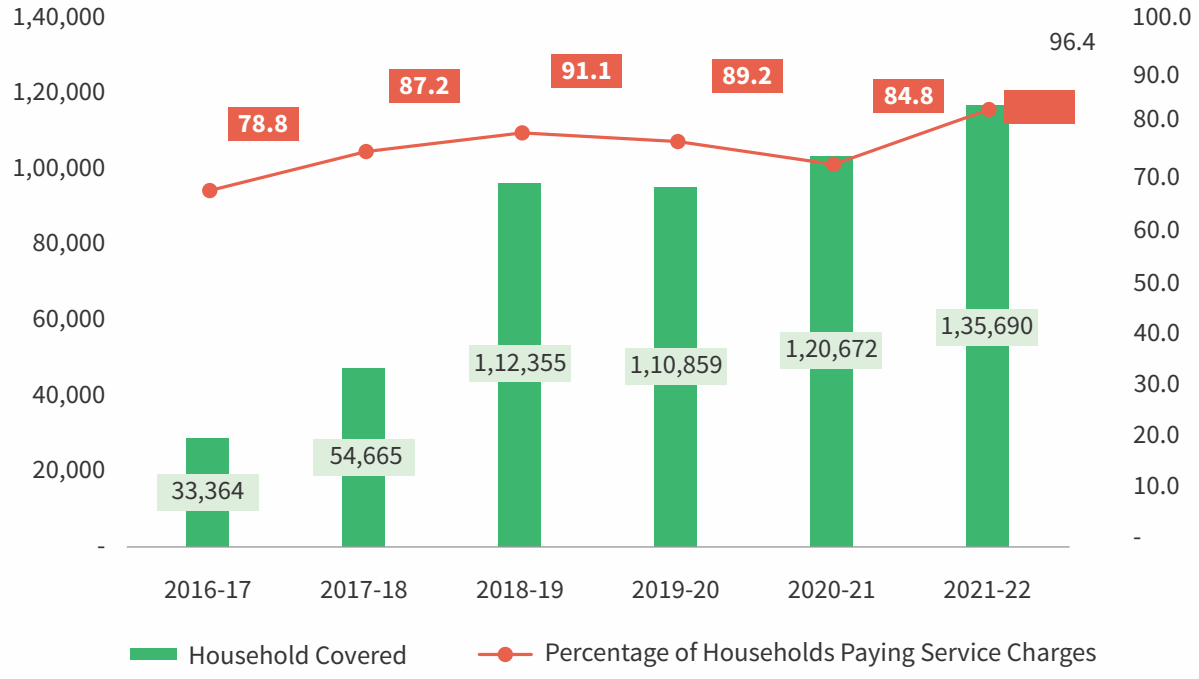
Mohalla Committees are the owners of the intervention, and the following activities are undertaken and supervised by them directly with guidance from ITC and NGO partners and with support from Municipal Corporation.

- **Awareness and Local Governance** - Mohalla Committees take the lead role in the area and coordinate with all stakeholders; appoint the waste collectors; mobilize the community for source segregation; monitor daily segregated waste collection activity, do service charge collection & payments to waste collectors, and thus ensure financial sustainability of the initiative.
- **Waste Collection** - The Committee appoints waste collectors for waste collection. They provide training to the waste collectors on the handling of waste, health & safety precautions, dealing with non-segregators, composting of bio-degradable waste, etc. After training, segregated waste collection is initiated.
- **Monitoring** - The Committee regularly monitors the segregation of waste, and the waste collectors inform them about non-segregators. The Committee then followsup with non-segregators and encourages them for segregation.
- **Service Charge** - The Mohalla Committee decides the service charge as per the operational cost of waste management activity and the households' ability to pay. Later, they levy additional charges for social events by households.
- **Use of Waste** - The committee installs a community composter for ward-level composting. Cluster composters are designed by ITC-trained fabricators based on anaerobic principle with a capacity of about 300 Cubic feet, partitioned into 3 chambers to handle biodegradable waste cyclically. The cluster composting process is jointly handled by Mohalla Committees and waste collectors. The compost thus produced is shared equally between Mohalla Committee and waste collectors. The waste collectors sell their part of the compost to a suitable buyer and Mohalla Committees sell the compost to its members and also uses it on plantations in public places. Apart from that, the waste collector also takes all recyclable waste and sells it to a scrap vendor, which provides additional income to the waste collector. It motivates the waste collector to focus on waste segregation. The rest of the non-recyclable waste is put at a material recovery facility (MRF) for further sorting. From there, the municipality sends the non-recyclable items to a sanitary landfill.

Financial and business model:

In about 6 years the project has covered almost 96% of the targeted households through 433 Mohalla Committees. The average membership is Rs 314 households per Mohalla Committee. The initiative supports the livelihood of about 450 waste collectors earning **up to Rs. 10,000 per month** and an additional income from the **sale of recyclables and compost** ranging between **Rs. 1,000-2,000 per month.**

Due to effective mobilization, 91.27% of the households are segregating waste at the source, and about 68% of the covered households are practicing one of the two decentralized composting methods -cluster composting or household composting. 94.76% of the participating households are paying a user fee. The average user fee per household per month currently is Rs. 39. These Committees together **generate nearly Rs. 45 lakhs** as user fees per month and disburse about Rs. 43 lakhs as honorarium to over **450 waste collectors** and waste processing workers.



Only 13.60% of the collected waste goes to landfill, which is inert and cannot be recycled or composted, a steady improvement over the years from almost everything going to landfill.

Successes and lessons learnt:

The model focuses on the formation of Mohalla Committees which are trained and empowered to promote decentralized waste management activities by encouraging households to adopt source segregation and home/ cluster composting. MCs are responsible for driving financial viability with revenue generation in the form of household user fees. MCs go beyond the household level for a greener and cleaner environment in the neighbourhood. This model mobilizes the community for a sustainable SWM model where generators take a leadership role through participation in Mohalla Committees and take responsibility for waste management in their locality with financial contribution by the residents in a decentralized manner, as prescribed in SWM Rules 2016.

ITC and the Saharanpur Municipality won the first prize in the Uttar Pradesh Swachh Ward Pratispardha in 2018-19. At the national level, Saharanpur's rank rose to 73 in Swachh Sarvekshan 2020, up from 378 in 2018 enabled amongst other factors also due to the adoption of the community-led decentralized waste management model.

In addition to waste management, these Mohalla Committees are acting as vibrant citizens institutions and are working proactively with Municipal Corporation to leverage schemes and programs for benefit of citizens. Municipal Corporation is leveraging the MCs for outreach to residents. At the time of COVID, Mohalla Committees and Municipal corporation worked hand in hand for the sanitization of localities, production, and distribution of masks, contact tracing and quarantine, vaccination, food distribution to the needy, as well as awareness and linkage with telemedicine facilities. For this Innovation, Saharanpur Municipal Corporation was **awarded** by the **Ministry of Housing and Urban Affairs** (MoHUA) under the **Smart City programme**. About 98 Mohalla Committees have leveraged colony roads and drains, and 7 Mohalla Committees have developed parks. From

their funds, 23 Mohalla Committees have organized plantation drives and 92 have distributed dustbins. 187 Mohalla Samits have organized vaccination camps and eye camps for the residents.

Building on Saharanpur experience, in 2019-20, ITC Mission **SunehraKal signed an MoU with the Urban Development Department of the Government of Uttar Pradesh** to further scale up this model to other Urban Local Bodies (ULBs) by building the capacity of 60 ULBs of the State to enable them to implement the community-driven decentralized solid waste management program. Till date, the amplification project has been rolled out in 45 ULBs across the state and 2,133 Mohalla Committees formed covering 7.7 lakh households.

Challenges and possible resolutions

Most of the SWM models focus on waste collection, whether segregated or non-segregated and dumping. Emphasis on the reduction of waste at the community level to reduce the burden of waste transportation and management, and community participation is missing in these traditional models.

Saharanpur model has demonstrated community ownership and sustainability, which not only **reduces the waste burden** but also reduces the financial and human resources burden on urban local bodies that have been struggling to manage their activities within a limited budget. This is a paradigm shift from the traditional approach where communities expect waste management to be the responsibility of ULBs. Motivating both the households and ULB officials to believe in the decentralized model is initially very challenging. The key is to **demonstrate the success of the model at a small scale** in a small locality first, which can then be upscaled.

Despite SWM 2016 rules advocating decentralized waste management, still several ULBs plan for cost-intensive centralized waste processing, without learning from the failures of other ULBs where the model is not working for a lack of source segregation. Convincing them to invest in decentralized composters has been very challenging but gradually ULBs are coming forward to install decentralized composters after witnessing the success of the decentralized SWM model at Saharanpur.

Quotes/Testimonials:

"It is a very good model. We were also rewarded by the state government in 2019 and this model was appreciated by all the municipal corporations".

- Shri Gyanendra Singh (IAS), Municipal Commissioner, Saharanpur (2016-21)

"5-6 years back, relatives, friends as well as government officials would refuse to come to this ward because of waste littering, unhygienic conditions, and bad smell. Presently, the area is 180 degrees different and due to the cleanliness of the area, fewer people face health issues now."

- Ms. Gulshan Khan, President, Nadeem Colony Mohalla Samiti (Ward No. 65)

Case study

6 Hub-spoke Model of rural solid waste management in Mysuru by ITC

Context

Rural areas in Mysuru district spanning 1,170 villages from 266 Gram Panchayats, generate around 30,660 tons of solid waste per annum, of which approximately 30% is dry waste and 70% is wet waste (Ikonet survey 2019). Waste was not managed properly till 2019 in the panchayats of Mysuru district. Though solid waste generated in rural areas was predominantly biodegradable, it was still becoming a major problem, as the waste was not segregated and was thrown away in open spaces, creating unhygienic conditions. Recyclable waste which could have been managed through secondary segregation was burnt, creating pollution. Hence, it became necessary that communities were sensitized about this issue to minimize the waste generation at source and that Panchayats were trained to manage the waste.

Aligned to Swachh Bharat Mission and SDG 6 on Clean Water & Sanitation, initially, ITC launched its Sanitation program intending to make its factory and agrivalue chain catchments Open Defecation Free. Later, the need was realized towards the logical progression of the program into Decentralised Solid Waste Management. Mysuru district has 8 Rural Taluks namely Periyapatna, Hunsur, KR Nagar, HD Kote, Nanjangud, T Narasipura, Saraguru and Mysuru. ITC has built 3,667 Household Toilets and 97 Toilet blocks in various schools and worked with Swachh Baharat Mission to make villages open defecation free (ODF).

Initiation and Planning process

Mission SunehraKal under ITC's Social Investments Program has successfully developed and demonstrated decentralized community-owned waste management models for small towns, rural areas, and temples in various parts of India. The Solid Waste Management Programme of ITC aims at managing waste close to the generators in a financially sustainable manner, ensuring minimal waste goes to landfill.

In 2019-20, ITC Mission SunehraKal, signed an MoU with Mysuru Zilla Panchayat to build the capacity of government functionaries, Panchayat members, and Swachhagrahi's

across 266 Gram Panchayats of Mysuru district on planning, implementation, and monitoring of decentralized and financially sustainable Solid Waste Management program. The partnership aimed at designing a low-cost, decentralized waste management model, suitable for rural areas, which can reduce waste going to landfills. Under this partnership, ITC Mission SunehraKal designed the **"Hub and Spoke model of Solid Waste Management"** (Fig)where Selected villages were initially developed as model hubs for demonstrating best practices on community-owned decentralized Solid Waste Management, which can act as a Resource center for disseminating awareness, key processes and training neighbouring spokes villages.

In this partnership, ITC played the role of a knowledge and technical support partner. ITC designed the implementation toolkit that included training and implementation manuals, behaviour change communication materials, training modules, and a monitoring framework. Key stakeholders - Panchayat Officials, Panchayat Members, Swachhagrahi (SBM volunteers), and community leaders were trained by ITC on various aspects of decentralized waste management. The role of Zila Panchayat was to ensure the implementation of the program through Panchayats. The key aspects of the project were:

Panchayat is taking ownership of Decentralized Solid Waste Management which has led to:

- 100% Source segregation of waste by households and commercial establishments.
- Promoting home composting in backyard pits (called Thippe locally)/ Cluster composting for biodegradable waste management.
- Activating SWM committees to create awareness on waste segregation and monitoring the progress.
- User fees from households and other bulk waste generators for financial sustainability.
- Tracking waste reduction to landfill.

During planning and roll-out, the following interventions were carried out-

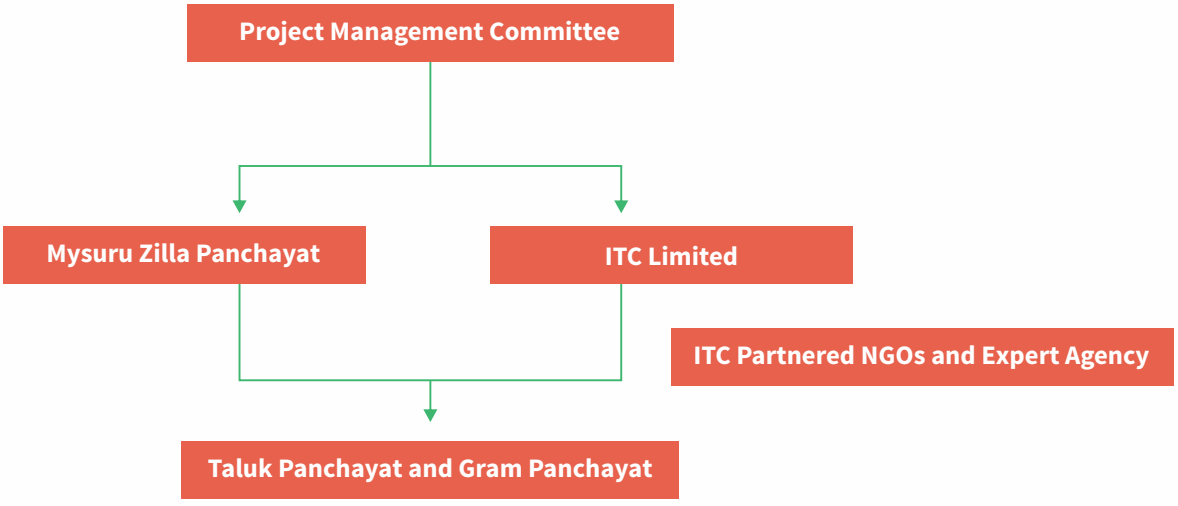
- **Local Super trainers** were developed by getting them trained by SWM experts who in turn trained panchayats and government officials.
- **"Communication Need Assessment"** workshop was organized to understand what communication would work best in Mysuru's rural areas. Based on this, high-impact behaviour change Information Education and Communication (IEC) materials were designed on the theme of **"My Waste, My Responsibility"**.
- A **baseline assessment** was done to understand the nature and quantum of waste generated in villages and waste going to landfill.
- **Demand generation was identified** as a key success factor in the project and for this, panchayats were asked to **pass a resolution in Gram Sabha** mandating source segregation, user fee, and appointment of

Swachhagrahi. Those panchayats who completed these tasks were first trained. This helped to identify suitable panchayats for developing them as hubs.

- As **behaviour change** requires sustained efforts, a door-to-door awareness campaign was executed in the initial 3 months through **Swachhagrahis** to inculcate the habit of source segregation.
- SHG groups were trained, and focus was given to communicating through women the health benefits of waste management.
- **Capacity Building** of all 266 Gram Panchayat functionaries and members, as well as volunteers, on planning and implementation, was executed. After training, panchayats submitted a Detailed Project Report (DPR) for approval of Zila Panchayat.
- ASHA, Anganwadi workers, ANM, and Panchayat watermen were trained to amplify awareness and knowledge of **decentralized waste management**
- **Waste management** was initiated in villages by Gram Panchayats post-completion of door-to-door awareness and training to village-level institutions.

Institutional set-up

Post MoU between ITC and Zila Panchayat (ZP) Mysuru, a **Project Management Committee (PMC)** was formed as governing body to monitor and review the program. PMC included Chief Executive Officer Zila Panchayat, other ZP officials, ITC, and representation from ITC-partnered NGOs (Fig 2). PMC meetings were organized every quarter to review progress and plan for the next quarter. Mysuru Zila Panchayat supported ITC Ltd in organizing training, meetings, and workshops for all targeted stakeholders through timely communication to Taluk Panchayats and Gram Panchayats.



Operations and technology used

Emphasis was laid on the collection of dry waste from households while encouraging home composting of wet waste. Dry waste was collected by Gram Panchayats through waste collectors using **rented auto tippers** and/or **pre-owned vehicles** from all households and was transported to temporary sheds or old buildings that were not in use, for secondary sorting. Segregated dry waste was thereafter sent to authorized recyclers for further processing. Low-value plastics were sent to cement factories by the agencies.

Wet waste was composted by households through a backyard composting method called "**Thippe**". Thippe is a traditional composting practice in rural areas of Mysuru which overtime became a dumping practice of mixed household waste. In this program, the revival of this practice was planned instead of promoting new methods, which helped in its large-scale adoption. If there was no space near the house, then waste was composted at cluster level through the "**NADEP Composting Method**" or at village level yard through the "**Windrow Composting Method**".

Compost produced at the household level is used by them in their kitchen gardens and backyard fruit trees. In the case of cluster level or central composting, panchayats applied it to roadside trees, and excess compost was sold to farmers.

Waste management processes & technologies adopted are illustrated below:

	Physical Operations	Technology adopted
Wet Waste	1. Source segregation 2. Home composting 3. Wet waste collection 4. Processing and compost usage	1. Thippe/Backyard composting 2. NADEP composting 3. Bucket compost 4. Windrow Composting
Dry Waste	1. Source Segregation 2. Dry waste collection 3. Secondary Sorting 4. Storage and Sales	Recyclables sent to recycling agency in Mysuru

Financial and Business Model

Under Swachh Bharat Gramin (SBMG) and the 15th Finance Commission, every Gram Panchayat can utilize funds for SWM implementation. However, in this model, Panchayats were supported to adopt a low-cost decentralized model. Average investment per panchayat in this model is presented below:

Particulars	ITC's Decentralized Model in Mysuru
Shed	Rs 20,000
NADEP unit	Rs 40,000
Vehicle	Rs 5,60,000
Others	Rs 1,50,000 (bins- 2 per Household)
Total	**Rs.7,70,000**

From the above table, it is clear that the decentralized model adopted by Panchayats with the help of the ITC- Zila Panchayat Mysuru partnership helps in cost reduction and subsequently ensures sustainability. A total of 76 Gram Panchayats have adopted the low-cost model of waste management so far, covering over 1 lakh households of which more than 50% are doing home composting and 92,000 are practicing source segregating.

Bilikere Gram Panchayat in Hunsur Taluk of Mysuru with 1,721 households and population of 5,796 was one of the earliest panchayats that adopted the Decentralized Waste Management model and was converted as an SWM Hub. Provided below is an illustration of the cost and revenue from Bilikere Hub Gram Panchayat:

<table>
<tr><th colspan="2">Operations and Maintenance Cost/ Annum</th><th colspan="2">Revenue from Waste Management/Annum</th></tr>
<tr><td>Vehicle Fuel and maintenance-</td><td>Rs 1.14 Lakh</td><td rowspan="3">• User fee Collection from HHs and Commercials
• Income from sales of recyclable waste</td><td>Rs. 5.52 Lakh (60%)</td></tr>
<tr><td>Manpower Salary</td><td>Rs 3.48 Lakh</td><td></td></tr>
<tr><td>Miscellaneous</td><td>Rs 0.50 Lakh</td><td>Rs 0.10 Lakh</td></tr>
<tr><td>Total</td><td>Rs 5.12 Lakh</td><td>Total</td><td>Rs 5.62 Lakh</td></tr>
</table>

It is evident from the table above that Bilikere Hub Gram Panchayat which adopted a low-cost decentralized model is not only able to meet its running cost but is also generating surpluses for waste management. This vindicates that if panchayats are capacitated and the behaviour change program is implemented effectively, resulting in service fees by households for their waste management, then the key aspect of financial stability of the program can be achieved. There are currently 24 SWM Hub GPs that act as resource and knowledge centres in this program which helped in adopting SWM by 164 Panchayats.

Successes and lessons learnt

Key achievements under Mysuru rural SWM (RSWM) program were:

- **High Impact IEC material for sensitizing and training residents:** Developed training modules, flyers, posters, brochures, animated videos, waste management games, wall writings, and jingles, which helped in the sensitization of households on segregation and composting. About 3.98 Lakh households (93% of the rural Mysuru district households) were sensitized through door-to-door awareness by using IEC materials.
- **Master Trainers in all Gram Panchayats:** Panchayat development officer, panchayat president, and swachhagrahis (2 per GP) of all Gram Panchayats of Mysuru District were trained and developed as **Master trainers for RSWM**. A total of 1,829 Master Trainers were trained.
- **Low-Cost Model Waste Management:** Waste management was initiated by 164 Gram Panchayats covering 2.2 Lakh HHs adopting the low-cost decentralized model through the Hub-Spoke approach.
- **Leveraging Front Line Workers:** Services of existing front-line workers i.e., ASHA, Anganwadi workers, ANMs, and watermen were used for door-to-door awareness on solid waste management rather than restricting it only to Swachhagrahis.

- **Linkage with NRLM:** Women SHG federation "Sanjeevini" was used to manage the complete waste management process such as ensuring source segregation, Waste collection, User fee collection, secondary sorting, sale of recyclables, monthly meetings, and monitoring & mobilizing in 27 Gram Panchayats. 32 GPs are in the process of engaging the SHGs Federation in waste management.
- **Communication through WhatsApp:** About 22 WhatsApp groups were created, consisting of 703 Govt. officials & PRI members for regular exchange of progress, best practices and learnings.
- **Documentation of waste managed:** Guiding and monitoring has led to 164 panchayats recording waste data through the waste data logbook, resulting in documentation of waste managed data at the GP level.

Solid waste management in rural Mysuru has improved post initiation of the ITC- Zila Panchayat SWM Programme in 2019. Earlier households and commercial establishments were dumping mixed waste in every nook and corner of the villages or near water bodies and were burning dry waste. However, post-intervention, performance on key outcome parameters under the Waste Management Programme has improved significantly as compared to the baseline in 164 Gram Panchayats (GPs) covered so far that has a universe of 2.2 Lakh Households.

Performance Indicators	Pre-Intervention-2019	Post-intervention - 2022
Source segregation Households	0%	91%
Home Composting/ Thippe Households	48%	55%
User fee collection	0%	37%

Lessons drawn

- **Use of effective IEC materials** and locally suitable behaviour change campaigns like "My Waste, My Responsibility" and leveraging the cadre of existing front-line workers was key to bringing the desired social behaviour change.
- **Capacitating GPs and helping them to initiate the Programme** instead of an external agency implementing it helped achieve ownership and sustainability.
- **Demonstrating best practices in Hub villages and demonstrating the impact to officials, Panchayat Raj Members, and Communities of spoke villages** helped in motivating them to adopt desired practices in their villages also, and overall, it helped in amplification of the programme.
- Source segregation of waste was focused upon to **avoid mixed waste collection**, which helped in the easy sorting of recyclables and dump waste.
- **Clear guidelines and communication by Zila Panchayat** at the beginning that GPs should only focus on the collection of dry waste helped in setting a tone for decentralized waste management.
- **Digital media** like WhatsApp groups helped in one-to-one connection as also in spreading the best practices across GPs and motivating others to replicate the model in their Gps.
- Use of **simple and locally acceptable practices** like Thippe and NADEP to manage wet waste helped to adopt composting at a large scale.

Challenges	Possible resolutions
GPs are not able to appoint waste collectors due to a shortage of funds.	▪ As wet waste can be managed through household composting, therefore, the number of waste collectors can be reduced. Additionally, with a weekly collection of dry waste cost can be reduced further. ▪ Existing personnel like watermen can be used in the waste management process to reduce cost. ▪ GP may collect user fees which must be used to pay the salaries of waste collectors.
GPs are not able to buy waste-collection vehicles	▪ Push carts may be purchased instead with Finance Commission fund.
GPs do not have funds to develop sheds for secondary segregation and storage of dry waste	▪ Old buildings in panchayats can be used for the storage of dry waste. ▪ Low-cost temporary sheds can be built, or old cattle shelters can be used for dry waste storage at the village level. ▪ Awareness needs to be created at the HH level to store dry waste in an old bag that can be handed over to the waste collector once a week. ▪ MGNREGS funds can be used for building NADEP at the ward level for composting.
Panchayats are generally inclined to opt for huge infrastructure for waste management	▪ While training, panchayats should be asked to create budgets mapping all the cost and revenue streams. This would help in sensitizing them to choose a low-cost model.
Panchayat presidents are not able to enforce user fees in their village	▪ The existing SWM rules that put the onus of waste management on panchayats and mandate household payment should be presented in simple language to make panchayat functionaries understand it.
Behaviour change is a long process that requires time	▪ Effective IEC focusing on local context, intensive structured campaigns, and linking waste problem with health and related expenditure helps to fast track the process.

Quote from the CEO, Zila Panchayat, Mysuru

Mysuru Zila Panchayat congratulates & appreciates, ITC Mission SunehraKal for its support in the implementation of the Rural Solid waste management Programme in Gram Panchayats of Mysuru District.

ITC's contribution to mobilize communities to adopt the decentralized method of waste management through regular training and awareness Programmes to all Gram Panchayats using quality IEC Materials is highly appreciated. It has helped Panchayats to understand SWM rules and its implementation methods with improved awareness level in the Community in all the taluks of Mysuru District. Your awareness programs enabled and motivated Gram Panchayats to undertake waste management successfully.

Case study 7

Green temple: Circular economy waste management model for places of worship by ITC

Context

Religious places in India are visited by a large number of devotees who carry different types of offerings inside these premises like flowers, leaves, milk sachets, coconuts, etc. Later in the day, these offerings find their way out of the premises, discarded either into some water bodies or left in the open spaces which becomes a waste dump, thus causing various environmental issues. Although waste in religious places is mostly biodegradable, but in the absence of any waste management system, it becomes a challenge to manage it. In this background, ITC Mission SunehraKal designed **a Green Temple Programme** for Decentralized Solid Waste Management (SWM) in the temple premises and initiated it along with its civil society partners in the year 2016 in Chennai. The project successfully established the unique **closed-loop circular economy model** in managing temple waste sustainably in 3 prominent temples by 2018 viz., Sri Kapaleeswarar temple Mylapore, Chennai, Sri Anantha Padmanabha Swamy Temple, Adyar, Chennai, and Sri Ranganathaswamy Temple, Srirangam, Trichy through deploying composting and biogas technologies.

93% of temple waste was managed within the temple premises in the pilot phase and was converted to resources used by these temples also leading to savings. Based on these experiences, since 2020, the initiative has been amplified to all the districts of Tamil Nadu targeting 41,746 temples in collaboration with the Hindu Religious and Charitable Endowments (HR&CE) Department.

Planning and implementation process

Building on the experience and learning from its community-based **Decentralized Solid Waste Management program** implemented in 10 states, ITC used the same principle of managing waste near the generators in designing the **Temple Waste Management Programme**, where almost the entire waste was going to dumps. The program continues to focus on the approach of building **community ownership for sustainability**, through capacitating temple committees who independently manage the waste in temple premises after initial hand-holding support; and forming partnerships to amplify reach and scale.

The program was launched with the identification of **large iconic temples** and developing them as **model temples**, identified as **hubs** that demonstrated best practices under the program. These best practices were later adopted by other temples that were identified as **spokes** in the **Hub & Spoke model**.

After a **successful demonstration** of the program approach in 76 temples across 3 districts, the state government noticed the work and proposed a **partnership with ITC as the knowledge partner**. ITC entered into a partnership with Hindu Religious and Charitable endowment (HR&CE) and started training government officials on the Green Temple model. The training has been imparted so far across 26 districts, which will be expanded to cover 38 districts.

The objectives of the programme were:

- **Mobilize, sensitize & educate** the temple stakeholders on managing temple waste within temple premises, on 3R principles i.e. – Reduce, Reuse and Recycle.
- Help temple authorities and temple committees to choose and implement **appropriate waste management technology.**
- Create Green Temple as a **resource hub** for transmitting knowledge and awareness on **Community Owned Sustainable SWM** to nearby temples, market areas, and residential associations.
- Create an overall clean and hygienic environment in and around the temples.

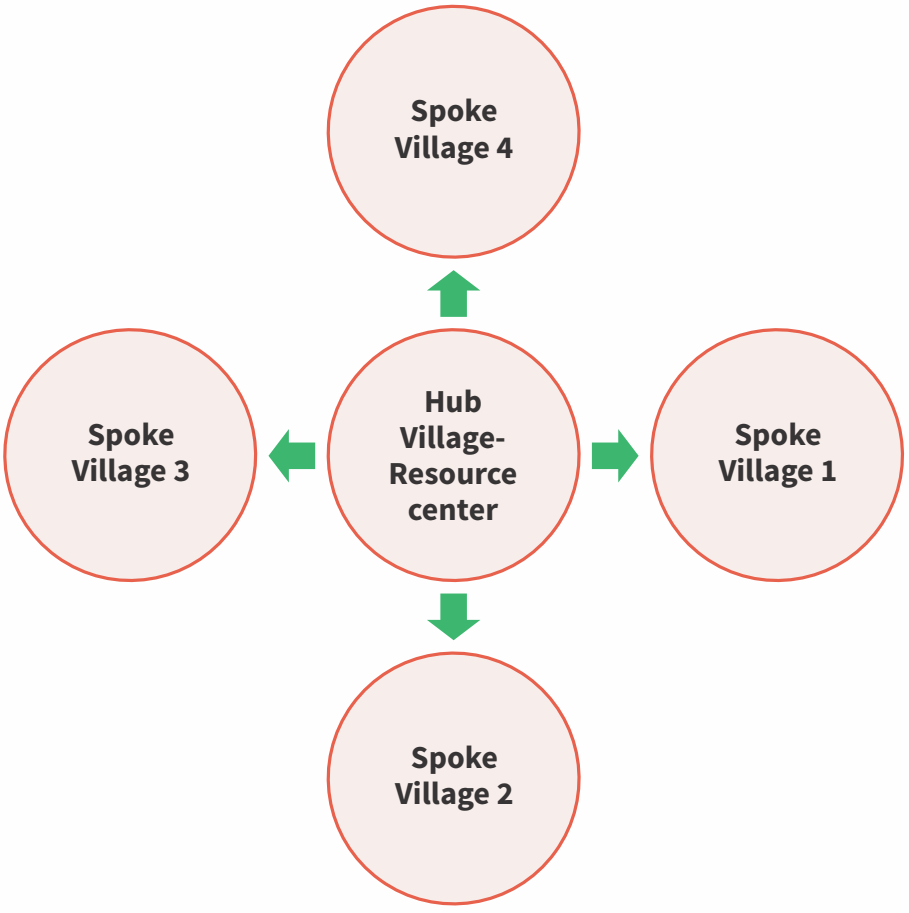
The key activities of the Green Temple Programme included:

- Setting up an **institutional system** for participation and ownership: Identification of interested people from Residential Welfare Associations (RWAs), market associations, vendors around the temple, and Devotees. Organizing them into Temple Committees and building their capacity for planning and implementing suitable SWM interventions.
- Setting up **appropriate technology** for waste management: Helping temple committees to identify and finalize suitable waste management technology according to the quantum and nature of waste generated.
- Designing **sustainability plan:** Designing SWM intervention in the Circular Economy model and ensuring that the cost incurred in operation and maintenance is offset by the savings generated through benefits of SWM (like the use of biogas and sale of compost).
- Developing **Information, Education, and Communication** (IEC) strategy: Designing communication strategy and IEC material that can be used by temple committees for driving awareness to the nearby market and residential areas along with other temples.

To catalyze the process of adoption, some of the temples are converted as model **Green Temple Hubs** that help nearby "**Spoke**" temples in adopting the process. The Hub serves as a success model and resource library for the spokes to learn and understand the know-how of implementing effective waste management practices. ITC and NGO partners train respective temple officials of HR&CE and volunteer groups, who become master trainers and in turn train the interested temples to adopt the appropriate waste management model.

Under ITC Mission SunehraKal, a temple, which **treats and manages** all the **biodegradable waste** generated at the temple **within its premises** using a **circular economy model** by effectively involving all the stakeholders is considered a Green Temple. The key steps under the Green Temple program implementation include:

- **Orientation of temple officials** for acceptance of the program;
- Formation of **temple committee**;
- Identification of local volunteers, training them, and associating them with specific temples;
- Carrying out the **baseline** for the temple;
- Identification and finalization of **infrastructure** suitable for the temple requirement like the size of composters, bio-gas plant, etc., and **facilitating funding** from external donors for the same.
- **Capacity building** of committee members and government officials through the use of IEC material.
- **Training of temple staff** for waste handling and management; and
- **Program monitoring** and analysis of periodic waste handled.



Institutional set-up

After successful pilots, **ITC and HR&CE** entered into an **MoU** in 2020 to **build the capacity of HR&CE officials** to implement Green Temple Programme across all the districts of Tamil Nadu. To help in effective planning and to review the progress of the program, a **Project Management Committee** (PMC) was formed at the state level with HR&CE Commissioner as Chairman and ITC representative as Convener. The program is implemented with the support of the Regional Joint Commissioner, incharge of temples for a cluster of districts, who are being oriented on the model and thereby help in organizing training for temple executive officers and volunteers under their jurisdictions.

To create awareness among devotees on waste segregation, and **build ownership and long-term sustainability** of the initiative, **Green Temple Committees** are formed who look after the Green Temple Programme in their area.

To create large-scale awareness of the program, **registered devotee groups** like Uzhavarapani devotees and Ayyappa devotee groups etc. were trained as volunteers and master trainers. These **master trainers** along with Executive Officers and Temple Committee Members generated funds for composters and other waste management requirements from various donors- individuals as well as institutions.

Operation and technology used

Based on the nature and the quantum of waste generated in a temple, waste management technology is selected. In large temples having Gaushalas, biogas chambers were installed for kitchens. Biogas thus generated is used in the temple kitchens for cooking “Anndanam” for devotees, which helps in reducing the cost of LPG. Medium and small temples, generating only flowers and other biodegradable waste, adopt composting. The compost produced in these temples is either used in the *Nandavanam* (Temple Garden) or sold outside to the devotees, which generates additional revenue.

To help temples choose an appropriate composting method, ITC has developed various options of composters like fully and semi-automated composters, Leaf Composters, Drum Composters, etc. ITC has also created a pool of vendors for supplying composters and biogas to temples. In this process, locally fabricated composters were designed, which helped in bringing down the cost of composters from Rs. 70,000 to below Rs. 5,000 making it a low-cost model. This approach of building an ecosystem resulted in 500 temples from 15 Districts adopting the Green Temple Programme.

The recyclable material generated in temples such as plastic is sold to recyclers in nearby areas by temple workers. Leftover inert waste, which is only less than 10%, is handed over to the municipality.

Financial Model and Impact

In Green Temples, over 910 MT of the waste has been avoided from going to landfill in the last 5 years even though most of the temples were closed for almost 2 years due to COVID lockdowns. Temples through this initiative, have successfully managed over 90% of their waste within their premises demonstrating the circular economy model.An illustration of waste managed and, biogas and compost generated in three Hub Temples is given in the table below:

Temple	Work Initiation	Biogas installed - Yes/No	Organic waste (MT/ Month)		LPG in temple Kitchen (Cylinder/ Month)
			Waste Managed within Temple (MT)	Landfill (MT)	
Sri Kapaleeshwarar Temple, Chennai	Jan-17	Yes	16.8	0.6	20
Sri AnanthaPadmanabha Swamy Temple, Trichy	Oct-17	No	3	0.6	NA
Sri Ranganatha Swamy Temple, Srirangam, Trichy	Mar -18	Yes	15.2	1.4	29
Total			**35**	**2.6**	**49**

In these Hub temples, post setting up the waste management system, only 7% of temple waste is going to the landfill in comparison to the baseline situation where most of the waste was being dumped in open spaces or near temple tanks. In addition, the initiative has helped in replacing LPG cylinders with Biogas in temple kitchens, thereby reducing the cost through savings on fuel.

Success and learnings

ITC's Green Temple (GT) model focuses on a closed-loop, decentralized waste management system, based on Circular Economy Principles, which processes temple waste into products that can be used within the temple premises. The GT Programme reduces or eliminates avoidable handling, transportation, and storage, which not only reduces associated waste management costs but also avoids GHG emissions from transportation and landfills. To make the program cost-effective and scalable, various types of low-cost composters are identified for temples to choose from, and a cadre of trained volunteers is developed.

Involvement of HR&CE in the implementation creates sustainability of the program. This unique collaborative green temple Programme is over the years becoming a key component of SWM interventions. ITC has also scaled up the Green Temple Programme in states other than Tamil Nadu by training temple stakeholders.

- **Temple Committee:** Involving devotees, local Resident Welfare Association (RWA) members and vendors around temples in the program resulted in the acceptability of the model. Formation and involvement of Green Temple Committees helped in ensuring sustainability.

- **Demand generation:** Hub temples established by ITC's direct intervention for demonstration encouraged temples from nearby areas to visit the Hub temples to understand the process and learn about the benefits. Hub and Spoke approach designed for creating demand and helping scaleup the program was very effective.
- **Creating various options for composting:** Instead of focusing on only one type of composting, various options of low-cost composters were designed. This helped temples to choose the most appropriate ones.
- **Composter inside temple compound:** It was a common perception of temple stakeholders that composters emit smell and need to be kept outside. Initial pilot, training, and exposure visits helped in resolving such misconceptions.
- **Ecosystem approach:** In this program, volunteers were trained on awareness creation, a pool of vendors was created for customization and supply of composters and biogas, temple officials were trained on planning, implementation, and monitoring, and temple workers were trained in managing waste, thus building an entire ecosystem for Green Temple, which helped in the adoption of the program at scale.
- **Green Temple partnership** is built by leveraging the strengths of various stakeholders; the reach and resources of HR&CE; the technical and project management capabilities of ITC and leveraging the influence of volunteers for the required behaviour change, thus making it a scalable model.

Quote from Ms. Kaveri, Joint commissioner, Sri Kapaleeswarar temple, Chennai

“It's a unique and useful program, which focuses on managing waste at source, which is in the interest of the government. The program not only managed the waste and generated some revenue in my temple but has also given positive perspective to lead things from scratch and taught us to achieve sustainability with proper stakeholder engagement. It is indeed the need of today's time, as the state has more than 44,000 temples and it is adding lots of pressure on landfill. So, it will be my request for other temples too to adopt this model. I thank ITC for framing this unique program for the institution, which was the least priority in the list earlier”.

Case study 8

HCL Samuday- Flagship rural development program for Solid waste management

Context

HCL Samuday is one of the flagship rural development programs of the HCL Foundation. Currently being implemented in the Hardoi district of Uttar Pradesh, it is reaching out to 2.1 million individuals. It is a holistic program covering various aspects of rural development like agriculture, education, environment, health, livelihood, water, sanitation, and hygiene (WASH).

Under the thematic area of WASH, the program seeks to improve the levels of hygiene in the geography by developing a sustainable model of achieving and maintaining the status of visually clean and green surroundings. The crucial components for achieving this are--bringing community-wide behaviour change, triggering the demand for best sanitation practices, and managing household (HH) waste at the HH level.

Managing plastic waste is a major concern both in urban and rural settings as it is observed that the plastic items that hold value are sold by the residents however unsaleable plastics are discarded improperly, which is a serious concern for the environment, cleanliness, and public health.

Initiation and planning process

Towards solving the issue, community engagement was ensured by conducting various activities like Nukkad Natak, audio/visual rounds, wall paintings, IPC with the help of printed materials, discussion with PRI members, and night chaupals. Through SBCC techniques, communities were made aware of the importance of segregating waste at the HH level. The majority of waste was managed by using bio-decomposers and collecting plastic waste from households through Safai karamcharis. Besides, inter-sectoral meetings were organized to disseminate messages for producing organic manure at the HH level with the help of Self-Help Groups, Farmers Groups, Solar User Groups, and the Gram Panchayat Water and Sanitation Committee. The project largely followed the community-based approaches and used IEC/SBCC tools to change the behaviour of the community on a sustained, long-term basis.

Communities in rural areas also recognized that managing waste at the HH level is important. This was successfully achieved through regular follow-ups and community mobilization activities. Investments were made for community mobilization activities instead of infrastructure, thereby shifting the focus from burning plastic waste to its collection at the HH level as also managing cow dung at the HH level with the help of a decomposer which was found to be the best solution for producing organic compost from waste.

A common practice prevalent in rural areas was to keep the cow dung for at least 2-3 years as they thought this was the required time to convert cow dung to manure which could then be used in agriculture. However, once the

technique of producing organic manure from bio-decomposer was adopted by a few in the community, others were also motivated to adopt the technique, resulting in mutual support, and adopting innovative local solutions, leading to greater ownership and sustainability.

The main challenge in this project was the collective adoption of the proposed new behaviour of source segregation and collection of plastic waste at the household level and, at the same time, the creation of a service delivery team by PRIs to promote an in-situ waste management approach. To achieve this, team HCL started the storage of plastics (non-biodegradable waste) through plastic holding at the household level and aerobic composting for the treatment of waste by residents themselves. Through this initiative, the households were trained in the storage of plastic waste, source segregation of waste, and in-situ composting of the waste heap (Ghura) at homes.

It was a tough call educating the households regarding source segregation of waste, yet, the team HCL could accomplish it, ensuring that households manage waste at the source at which they are generated.

Institutional set-up

Rather than creating another set-up, the Swachhta Samitis already present in the village were strengthened in liaison with PRI members and self-motivated people from the village to create increased awareness in the community.

To create a pool of self-motivated groups, several activities on proper waste segregation and management were conducted with them from time to time to keep them informed of innovative ideas. Timely follow-ups were carried out by the HCLF team to monitor the project execution on the ground. The cumulative result of community engagement resulted in an increased collection of plastic at the household level and the adoption 0f composting practices for better results. Some of the activities conducted with the help of community members were - mass cleanliness drives, removal of garbage vulnerable points, follow-ups of the roasters of Safai Karamcharis, beautification (wall-paintings, installation of village resource map, signage, and plantation), capacity building workshops, and strengthening of Swachhta Samiti.

Operations and technology used

In-situ waste management technology namely, aerobic composting techniques and the Windrow method through a culture of bio-decomposer were used for producing bulk compost. It was observed that every GP employed the aerobic composting technique by application of WD Inoculum, to the pre-accumulated heap of biodegradable solid waste, commonly called Ghura. However, this seldom resulted in quality organic manure as it contradicts the principles of aerobic composting, therefore the team suggested following steps to the beneficiary-

1. Opening the Ghura/heap
2. Watering the heap
3. Mulching the heap
4. Preparing WD inoculum
5. Applying WD Inoculum twice and then churning the heap twice. This process was to be repeated till the waste was converted to manure.

This method produced better quality organic manure within 30-40 days. Once the pre-accumulated waste got converted to organic manure, another composting method called the Windrow composting method was used as it takes much less time than aerobic composting. This method is easy to follow, replicable, and results in quality manure, ensuring sustained behaviour change as households can convert organic waste to manure themselves.

Financial and business model

Rather than being a business model, the model was community-driven whereby the community itself learns and unlearns. Through regular follow-ups, the households were motivated for collecting single-use plastic at the HH level and preparing manure from their bio-degradable waste at the same place with zero cost and without any labour. The community members themselves teach others; the steps involved in compost production. The team also sought support from the government block office as well as the district officials to support the community-driven model by providing a team of Safai Karamcharis for regular cleaning work in the GPs. All these activities were undertaken in close coordination with the PRI members for ensuring the sustainability of the intervention in the long term.

Some of the project beneficiaries saw a business opportunity in this model and they came up with the idea of selling compost to different nurseries and agricultural agencies by producing compost through bio-decomposer. They started by purchasing cow dung, preparing waste decomposer inoculum, applying it to the waste, and mixing waste from time to time. It created better results rather than creating dumps in the villages.

Successes and lessons learnt

Many villages adopted source segregation and plastic holding at the household level & in-situ composting of biodegradable solid waste. One such village is Bhatauli village in Rampur Bhatauli Gram Panchayat under Behander Block, which adopted this model and started managing waste at the GP and HH levels. Before the intervention, the village lacked waste management services and there was low awareness among residents regarding their role in waste management. After interacting with the villagers and assessing their awareness levels, team HCLF started the work through a triggering/PRA meeting, which was organized to initiate concept seeding and help them realize the negative impact of plastic burning. This transition phase included many training sessions, several meetings, and interpersonal communications at the household level to make them understand the ill effects of plastic waste. The idea was to gradually incorporate the concept of source segregation and plastic holding at the household level and in-situ composting of the biodegradable solid waste. A sack was hung outside each house, in which people stored their domestic plastic waste instead of burning or throwing it into water bodies. It was observed that more than 80% of the households started practising this. Besides, they took care of their biodegradable solid waste resulting in a visibly cleaner hamlet.

Challenges and possible resolutions

During the initiation of the clean village initiative Phase 1, the team encountered various challenges right from mobilizing the people of the village and changing their behaviour towards waste management to working with various functionaries. Through learning and observation, the following resolutions emerged to encounter these challenges.

Challenges:

- ***Community mobilization:*** Initially, it was challenging to mobilize the community as most of the people of the village were either not interested, busy, or were only looking for freebies.

- ***Behavioural change:*** Behavioural change was one of the biggest problems in this project as people are habituated to following some habits for years and it is difficult to change these stubborn, bad practices.
- ***Working with functionaries:*** Working with the existing functionaries was one of the challenging things for the team as it needed a lot of paperwork and liaising.

Resolution:

- Regular field visits and follow-ups in the intervention area.
- Use of IEC/BCC activities and campaigns for mobilization and awareness.
- Triggering activities, campaigns, audio-visual activities, awareness rallies, etc. helped in encouraging people and it also motivated them to participate.
- Alignment with the Swachh Bharat Mission-2 (SBM-2) guidelines helped in coming to a point of common interest with the functionaries and helped in coordinating with them effectively.
- Training and capacity building of Safai Karamcharis, Swachhta Samiti/GPWSC, and PRI members.
- Demonstration at the community level and identifying opinion leaders from the community and taking their help in rapport building.

Case study 9

Goa model by Sampurn(e)arth

Context

The landmark Solid Waste Management Rule, 2016, alongside many other rules and regulations, have fundamentally changed the way the ULBs and Panchayats ought to deal with their constituents' waste. These regulations, as well as the broad change in India's waste composition, have expanded the waste market, where many new formal actors have stepped in to tap into the widely 'untapped' waste market. However, the informal sector who has been traditionally dealing with waste, from collection to processing and recycling, has been left behind by this changing ecosystem, unable to catch up with the rapid market change.

As a pioneer in waste management and one of the first registered PROs in India, Sampurn(e)arth has been engaging with the informal waste sector since 2012. Their multi-stakeholder and holistic approach have strengthened their network within the informal sector, helping them to move the industry towards adopting a more inclusive waste management process. Since 2020, they started to cement the foundation of the Waste Management Federation by organizing the informal waste workers into SHGs, engaging deeply with the entire workforce down the supply chain of their flexible plastic recycling units. Sampurn(e)arth's pilot project in Goa has proven that bringing the workers into a partnership can be beneficial in improving the recovery of waste, and market expansion, besides helping the community immensely. Hence, it is hoped that they will be able to establish a unique model in India that can be scaled up and followed by the rest of the industry, moving towards a Waste Management Federation where no one is left behind.

Initiation and planning

As one of the smallest territories in the country, Goa offered a perfect environment for the pilot project, where Sampurn(e)arth designed a comprehensive, holistic, and multi-stakeholder program, covering all the steps required for setting up inclusive waste management. Their attempts to achieve zero-landfilling in Bicholimand Sattari Taluka have been recognized by **NITI Aayog** as the best waste management practices in their 2021 report. Concurrently, their alignment with the State Government, the Pollution Control Board (GPCB), and GWMC (Goa Waste Management Corporation) has helped them immensely to initiate the program in Goa, where they are running sustainable projects and are upscaling the model into other states (mainly in Maharashtra and Gujarat), hoping to establish a model to be followed by others in the industry.

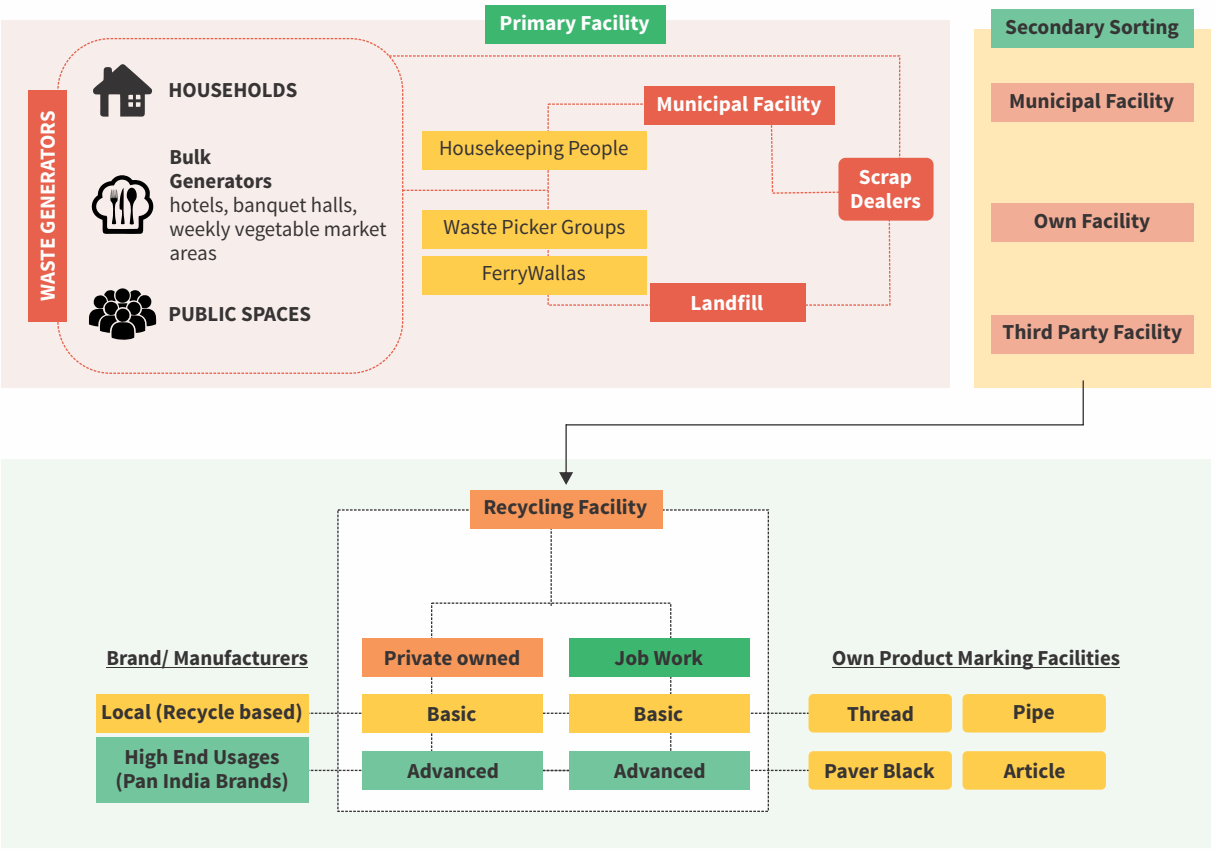
Institutional set-up

Sampurn(e)arth (SESPL) started in 2012 with the vision to convert waste into usable resources while creating meaningful livelihood

opportunities. They handle and process both organic (wet) and inorganic (dry) waste. For organic fractions design, they install and operate customized composting and bio-methanation facilities. For dry waste, Sampurn(e)arth operates through an integrated multi-stakeholder platform, which is a nationwide multi-stakeholder integrated platform for the collection and recycling of different categories of dry waste including plastics. Through this platform, they set up and operate flexible plastic recycling centres in multiple cities with local partners. The marketplace includes Urban Local Bodies, Pollution Control Boards, waste generators (residential, commercial/corporate, institutional), and most importantly, the whole interconnected informal market such as the waste pickers, scrap dealers, and informal recyclers, who are the backbone of the recycling industry in India. Due to the recently introduced and implemented national law of Extended Producer Responsibility (EPR), brands and manufacturers are also an integral part of the system for funding more plastic collection and recovery programs as well as utilizing post-consumer recycled material in their products and commodities.

Operations and technology used

The model primarily relies on covering all the stages of dry waste management in certain localities in Goa, where Sampurn(e)arth could follow the waste from the source of its generation to the endpoint of recycling. Their focus thus far has been post-consumer plastic waste, a type of plastic that due to its low value has not been recovered from urban and panchayats waste streams, causing them to end up in landfills or at best, being treated as RDF. Hence, creating a soft plastic waste stream can hugely reduce the burden on the ULB facilities, landfills, and most importantly, our environment. Hence, for increasing the post-consumer recycling of soft plastic it is necessary to establish the whole supply chain. The diagram below shows the waste flow and the required facilities in each stage for an integrated plastic waste management facility.



The social activities include organizing and formalizing the informal workers which require regular and deep engagement with the marginalized community. To do so, they have a dedicated team and detailed plan for the empowerment of the workers in the network. The activities primarily focus on the empowerment and education of the workers by setting up regular capacity-building sessions and health camps, parallelly organizing the workers at the facility into SHGs, where they practice decision-making processes, building trust and comradeship between the individuals. Furthermore, Sampurn(e)arth is registering all the workers in their network into the available government schemes. Their social support activities are summarized below:

- Formalizing the informal waste sector
  - Mapping the unorganized informal waste workers.
  - Registration of all waste workers into government schemes such as E-Shram1
  - Issuing official ID cards for waste pickers in coordination with ULBs
  - Supporting the scrap dealers in obtaining PCB certificate
- Educating the Informal Waste Sector
  - Health and personal hygiene camps
  - Collective cultural and social educational camps
  - Advocating child-labour free facilities within the informal market
  - Raising awareness on environmental regulations within the informal scrap markets

- Establishing cooperatives of waste workers down the supply chain
  - Organizing the facility workers into SHGs as partners
  - Regular meetings and savings
  - Practising democratic decision making
  - Micro-loan arrangements based on group savings and shared profit

Business model

In Goa, so far they have established one primary facility in Bicholim (where the waste from Bicholim and Sattari Talukas comes in a segregated manner), a secondary sorting facility at Harvalem (where soft plastic is further segregated into 5 types), and a recycling centre at Pissurlem (where they process soft plastic into lumps and granules for manufacturing). Establishing all the facilities at each stage allows them to manage and supervise the waste flow from the primary stage to the final product. Particularly, building the whole supply chain in an integrated model starts with bringing awareness to the households on the importance of segregation at source.

Through their IEC activities in 30 village panchayats, they managed to increase the level of source segregation up to 80%, increasing the primary recovery at the Bicholim MRF. The IEC activities have been coupled with extensive engagement with the informal waste workers community, since understanding how the value chain works within the informal waste markets is the first step towards inclusive waste management. They have done extensive surveys on multiple informal waste markets, comprehending the network of these workers as well as their relationships with the broader 'formal' waste management. The aim here is to establish a truly transparent supply chain of workers to be able to share the profit of last stage value addition with the workers down the supply chain, ultimately organizing them all into a federation for inclusive waste management.

Challenges & possible resolutions

Throughout Sampurn(e)arth's journey in Goa they faced many operational as well as organizational challenges while trying to establish an inclusive, holistic, and comprehensive waste management model. Securing quality waste from the source is one of the major challenges that hampers productivity and recovery at the primary facility (Bicholim MRF). They tried to solve this challenge by developing detailed IEC plans for segregation at source and regular collections. However, collaboration and coordination with government bodies that are responsible for primary collection are essential for this resolution to work. Aligning all the stakeholders around the project also required daily coordination and understanding. The high recovery at Bicholim has been a result of these two major steps. Nonetheless, sustaining the project, both financially and operationally, needs a continuous effort to raise awareness in the community and the work needs to be done by all the stakeholders to achieve zero-landfilling.

The main struggle regarding organizing the workers thus far has been their instability when joining the network. The primary reason for this is that majority of these workers are migrants who keep on moving from one job to another. This instability was a huge obstacle in forming SHGs, creating good teamwork spirits and responsibility towards their colleagues and their workplace. Furthermore, many of the workers at the municipal councils were working there under a third-party labor contract. These contractors are all very protective of their workers' relationships with other organizations and are not always cooperative.

To overcome this challenge, the team tried to enhance regular engagement with these workers, through many activities and SHG meetings at the plant level. Moreover, they increased engagement with local communities to integrate more local workers into their network, to reduce dependency on migrant workers. The homogeneity of the local community has proven to be a crucial factor in creating more reliable and functional SHGs.

To be able to sustain the established network of informal workers, Sampurn(e)arth is exploring ways in which they can link these workers from all these centres together, i.e., to develop a cooperative-like model that can realize the profit-sharing model once these centers are all stable and are making a profit. To do so, they have coupled with IRMA (Institute of Rural Management Anand) in Gujarat, an institute connected to the biggest cooperative in the country (Amul) with long-standing research and proposals on legal and social aspects of workers' organizations.

They are working with 2 students there for conducting formal research on modeling the best way of organizing waste workers throughout the supply chain, a model that also has the potential of expansion and scaling up, hoping to establish an integrated system that can be held up as a model for the rest of the country to follow up on. Sampurn(e)arth is hoping that their achievements of last year, can be sustained, scaled up, and set as a model for Inclusive Waste Management.

Case study 10

Set-up of Solid Waste Management Plant by Observing I Ecotech

Context

The Technology for complete conversion of Municipal solid Waste (MSW) "unsegregated waste" containing food, plastics, biomass, paper, cloth, etc. was designed and developed in India and demonstrated by way of a demo unit, processing 5 (five) kg of complex mixed waste in a zero-waste conversion plant which was set up in Visakhapatnam for the Naval Eastern Command.

With the exponential growth in the generation of waste, largely resulting from facilities of easy supply, ordering online and large-scale movement of packaged goods, the need for safe disposal of waste became a glaring necessity. The concept of "Utilization of Waste" and "Waste to Wealth" emerged globally, but the actual possibility of having such a facility in India, that too with Indian technology, somehow did not gain acceptability with the decision-making authorities, funding agencies, etc. It was, therefore, necessary to demonstrate the technology at a commercial level, to try and gain its wider acceptance.

Initiation and planning process:

A presentation was made to the Naval Authorities, in Visakhapatnam, with details of the indigenous technology for complete conversion of waste into reusable energy by-products, with zero CO2 Emissions and post-process residue.

The Naval Authorities allocated land and agreed to provide waste to the plant, but Observing I Ecotech had to construct, install and operate the plant at their own cost. The plant has been operating for 2 years (during the Covid lockdown it operated at lower waste quantity) and the test reports /laboratory analysis of the energy products recovered are available for content and calorific values.

Institutional set-up

Planning, manufacturing, installation, and operation of the plant were handled by Observing I Ecotech, under the supervision of Mr. Ravi Nafde, Partner in Observing I Ecotech and designer of the technology; and Mrs. Charmaine Sharma, Technical Staff, for Design & Construction (Civil Work) of various components of the Plant.

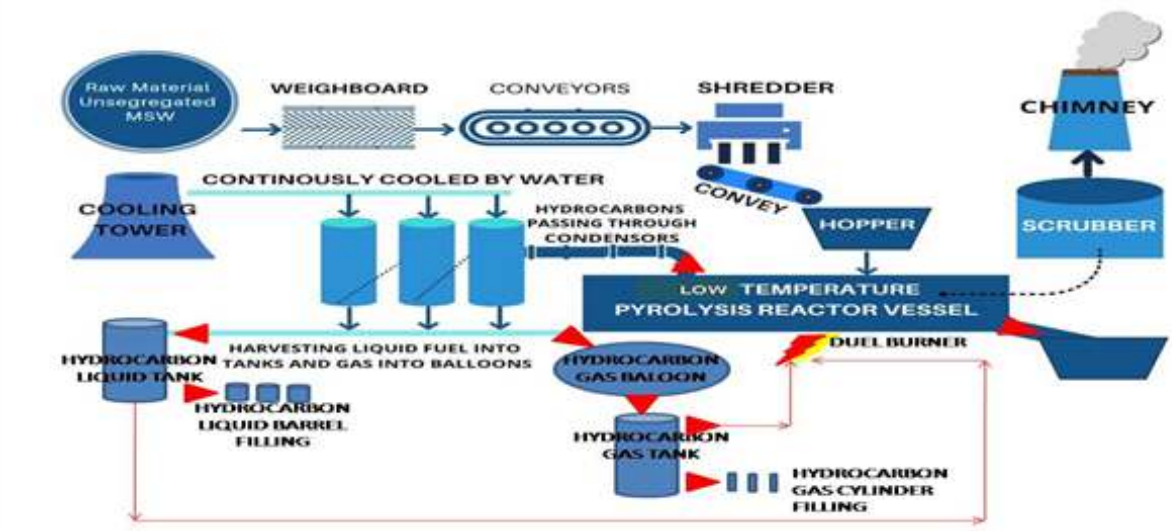
The Authorities of the Naval Eastern Command assisted by levelling the land, providing requisite permission to dig a bore well and have continuous water as required, and providing waste to the plant. Since the waste varied in quantity from large quantities of food to large quantities of biomass from garden waste, and a mixture of plastics, cloth, leather boots, etc., it was an excellent demonstration of the capability of the plant to process all types of waste without requiring further segregation.

The funds for manufacturing and setting up the plant were arranged by Observing I Ecotech with personal guarantees.

Operations and technology used

The technology of Continuous Slow Pyrolysis and providing a feed of mixed, unsegregated waste is Observing I's proprietary and was featured in Jim Lane's "The Digest" the World's leading publication on the bioeconomy.

The first commercial plant, processing unsegregated MSW and garden waste (Capacity of 10 tons per day) at full capacity i.e., 400 kg/hr., saves 2500 MT of CO2 per annum. Below is the plant's layout showing a flow chart for automated conversion of waste and conversion to liquid fuel, gas, and pet bottles.



Waste feed and functioning of the plant

- The plant can be fed with mixed waste, including plastics, food, biomass, paper, rubber, etc. Or single waste feed i.e., Plastic waste. Metallic components can be sifted out before shredding. Meticulous sorting of waste is not required, making it economically viable.
- The plant runs 24x7, therefore: -
  - No build-up of waste at the site
  - Efficiency of running costs
  - No post-process residue so no land is required for effluent or ash dumping
  - Waste is fed to the shredding system through a conveyor system fitted with a trommel for removal of small stones, small metallic items, etc.
  - Waste is shredded and fed on Conveyor 2, continuously to the reactor feeding system.
  - The reactor temperature is maintained at 250 deg C to 300 deg C through dual burners. Gas is produced from waste conversion or Liquid Fuel is produced from Waste Conversion, thus making it a circular economy model.
  - Waste is continuously converted into Liquid Fuel, Gas, and Carbon Black since all materials convert to their hydrocarbons inside the reactor in the absence of oxygen. There is no incineration of materials therefore no Furans and Dioxins were produced in the process.

Plant components include a waste feeding section, trommel for removal of smaller unwanted elements i.e., stones, metal components, etc., waste conversion pyrolysis reactor, harvesting and storage, and gas and liquid fuel processing and packaging systems.

SN	Section	Item
1	**Waste Feed**	Unloading and feeding to the hopper
		Waste Shredding / Sizing
		Belt Conveyor
		Trommel/ gravity screens/ density separators
		Intermittent Storage bin post sizing
2	**Processing Equipment – REACTOR**	Screw Feeder for shredded Waste
		Melter, Extractor & Reactor
		Screw Feeder & storage hopper
		Insulation
		Frame & Cover
3	**Ancillary Accessories**	Duel burners
		Load cells
		Condensers stage three stage
		Ventury Scrubber and Chimney
4	**Storage**	Storage Tank LHC
		Storage Tank Waste O/p
		Piping & Accessories
		Blower
5	**Power and Controls**	Voltage display, Ammeter display, Level display
		Compensating cable
		AC drive, controllers & other accessories
		Thermocouple, PID, thermocouple well
		Electrical hardware & SCADA system
6	**General**	Dispenser and loaders for by-products
7.	**Housing and Functional Structure**	As per civil drawings that will be prepared after Site Map is provided and Site inspection for vehicular movement is established.
8	**Weigh Bridge**	As per requirements.
9	**By-product handling accessories**	Liquid Fuel Coalescing system Gas compressing system

Safety measures of the plant

- No pollution control system is required, and control systems are provided for monitoring and feedback
- There is no reason to cause backfire, as the process is pyrolysis (converting to hydrocarbons in the absence of oxygen) and not burning.
- There is no particulate matter in the emission.
- The maximum temperature requirement is 350°c to 500°c hence very low energy is consumed
- No CO2 emissions under controlled operational conditions.

Financial and business model

The economic viability of the technology which involves the conversion of waste to wealth in the form of reusable products is provided in the following table:

ROI of Total 500 Tons per day MSW Waste Conversion Project; Broken down into 50/150/300 TPD Plants					
Waste Conversion Plant MSW 50 /150 /300 MT per day/					
No	**Description**	**Values**			**Unit**
A	**Client Requirement:**				
1	Waste Conversion ERT Plant for MSW CAPACITY	50	150	500	**MT/Day**
1		0	0		**Kg/day**
2	Average MSW Conversion / Hour	2	6	21	**MT/Hr**
3	Average MSW Conversion / Month	600	1800	6000	**MT/year**
3	Average MSW Conversion / Year	17500	52500	175000	**MT/year**
B	**Proposed Ratings of Waste Plastics conversion Plant**	**50**	**150.00**	**500.00**	**MT per Day**
C	**Plant Output / Production**				
1	Hydrocarbon Gas MSW/SHW CV 7500 - 9000 kcal	**6**	**19.24**	**67.50**	**MT/day**
2	Hydrocarbon Oil (hydrocarbon liquid) from MSW/SHW of CV 7000-8000 kcal	**2**	**6.41**	**22.50**	**MT/day**
3	Solid Residue Carbon and Inerts from MSW/SHW of CV 3000 - 5000 kcal	**17**	**48.60**	**157.50**	**MT/day**
4	Condensate (Moisture)	**17**	**54.00**	**180.00**	**MT/day**
5	Inerts (Metals, Glass, CAD Waste etc)	**2**	**6.75**	**22.50**	**MT/day**
D	**Fixed Cost of Plant**				
1	Plant Cost at site basis/set	1607	3899.19	7950.76	**Rs in Lakhs**
2	Total Cost for Imported Components	0	0.00	0.00	**Rs in Lakhs**
3	5 % Customs Duty on EPCG Scheme	0	0.00	0.00	**Rs in Lakhs**

4	18% GST	289	756.00	2700.00	**Rs in Lakhs**
5	Total Cost of Plant	1897	4655.19	10650.76	**Rs in Lakhs**
6	Civil Work	150	400.00	800.00	**Rs in Lakhs**
7	**Total Estimated Project Cost**	**2047**	5055.19	**11450.76**	**Rs in Lakhs**
E	**Fixed Cost On Account Of Interest**				
1	Interest On Project Cost @ 12.5 % pa over a period of 5 years	1279	6318.99	7156.72	**Rs in Lakhs**
2	Average Interest Cost / Year	256	631.90	1431.34	**Rs in Lakhs**
F	**Depreciation**				
1	On Total Cost of Plant 1st year	236	352.66	377.95	**Rs in Lakhs**
2	On Total Cost of Civil work 1st year	8	17.15	27.93	**Rs in Lakhs**
G	Total Fixed Cost / Year	500	1001.71	1837.23	**Rs in Lakhs**
1	**Cost / Unit on account of fixed Cost**	**0.0276**	**0.0184**	**0.0102**	**Rs in Lakh/MT**
H	**Variable Costs Of Waste Plastics Conversion Plant**				
1	**Fuel Cost**	0.000	0.000	0.00	**Rs in Lakhs**
2	Total Fuel Consumption (LDO at 8300 Kcal/kg) @ Rs. 46 per lt	0.000	0.000	0.00	**Rs in Lakhs /hr**
3	**Cost of Electricity**	2.407	7.975	24.26	**Rs in Lakhs**
4	Total Fuel Consumption @ Rs. 10 per unit	0.100	0.332	1.01	**Rs in Lakhs /hr**
5	**Fuel Cost / Annum**	879	2910.91	8855.38	**Rs in Lakhs**
I	**Average Operation & Maintenance Cost**				
1	Yearly Operation cost	1049	3100.64	9325.68	**Rs in Lakhs**
2	Maintenance cost	97	299.87	575.36	**Rs in Lakhs**
J	Total Variable Cost / Year for 24 Hrs x 340 days / year	2025	6311.42	18756.42	**Rs / Lacs.**
1	**Variable Cost / Unit**	**11188**	**11623.24**	**10362.66**	**Rs. / MT**
K	**Total Costs per Unit Fixed & Variable**	**11**	**11.62**	**10.36**	**Rs. / kg**
L	**Gross Operating Cost (Annual)**	**2025**	**6311.43**	**18756.44**	**Rs in Lakhs**
M	**Sales Realisation (Annual)**	**2336**	**7233.14**	**24858.90**	**Rs in Lakhs**
N	**Gross Profit (Annual)**	**311**	**921.71**	**6102.46**	**Rs in Lakhs**
O	**Return on Investment from operating the Project**	**6.578**	**5.485**	**1.876**	**Years**
1	**Say**	**7 to 9**	**6 to 8**	**2 to 4**	**Years**

- It is important to note that returns on waste conversion will depend on the composition and calorific value of the waste.
- However, all waste will be converted without post-process residue and nil CO2 emissions.
- The increasing demand for gas harvested from biomass or mixed waste is also increasing the case for waste conversion.
- Extraction of graphene from carbon black is another huge case for increased demand for Carbon Black. Graphene is the next big contributor to sustainability in every product.

Successes and lessons learnt

The most important lesson learnt is that Waste is indeed a highly disregarded resource material. It is fascinating to watch the conversion of waste into clean energy products!

The reluctance of accepting new and improved solutions in most decision-making bodies despite a demonstration of the possibility is another fact that remains to be addressed. It needs to be understood that "incineration" is not a viable option and technologies that ensure no incineration of materials need to be identified and listed.

The Capital cost of such Plants must be reduced, and the downstream processing and collection of gas need to be designed and streamlined, perhaps for real-time usage. So while the waste is processed and gas is generated/collected it can be used directly for the fuelling industry.

Challenges and possible resolutions

The most important challenge is that of funding – especially for developed and proven technologies. Having invested their funds in setting up the first plant, they are not in a position to manufacture, install and operate plants without access to institutional funding under the various schemes launched by MSME and Startup India, etc.

The current challenge for new and improved technologies is the non-revision of Licensing Authorities /Agencies. The Government can allow the setting up of pilot plants to demonstrate the efficacy and safety of technologies such as theirs.

One challenge that would provide a revolutionary approach to the collection and utilization of waste would be to design and deploy a "Mobile Waste Conversion Plant" where waste is collected and directly fed for processing. This could serve the rural areas in India where there is currently no waste collection mechanism.

While the energy products are collected in real-time, these can be offloaded in gas cylinders, fuel barrels, and coal bins for usage in rural areas. It would provide a spectacular solution to both the usage and clearance of waste

Case study 11

Waste is Wealth- Ganjam district by UNICEF Odisha

Context

Located in the Ganjam district, Chamakhandi Gram Panchayat falls under the Chatrapur block. It is located around 7-8 km from the district headquarters in Chatrapur. A total of 1054 households are located in the Gram Panchayat. It comprises four revenue villages: Chamakhandi, B.Totapalli, Sindurapalli, and Banabulapalli. Before the Solid Waste Management intervention, the situation in Chamakhandi Gram Panchayat was critical. Hence the project was executed by the Ganjam district and gram panchayat administration with support from the UNICEF and Centre for Policy Research as technical and knowledge partners.

Initiation and Planning process

With such limited solid waste management done here, vacant land or roads were used to dispose of garbage or to burn them. There was a bad odour emanating from the decomposing waste that created an unpleasant environment for the residents. Moreover, people living nearby used to suffer from health ailments like fever, cough, diarrhoea, etc. due to flies & stench caused by accumulated waste. Solid waste accumulated near the drainage pipes and clogged the outlets as well. People were unaware of the importance of solid waste management, segregation of waste, or even the Swachh Bharat Mission.

Operations and technology used

The Ganjam District Administration established the Rural Mini Micro Composting Centre & Material Recovery Facility to manage solid waste generated in rural areas under the tagline "*Mo Swabhimaan Swachh Ganjam*". A rural MMCC/MRF was established in Chamakhandi Gram Panchayat. Chamakhandi's rural MMCC/MRF is located in Jagyashala. Rural MMCCs and MRFs consist of a receiving yard, sterilization chamber, tubs for storing wet waste, restrooms for workers, toilets, and separate tanks for storing segregated dry waste.

It costed Rs 15,00,000 to construct the facility. A combination of SBM funds, MGNERA funds, and untied and unspent balance funds from CFCs and SFCs was used in the establishment of this facility. Battery-operated vehicles

(BOV) have been purchased with funds from Ganjam District Mineral Fund for door-to-door solid waste collection. The Chamakhandi rural MMCC/MRF was equipped with two BOVs. The facility has an area of about 2100 square feet.

In June 2021, the Chamakhandi Rural MMCC/MRF was commissioned. A shredder has also been installed within the facility recently. A total of 350-400 kg of wet waste and 75-90 kg of dry waste are received in the facility each day. There are several key stakeholders here, including the Sarpanch, Panchayat Executive Officer, SwachhataSahayak, SHG members, and rural citizens. Door-to-door waste collection occurs between 7 AM and 12 PM during the facility's operation. In the morning, the BOV collects wet and dry waste from the villages and disposes of it at the rural MMCC/MRF.

The Gram Panchayat administration has provided each household with two dustbins to store wet and dry waste separately. Further segregation is carried out in rural MMCCs and MRFs by SHG members. Personal protective equipment has been provided for all workers to protect themselves from hazardous waste. In the facility, the supervisor is from the Mahalakshmi SHG, and the rest of the workers are from the Srilakshmi SHG.

In total, 21 days are required for the wet waste to be transformed into compost. The compost is branded as "*Mo Khata*" while the dry waste is stored in separate bins (plastic, metals, polythene bags, paper/cartons, and glass).

MMCC/MRFs of Chamakhandi Gram Panchayat have been linked with Urban MRFs of nearby Chatrapur NACs after the emergence of Urban-Rural Convergence for Managing Faecal Sludge and Plastic Waste Management. The tagging of Chatrapur NAC and Chamakhandi Gram Panchayat is based on the Gram Panchayat-led model since Chamakhandi Gram Panchayat processes most of the waste (wet and dry, except low-density plastics).

All dry waste except low-density plastic bags is sold to Kabadiwallahs. A sufficient quantity of low-density plastic bags are stored and transferred to Chatrapur MRF for further processing. According to the Urban-Rural Convergence for Plastic Waste Management, this is the appropriate approach. Along with managing the facility, the SHG members also creates awareness among people and collects monthly fees from households for Solid Waste Management.

Financial and business model

This initiative has been designed in a way that leads to a self-sustaining sanitation model. By selling *Mo Khata* (compost) and recyclable dry waste, SHGs will be able to generate revenue for the facility.

Success and lessons learnt

Waste collection from door-to-door continues. A resolution has been passed by the Gram Panchayat administration for the collection of Solid Waste Management user fees. Each month, the SHG members collect Solid Waste Management user fees from households, commercial establishments, and institutions. The Chamakhandi Gram Panchayat has been formally tagged to Chatrapur NAC. On 29 April 22, the ULB and the Gram Panchayat signed a Memorandum of Agreement.

As of now, around Rs 16000 is being generated through the sale of recyclables to local Kabadiwallahs. Additionally, talks are underway between the Horticulture Department and the Forest Department regarding the sale of *Mo Khata*. As part of the convergence program, Chamakhandi rural MRF sent around 300 kgs of low-density plastic bags (non-recyclables) to Chatrapur MRF for further processing.

Challenges and possible resolutions

There were certain challenges that are being addressed as mentioned ahead –

1. Due to the defect in the first design of BOVs, the waste was mixed when it was collected. After addressing the weight distribution issue of the BOV's wet and dry waste compartments, this issue was resolved.
2. Several members of the community claim that the BOV vehicle arrives at an irregular time and day. As a result, if the BOV does not arrive for one or two days in a row, people are forced to throw their waste outside.
3. Additionally, BOV has trouble retaining battery charge over long distances.
4. Keeping the interest of SHG members in place for their significant contribution to the value chain requires selling compost and recyclables to generate revenue.

Quotes

Before BOV coming to our village, we used to throw our household waste into the open. It often led to bad odours and flies, which would negatively impact the health of my family members. Following the intervention, the BOV collects waste from door-to-door. My life has been made much easier because I don't have to throw waste out into the open anymore. As a result, the environment is kept clean, and the health of my family is not compromised", says Basanti Sahu, a resident of Chamakhandi village.

Case study 12

A change of heart by BBC Media Action (India) Limited

Context

The Swachh Bharat Mission started India on its sanitation journey by building individual household toilets at scale and ending open defecation. By making sanitation accessible to everyone and coupling it with behaviour change, the Mission significantly altered perceptions of hygiene as well as dignity. It became a people's movement.

With the momentum created by the Mission, people in India realized that sanitation impacts their lives in many ways and that it needs to be everyone's agenda. It calls for citizen engagement and community action because communities know their needs best and wields the most influence.

Initiation and planning process

Following a request by the Secretary Ministry of Housing and Urban Affairs (MoHUA) and with support from the Bill and Melinda Gates Foundation, BBC Media Action developed the coffee table book A Change of Heart which includes 15 stories from 11 Indian states, that showcase and celebrates people's conviction and dedication towards the Clean India Mission, turning it truly into a people's movement.

The stories in this book describe a range of reasons that propelled people to engage with sanitation. They demonstrate personal endeavors stemming from passion, local pride, novel civic initiatives, and technology partnerships to address the challenge. The book shows that the challenge of sanitation is ongoing. And each story in it needs to inspire many more. It demonstrates that for a nation to change, it all has to start with a change of heart.

The objective of this book was to vividly showcase India's journey in urban sanitation through human stories from various levels of society, for people to draw inspiration from best practices and models to continue the momentum in transforming urban spaces. The stories span multiple themes across the sanitation value chain - access to toilets; a people's movement; sustainability; innovation; faecal sludge management; plastics and solid waste management.

Due to COVID-19, on-ground production i.e.,

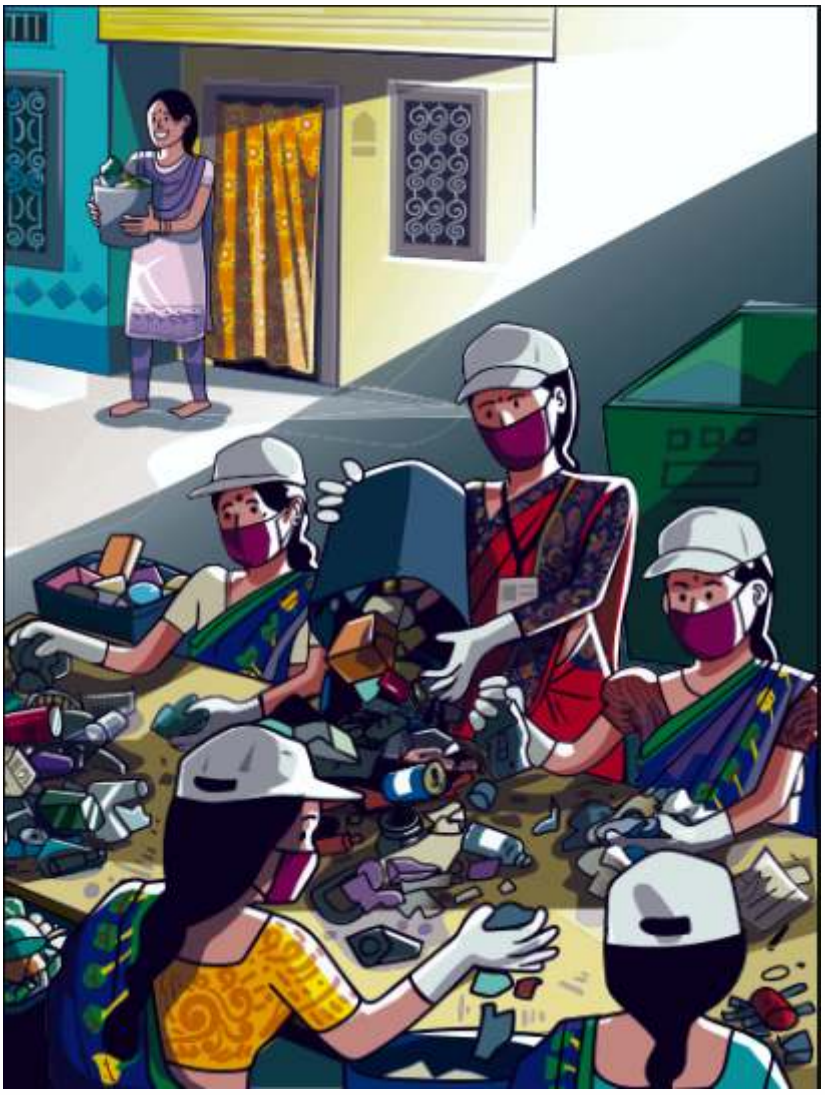
photography and filming were restricted, so the approach was pivoted to using unique graphic illustrations, and telephonic interviews with the subjects that were identified as positive deviants in their communities. The insight that guided the development of the book was 'pride and ownership', where people featured played a part in the movement that could inspire others to play a part too.

The stories were identified with the help of the Ministry of Housing and Urban Affairs and the partners in the National Faecal Sludge and Septage Management (NFSSM) Alliance after several consultations to ensure that stories are representative from across the sanitation value chain and that they are inclusive demographically.

The process from identifying stories, to taking consent from those it features, interviewing them (with translators and local stakeholders), sourcing their photographs so illustrations could be representative, to vetting the data to ensure credibility was done completely remotely. This was a considerable challenge, but patience, the support of partners, and the creativity of nine illustrators and the writer considered much detail to tell their stories.

The coffee table book was about people who modeled change in their way, like the garbage café in Ambikapur (Chhattisgarh) which operates from the city's main bus stand and gave food coupons to anyone who deposited a kilogram of plastic waste. It gave one lunch coupon for every kg of plastic waste and one breakfast coupon for half a kg. So far, 1500+ kgs of plastic waste have been collected and 1,180+ lunch & 800+ breakfast tokens have been issued.

Citizens of Ambikapur, Chhattisgarh love Garbage Cafe for its food & unique currency. Ambikapur, which was selected as the second cleanest city after Indore, planned to use the plastic for construction of roads. The first such road in the state was made in the city by mixing 8 lakh plastic bags. The road constructed by mixing plastic and asphalt is durable because the water does permeate through it.



Another inspiring story was of Ms. Sunita Sarkhel from Ambikapur, Chattisgarh - a family of didis. The story represents the initiatives she took toward improving waste management in the town of Ambikapur. Through this initiative, 600 women got livelihood opportunities as Swachhata Didis. It also ensured 100% door-to-door collection and 100% source segregation of waste.

Another story is of Satveer Singh from Warangal (Telangana) who, as a

manual scavenger formerly, championed the cause of rehabilitating other manual scavengers and started his desludging operation. Rachna from Ujjain (Madhya Pradesh), a 20-year-old who helped her mother at a tea stall, requested the local authorities to convert an unused bus stop into a *SHE chalaya* and created further access to toilets.

Some stories were told with a gender lens of people like Venkatalakshmi from Narsapur (Andhra Pradesh) broke barriers to become the first woman desludging entrepreneur, and the transgender Self Help Group (SHG) *Bahucharamata* in Cuttack that led the charge in the operation and maintenance of the septage treatment plant. Another one is the 'Map of Possibilities' where Google partnered with the government of India to pin the available toilets on google maps enabling people to find, mark and review them.

The book also has the story of Pi Laltharzeli of Mitam in Mizoram - a club with a difference. The story narrates Pi Laltharzeli's initiatives through the eyes of a young boy Stephen who is a part of the CSC (Children Sanitation Club) established by her in the town of Mitam. So far, more than 100 CSCs were established in Mitam district, and more than 25,000 children have registered for them. The club has organized over 100 events in a year.

Other case studies of changemakers include the re-popularization of the dry toilets in Ladhak, by Ladhak Ecological Development Plan & Bremen Overseas Research & Development Association with financial support from the Ministry of Economic Cooperation & Development. They have set up an all-weather toilet in the middle of Leh which is maintained by the People's Action Group for Inclusion & Rights, an organization maintained by specially-abled people.

In another case study, it was depicted that Venkatalakshmi, a woman in the streets of Narsapur, Andhra Pradesh is taking up the task of driving a fleet of 3 trucks for desludging septic tanks. Over the years, she has started advertising her service and is successfully transporting 80-90 kiloliters of load per day every month, a classic case of women empowerment in the sanitation sector.

Shri Hardeep Singh Puri, Minister of Housing and Urban Affairs (MoHUA), at an event *Azadi Ka Amrit Mohatsav* on 27 September 2021, launched the seventh edition of Swachh Survekshan 2022, designed with 'People First' as its driving philosophy, along with A Change of Heart coffee table book. The event was webcasted live and attended by over 1,000 State and city-level officials and sector partners.

PART B

Models of Success in Greywater Management in Urban and Rural India: Success around Technology, Approaches, Sustainability, and Impact

Case study 1

Promoting appropriate low-cost & low-maintenance wastewater treatment solutions in Dungarpur city, Rajasthan by FINISH Society

Context

Water bodies are an integral part of a city's beautification & ecosystem challenge but maintaining them can pose quite a formidable challenge. FINISH Society since the beginning, strongly promotes safe sanitation technologies as it affects the groundwater quality. Over time, FINISH society expanded its initiatives in solid & liquid waste management as a natural extension of sanitation programs.

FINISH Mondial, the Government of the Netherlands-supported ODF+ program, in India aims to improve the status of health, hygiene, and cleanliness through interventions in WASH (households and schools), Solid & Liquid Waste Management, and Faecal Sludge Management, inclusively and sustainably.

The Dungarpur Municipal Corporation has set up a brilliant example by rejuvenating the Gep Sagar Lake and a nearby pond using a wastewater treatment plant, the implementation of which has been done by FINISH Society around four years back.

Initiation, planning & Institutional set-up

Before the project was implemented, untreated grey water was entering the lake and polluting it. Visitors and locals found it difficult to go near the lake due to the stench, however, the scenario is different now. A part of the lake has been turned into a bird sanctuary and a park has been developed adjacent to it around two years back for visitors and tourists. The plants were funded by the municipality with technical support for design and supervision done by the FINISH Society.

Operations and technology used

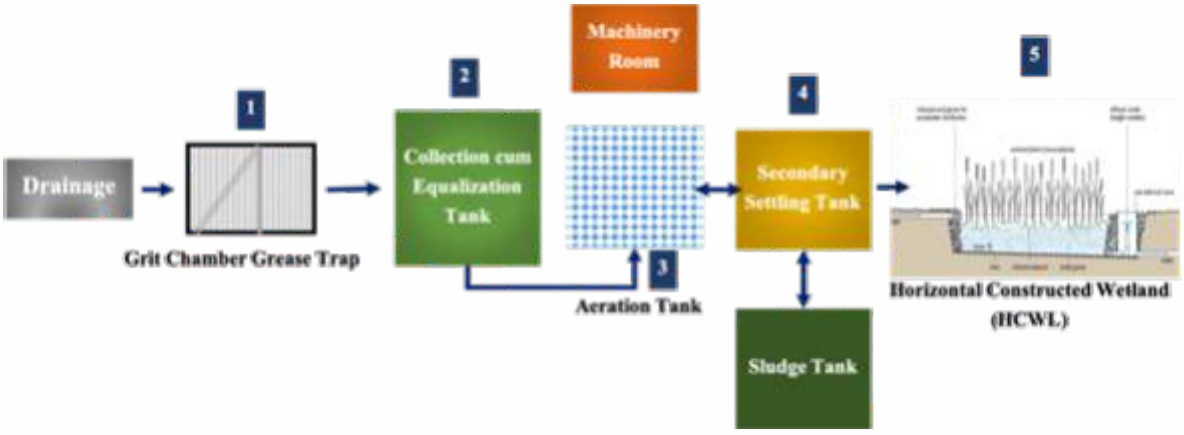
Two treatment systems (Gepsagar and Soneriya) were set up at a distance of 2 km from each other in Dungarpur. In one case, the technology adopted was a Horizontal Constructed Wet Land (HCWL) while in the other, which had a higher organic load due to the presence of industrial effluents, the technology adopted was a combination of a moving bed biofilm reactor (MBBR) and HCWL.

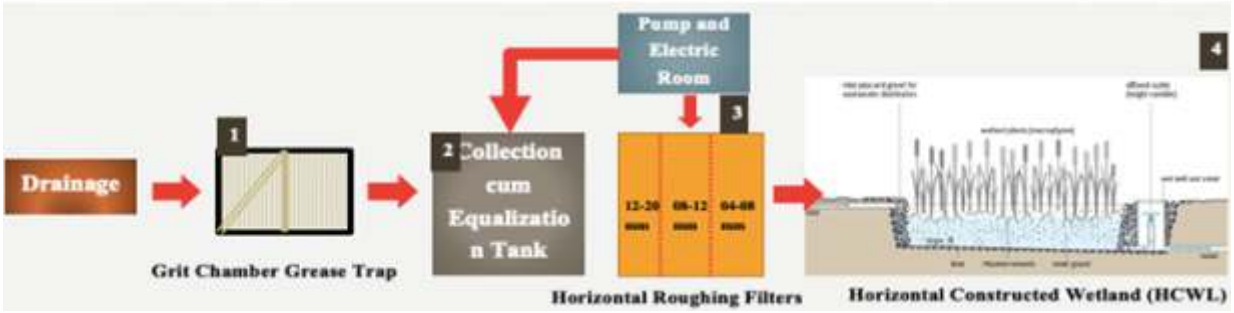
The wastewater enters the grease trap from the grit chamber/grease trap (GCGT) where settleable solids are removed by gravity which further enters the equalization tank which is also used as the pumping tank which then enters the aeration tank containing MBBR. Aeration is provided through bubble diffusers to provide oxygen for microbial growth to fully disperse the plastic media. The overflow from the MBBR tank enters the settling tank. Here the settling takes place and after sufficient retention time, the clear water flows to the HCWL. The sludge settled at the bottom is removed periodically.

HCWL is an engineered mimic of a natural wetland. The mechanism of removal of pollutants in HCWL is chemical, physical, and biological. After the removal of suspended solids, the remaining ones are degraded biologically by bacteria attached to the reed plants like typha or phragmites and segment surfaces. Nitrogen removal in the HCWL is by using bacteria in aerobic zones to nitrates which get converted to Nitrogen by denitrifying bacteria in anoxic zones. The plants also uptake phosphorus significantly. The result meets RPCB standards and is fit for discharge into the lake.

The settled sludge from the settling tank is periodically drained with the use of a sludge pump into a sludge holding tank. The sludge can be disposed of as feed into a biogas plant or to the sanitary landfill, after moisture reduction.

Gep Sagar Wastewater Treatment Plant has a capacity of 20m3/day (KLD) and Soneriya Wastewater Treatment Plant has a capacity of 50m3/day (KLD).





Financial and business model

The plants have used nature-based systems and hence have very simple maintenance requirements at a minimal cost. The operating cost is borne by the urban local body.

Successes and lessons learnt

33-year-old tea stall owner Harish Patedar, who has a stall near the lake and the treatment plant, says that earlier it was difficult to stand near the lake even for seconds but now it has more visitors and even he has more customers. *"I came here five years back and earlier this whole area was polluted, full of moss but after treating the water, this was followed by developing a park and a sanctuary.*

Today, the place is flooded with tourists especially from Gujrat on Sundays as it is very near the border." He added that he has noticed regular and timely cleaning of the water treatment plant.

Assistant Engineer, Municipal Council, Dungarpur, Vikas Legha says: *"We are taking many measures to beautify and keep our city clean and therefore, we have received the 'Cleanest City' title under 50,000 population and seventh rank in India under the general category of clean cities."* He also talks about the waste management and source segregation happening in the city, adding that they have received a brilliant response from the citizens and people are cooperating very well. He sounds elated when he says: *"It feels great to say that we have 100 percent collection and transportation followed by recycling and management after sorting."*

He also adds that Dungarpur was the first ODF (open defecation) free city in Rajasthan. FINISH Project Manager, Dungarpur, Narendra Sharma says, *"We would not be able to achieve this without support from the Municipal Council."*

Case study 2

Re-imagining environmental sustainability in community sanitation in urban informal settlements by Hindustan Unilever (HUL)

Context

With a population of 1.3 billion and accelerated urbanization, India faces immense pressure on its cities. The population living in informal urban settlements has more than doubled in the past decade and is projected to continue growing. With this exponential growth and the onset of the COVID-19 pandemic, it has become more critical than ever to provide hygiene and sanitation solutions to low-income households and especially to communities residing in congested urban informal settlements.

In 2016, HUL launched the first *Suvidha ['convenience'] center*, the first of what is today a total of 7 centers. Suvidha is a purpose-built, sustainable community center that addresses the sanitation, hygiene, drinking water, and laundry needs of low-income urban households. Each Suvidha center saves 4 million liters of water annually using a closed-loop approach to reusing water.

These centers collectively serve over 2,00,000 people and save over 35 million liters of water every year. In addition, the company also drives behaviour change campaigns on water, sanitation, and hygiene in the communities around the center for sustainable impact. This has bolstered health, nutrition, sanitation, and livelihood outcomes in the community.

Initiation and planning process

Needs of urban informal settlements: 5 million people in Mumbai's urban informal settlements (slums) don't have access to toilets at home and therefore depend on community toilets. People living in settlements like these continue to face interlinked challenges of hygiene, water, sanitation, and sustainability. It is therefore that the Suvidha model prioritizes locations basis their low HDI status and need on the ground.

Challenges of Public Sanitation: Through extensive research and discussions with sanitation experts, HUL found that there is a vicious cycle in public toilets all over the world. With the government having the resources for Capital Expenditure (CAPEX), it is the Operational costs – especially high maintenance costs that results in poor hygiene standards. Dirty and dingy public toilets demotivate people to keep them clean. They, therefore, vandalize resulting in higher costs, keeping the vicious cycle going.

Solution – A Public-Private Partnership: Suvidha is a public-private partnership that was initiated by Hindustan Unilever with the Municipal Corporation of Greater Mumbai in 2016. The journey of a Suvidha Centre typically takes 16 months from identification of the site to breaking even operationally.

Construction

- **Identification of locations:** Communities with low HDI in Mumbai were identified and the HUL team used a checklist to ensure that the location can support the construction of a center
- **Aligning Government Permissions:** While initiating the project, aligning various permissions from multiple government departments took many years. Though with the success of the project it became easier to align various authorities – leading to a single window approval system set up for the centers. Hindustan Unilever partnered with the MCGM for Suvidha, and the project is led by the Deputy Municipal Commissioner & Assistant Municipal Commissioner at MCGM. The HUL team also worked closely with the Engineers and Executive Engineers at the Solid Waste Management team, the Municipal Corporation Maintenance (engineering) team, and the Water Department.
- **Construction of Suvidha Centre:** Once permissions were aligned, the existing community toilet was broken down and the construction of the new center began. All the construction norms of the government and Unilever were followed.
- **Back-up toilets** were made for the community while Suvidha centers were being constructed to ensure the safety and convenience of the community.
- **Accessible for all:** The centers were designed with the safety and accessibility needs of women, children, the elderly, and PWDs in mind.

For the community – by the community:

- **Engaging the Community:** Apart from ensuring community engagement before and during the construction of the centre, the HUL team also conducted an intensive community mobilization program that especially engaged the women and children in the community, therefore driving usage and a sense of ownership.
- **Behaviour Change Programme:** The team also worked with local NGOs to conduct an intensive behaviour change program on WASH, Health, and nutrition messages.
- **Livelihood for the community:** The centres provide paid employment opportunities to the community to run, clean, and manage the centers. The model currently provides employment for over 122,000 man-days and employs over 200 people at any given point in time

Institutional set-up

Suvidha is a unique Public Private Partnership (PPP) and has been recognized by the 'World Economic Forum' in 2021 as an example of a PPP that governments can adopt to create healthier cities.

- **Funding:** The centers are co-funded by the CSR budgets of Unilever and HSBC
- **Construction & Behaviour Change Programs:** Carried out by Unilever
- **Running of the center:** Run by NGOs in close consultation with the communities.

Operations and technology used

Many urban informal settlements lack sewerage connections, and it is imperative to explore ways to make WASH facilities water efficient through water recycling. With power contributing to a significant portion of operating costs and the center's environmental footprint, energy efficiency is another immediate imperative to enhancing sustainability. Towards the end, new technologies need to be integrated into community toilet models and tested. Further, these community toilets also require improved construction techniques so that they can be built faster and with fewer resources.

Greywater treatment

To this end, all Suvidha Centres have a **grey water management plant** that uses **circular economy** principles to reduce water use. Here, grey water collected through handwashing stations, leg–washing stations, showers, and washing machines is treated and reused in toilets for flushing.

1. Fresh water is first used for brushing teeth, bathing, handwashing, and laundry.
2. The wastewater from these activities becomes the input for flushing toilets. This helps save an estimated 40,000 liters of water every day.
3. The technology used in the process is flocculation & disinfection.
4. Greywater and wastewater from bathing and washing are passed through a bar screen to remove large objects and through an oil trap to remove oil.
5. From the underground storage tank, it is pumped to upflow settling tank. Here, coagulant, polymer, and primary disinfectant are added which causes the large particles of impurities to clot through the process of Flocculation.
6. The settled sludge is sent to the municipal sewer and the clarified water is pumped through a sand filter to remove any residual suspended solids and through a carbon filter to remove odour and colour.
7. A secondary disinfectant dosing is added, and treated water is stored in an overhead tank, ready for reuse in flushing.
8. Aluminum-based chemicals and chlorine are used in the process

Blackwater Treatment

Launched in 2021, the Suvidha center at Ghatkopar is the first of its kind to treat and reuse both grey water and black water at a community toilet level. The center caters to over 20,000 users and saves over 10 million liters of freshwater annually by reusing treated wastewater. The wastewater treatment system implemented at Suvidha Ghatkopar is a first-of-its-kind - Nature Based Solution implemented in a Public Toilet/Community Toilet context. Based on DEWATS™ technology & designed by CDD India, this hybrid treatment system can potentially treat 30,000 liters of wastewater every day which can then be reused for flushing purposes. 90% of the treatment happens underground through gravity with zero use of chemicals. In operation since October 2021, this solution

has proven to be odourless, easy to operate & maintain by local NGO staff. Thus, the intervention not only tackles the environmental and health costs associated with wastewater but also becomes a significantly affordable option for water purchase by poor & vulnerable communities.

Financial and business model

Capital Expenditure (CAPEX):

- **Land & amenities:** The land, amenities, and requisite permissions are provided by the government of Mumbai
- **Funding:** The centers are co-funded by the CSR budgets of Unilever and HSBC.

Operational Expenditure (OPEX):

While all public toilets in the world run on a pay-per-use model and therefore struggle with a funding constraint for operational costs:

- Monthly passes for families who live close to the center
- Laundromats

All profits made from the center are further used for the upkeep and maintenance of the center.

Successes and lessons learnt:

Suvidha's impact

Rigorous studies and impact assessments by the Research Triangle Institute and the Kantar Group have established Suvidha has had a great impact on the communities it established in – with respect to users' health, self-esteem, safety, convenience & ease of access, value for money, accessibility, and even water and energy saving.

Suvidha has also delivered a few unexpected outcomes, including cleaner neighborhoods, reduced anti-social elements due to well-lit Suvidha premises; a sense of oneness within the community, and conformance of Suvidha with national and international standards

Lessons learnt

From developing the initial concept to opening the first five Hygiene Centres, they have learnt some key lessons along the way. These insights may be useful to others that want to adopt similar market-based solutions through novel, sustainable business models.

Lesson 1: Find the Right Partners

Hindustan Unilever is not in the construction business. Nor are they architects, planning specialists, plumbers, or carpenters. But they needed all these skills and more to build the centres. They had to ask for help and draw on specialist skills. They learnt that identifying specialists from subject matter experts who had practical knowledge and experience essential to could understand that understood the challenges and progress towards feasible solutions had practical experience was essential for progress.

This project would not have been possible without the support of the MCGM and their corporate partner- HSBC India. By partnering with both, United Way India and PrathaSamajik Sanstha, they were able to tap into their skills and networks of others, these groups often have a comprehensive since they have a good understanding of community needs on the ground which helped us and can help companies to navigate cultural sensitivities and political challenges.

It is essential to select the right partners based on a set of shared objectives and values. They, therefore, brought in technical partners for the project including the Consortium of DEWATS Dissemination Society (CDD), Waterlife, BePure, and Ernst & Young (EY).

Lesson 2: Work Closely with Communities

The whole process of developing a new business model had to be as consultative as possible. Co-creation with the end users in the community helped us make it a success. Mumbai is one of the most diverse cities in the world, and each community has its sensitivities and challenges. Having an inclusive process also helped to get buy-in from local stakeholders and to develop imparts a sense of ownership. Ultimately, getting all these insights from a wide range of different stakeholders – including end-users, regulators, and other companies – helped them come up with a more resilient model.

Lesson 3: Expect the Unexpected

With any project, there are always surprises. Doing something challenging and different made the surprises bigger. External factors included inclement weather that contributed to delays. Festival seasons meant led to interruptions to scheduled plans due to fewer working days or the absence of local labour. Working in an area without planned infrastructure like water and electricity was a major challenge. There were many unknown risks, from high-tension wires that run above slums to poor soil quality near the ocean on reclaimed land.

However, they have seen many women come forward to become champions of the community and this has helped in the widespread acceptance of the Suvidha centers across Mumbai. Being flexible and ready to adapt to an unpredictable environment helped them navigate through every obstacle that came up. Preparing for the unknown in advance helped them put together teams to overcome the barriers. Above all, the project required patience, perseverance, and optimism to turn it into reality.

Case study 3

Greywater management: A noble initiative by Budhudih Gram panchayat in Jharkhand - UNICEF Jharkhand

Context

Swacch Bharat Mission (Grameen) has created a sanitation movement across the country. To sustain the momentum and improve further, Government of India launched Swacch Bharat Mission (Grameen) phase II while focusing on ODF plus activities. In order to sustain the sanitation status and provide safe drinking water to all rural families, the Honorable Prime Minister launched Jal Jeevan Mission aiming at providing Functional Household Tap Connections by 2024 with 55 LPD of the prescribed quality.

Department of Drinking Water and Sanitation (DWSD) Jharkhand has planned and prioritized surface water-based multi villages schemes for providing functional house tap connection (FHTC) wherever possible. In the areas where surface water is not available, groundwater-based single village schemes are taken for providing FHTC to the families. The FHTC coverage plan of Jharkhand is strategized to provide 39% FHTC through MVS and 61% from SVS to rural families till 2024. Along with household connections, schools, Aanganwadi, health care facilities, and other government institutions are included for tap water supply.

Tap water connection at every household throws the biggest concern for liquid waste management under SBM-G Phase-II. Hence, greywater management becomes critical for both SBM-G Phase-II and JJM. Liquid waste management is critical for ODF plus and source sustainability is crucial for JJM.

For grey water management and sustainability of sources, the DWSD has converged with different Departments for creating infrastructures for grey water management, water conservation, and bore well recharge. A joint letter has been issued by Secretary, Panchayat Raj Department and DWSD, Govt. of Jharkhand to Deputy Commissioners of the State for the development of grey water management infrastructures, rainwater harvesting structures, solid waste management infrastructures at community and institutional level -schools, AWCs, health care facilities, GP buildings, etc.

After the successful implementation of SBM-G phase-I, the next step was liquid management to resolve the issue of water logging and water flow on roads causing bacterial diseases. Budhudih situated in plain areas faced the challenges of water flow on roads from handpumps after use and water logging in many places of the village. Post-launch of JJM and SBM-G phase-II, state and district level orientation of all the Panchayat Mukhiyas were done in mission mode for ODF plus and sustaining sources under JJM.

The former Mukhiya, Mrs. Renu Devi participated in district-level training and learnt technologies of grey water management, funding mechanism, and resources required. She was determined to ensure each handpump had a soak pit; a soak pit at the community level and the institutional level must be constructed with community participation. The Mukhiya was motivated to convert the village into a model village while attaining ODF plus village.

Initiation and planning

Change involves layers of challenges. Mr. Renu with Jalsahiya of the Village Water and Sanitation Committee (VWSC) conducted a planning meeting with stakeholders and villagers to develop a comprehensive plan for greywater management. DWSD and UNICEF-supported team members were also invited to provide technical support on the project. Phase-wise planning was developed for the intervention. A team was formed in Budhidih village for site selection, community awareness generation, model section, and mobilization of masons and other resources.

In the first phase, sites were selected for soak pit constructions. Handpumps in the village, schools, Aanganwadi and health care facilities, and other public places were identified and selected for grey water management. Land-related issues were resolved for the construction of different models of soak pits as appropriate. Estimated budgets with models were prepared by the technical team of Budhidih Panchayat.

In the second phase, community mobilization activities were conducted on ODF plus activities through DWSD and UNICEF-supported teams. During the community mobilization process, emphasis on liquid waste management was done. Communities were also made aware of the link between water quality, source sustainability, and greywater management under JJM. The Jalsahiya conducted a sanitary survey of the village to highlight the need for grey water management in Budhudih. The survey result was shared with the villagers in the context of water quality surveillance and the need for greywater management. Once communities were sensitized, the Mukhiya, then, processed further for the next intervention.

The plan was incorporated in Gram Panchayat Development Plan (GPDP) through gram sabhas to implement grey water management through the 15th FC tied grant. Discussions were held in gram sabhas and in the working committee of the Panchayat before implementing the plan. The budget, models, and required resources were reviewed thoroughly in the context of guidelines provided by the State and District. Finally, the plan was approved, and implementation started.

For women's participation, Self Help Group (SHG) members were engaged in the project. SHGs members mobilized women on household greywater management. The focus was was on soak pits construction at the household level without government schemes' support. Members of the groups sensitized villagers on waterborne diseases and the importance of greywater management from the perspective of water conservation.

At the institutional level school management committees, Aanganwadi Sevikas, Hospital Management Committees, Health Sevikas, and ward members were sensitized and engaged in the mission. Sites for soak pits constructions in schools, Aanganwadi, and health care facility was discussed with them. Thus, the roadmap was clear for greywater management in a comprehensive way aiming at ODF plus village while developing supportive assets for JJM.

With the technical support from DWSD and UNICEF supported team, a comprehensive plan was developed to engage all the stakeholders, institutions, and communities. The intervention period started in the village. A participatory approach was adopted in the implementation process for greywater management.

Institutional set-up

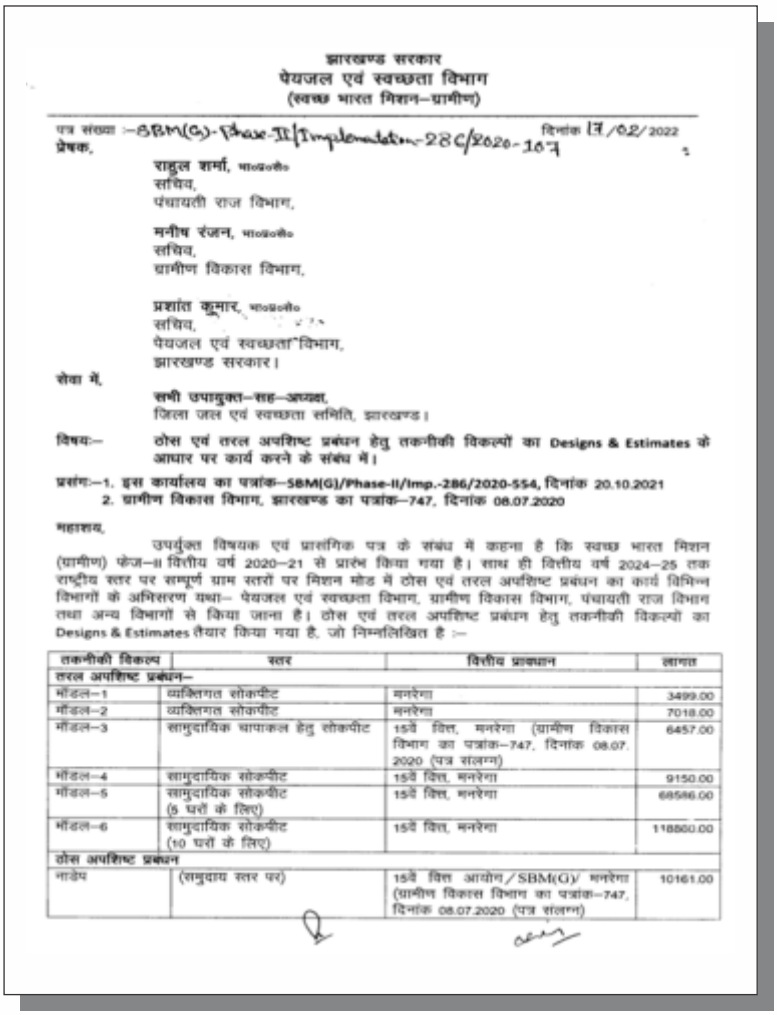
As discussed above, the Panchayat engaged the School Management Committee, Hospital Management Committee, members of SHGs, VWSC, Sevika, Sahiya, and communities as a whole. Schools, Aangwadi, and

health care facilities took responsibility to monitor the construction of soak pits. Post-construction, it was also decided that the institutional committees will look after O&M issues of the assets created for grey water management.

At the district level, DWSD provided technical support in the design and estimate of the models for implementation of greywater management while focusing on greywater management in Budhidih village. Mrs. Renu also engaged Block Development Officer who is the competent authority for monitoring the progress at the Panchayat level. The Panchayat secretary of the Panchayat was held responsible for financial management. Panchayati Raj Department provided handhold support in transferring the 15th FC fund for accelerating the progress of the works taken in GPDP.

Operation and technology used & financial model

The state has provided an estimated budget with different models of soak pits for greywater management. Mrs. Renu, the former Mukhiya, Budhudih Panchayat, used the existing models. DWSD, Giridih provided technical support in augmenting the models and budgets as required. The models used in Budhudih village for greywater management are given below:



झारखण्ड सरकार
पेयजल एवं स्वच्छता विभाग
(स्वच्छ भारत मिशन–ग्रामीण)

पत्र संख्या :–SBM(G)-Phase-II/Implementation-286/2020-167 दिनांक 17/02/2022

प्रेषक,

राहुल शर्मा, भा०प्र०से०
सचिव,
पंचायती राज विभाग,

मनीष रंजन, भा०प्र०से०
सचिव,
ग्रामीण विकास विभाग,

प्रशांत कुमार, भा०प्र०से०
सचिव,
पेयजल एवं स्वच्छता विभाग,
झारखण्ड सरकार।

सेवा में,

सभी उपायुक्त–सह–अध्यक्ष,
जिला जल एवं स्वच्छता समिति, झारखण्ड।

विषय:– ठोस एवं तरल अपशिष्ट प्रबंधन हेतु तकनीकी विकल्पों का Designs & Estimates के आधार पर कार्य करने के संबंध में।

प्रसंग:–1. इस कार्यालय का पत्रांक–SBM(G)/Phase-II/Imp.-286/2020-554, दिनांक 20.10.2021
2. ग्रामीण विकास विभाग, झारखण्ड का पत्रांक–747, दिनांक 08.07.2020

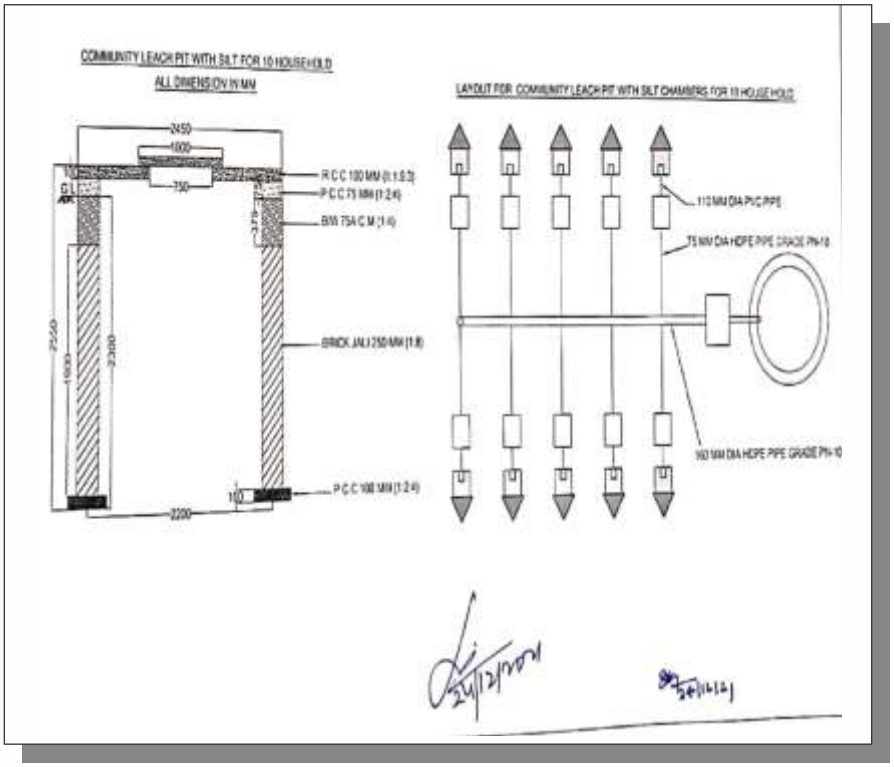
महाशय,

उपर्युक्त विषयक एवं प्रासंगिक पत्र के संबंध में कहना है कि स्वच्छ भारत मिशन (ग्रामीण) फेज–II वित्तीय वर्ष 2020–21 से प्रारंभ किया गया है। साथ ही वित्तीय वर्ष 2024–25 तक राष्ट्रीय स्तर पर सम्पूर्ण ग्राम स्तरों पर मिशन मोड में ठोस एवं तरल अपशिष्ट प्रबंधन का कार्य विभिन्न विभागों के अभिसरण यथा– पेयजल एवं स्वच्छता विभाग, ग्रामीण विकास विभाग, पंचायती राज विभाग तथा अन्य विभागों से किया जाना है। ठोस एवं तरल अपशिष्ट प्रबंधन हेतु तकनीकी विकल्पों का Designs & Estimates तैयार किया गया है, जो निम्नलिखित है :–

तकनीकी विकल्प	स्तर	वित्तीय प्रावधान	लागत
तरल अपशिष्ट प्रबंधन–			
मॉडल–1	व्यक्तिगत सोकपीट	मनरेगा	3499.00
मॉडल–2	व्यक्तिगत सोकपीट	मनरेगा	7018.00
मॉडल–3	सामुदायिक घाघाकल हेतु सोकपीट	15वें वित्त, मनरेगा (ग्रामीण विकास विभाग का पत्रांक–747, दिनांक 08.07.2020 (पत्र संलग्न)	6457.00
मॉडल–4	सामुदायिक सोकपीट	15वें वित्त, मनरेगा	9150.00
मॉडल–5	सामुदायिक सोकपीट (5 घरों के लिए)	15वें वित्त, मनरेगा	68586.00
मॉडल–6	सामुदायिक सोकपीट (10 घरों के लिए)	15वें वित्त, मनरेगा	118860.00
ठोस अपशिष्ट प्रबंधन			
नाडेप	(समुदाय स्तर पर)	15वें वित्त आयोग/SBM(G)/ मनरेगा (ग्रामीण विकास विभाग का पत्रांक–747, दिनांक 08.07.2020 (पत्र संलग्न)	10161.00

1. Name of Work- Model estimate of Community Leach Pit with Silt Chamber for 10 Households having waste water discharge of 300 L/Day

Sl No	Particular						Quantity	Unit	Rate	Amount
1	Earth work in excavation in foundation trenches in ordinary soil (wet classification of soil item-B and disposal of excavated earth as obtained to a distance up to 50 m including all lifts leveling,ramming the foundation trenches, removing roots of trees shrubs all complete as per approved design, building specification and direction of Er. BCD-5.1.01+5.1.02									
	Particulars	No	L	W	H	Quantity				
	Soak Pit	0.786	2.650	2.650	2.300	12.606				
	Chamber	1	1.250	0.950	0.625	0.993				
	For 110 mm dia PVC Pipe	1	3.00	0.300	0.300	0.270				
	For 160 mm dia HDPE Pipe	1	50.00	0.500	0.500	12.500				
	Total					26.445	26.445	M^3	153.84	4068.29
2	Providing coarse clean sand in filling in foundation trenches or in plinth including ramming and watering in layers not exceeding 150mm thick with all leads and lifts including cost of all materials labours , royalty and taxes all complete as per building specification and direction of Er.(mode of measurement compacted volume) BCD 5.1.10									
	Chamber	1	1.250	0.950	0.075	0.089	0.089	M^3	435.58	38.81
3	Providing P.C.C M-150 in nominal mix of (1:2:4) in foundation with approved quality of stone chips 20mm to 6mm size graded and clean coarse sand of F.M 2.5 to 3 including screening,shuttering , mixing cement concrete in mixer and placing in position ,vibrating, sticking, curing, taxes and royalty all complete as per building specification and direction of Er.5.3.1.2									
	Soak Pit	3.14	2.200	0.450	0.160	0.311				
	Soak Pit Top on Wall	3.14	2.200	0.250	0.075	0.130				
	Chamber	1	1.250	0.950	0.075	0.089				
	Total					0.53	0.53	M^3	4492.36	2380.95
4	Providing 250 mm thick Brick Jali work in C.M(1:6) in superstructure with designation 75A and approved quality of clean coarse sand of F.M 2 to 2.5, finished with deep ruled pointing in C.M. (1:3) with sand of 1.5 on entire surface including the cost of finishing the holes, screening carriage of materials, scaffolding,raking out joints 15mm depth curing,taxes and royalty all complete as per bldg. specification and direction of Er.BCD-5.2.25									
	Soak Pit (Jali Portion)	3.14	2.200	0	1.900	13.125	13.13	M^2	1715.37	22523.73
5	Providing designation 75A Brick work in C.M(1:4) in foundation and plinth with approved quality of clean coarse sand of F.M 2 to 2.5 including providing 10mm thick mortar joints, cost of screening,scaffolding,raking out joints 15mm depth,curing,taxes and royalty all complete as per bldg. specification and direction of Er.BCD-5.2.2									
	Soak Pit (without Jali Portion on Top wall)	3.14	2.200	0.250	0.375	0.648				
	Chamber L/W	2	1.025	0.125	0.675	0.173				
	S/W	2	0.725	0.125	0.675	0.122				
	Total					0.943	0.943	M^3	5262.05	4962.11



Success and lessons learnt

Understanding the need for greywater management from the community's perspective

Implementation of greywater management must be from the community perspective. In the process, the community must be engaged right from the planning to the execution process.

Developing a village action plan with communities and heads of institutions (schools, AWCs, HCFs, etc.)

Development of a village action plan is a must and the same must be incorporated in GPDP along with the requirement of schools, AWCs, HCFs, etc. Simultaneously, an O&M plan must also be developed.

Avoiding delay in the implementation of the plan when the community is ready to provide support

Once the community is mobilized and sensitized, implementation of the scheme must be time-bound. Delay in implementation will reverse the efforts, lest communities assume that this is just a brag.

Maintaining the quality of the assets being created

Quality infrastructure is essential to maintain faith among communities. Transparency is important in the implementation strategy.

Developing an O&M plan with the community and taking resolution from Gram Sabha

Development of an O&M plan with communities at all levels with budgetary and resource provision is mandatory. The same must be validated by Gram Sabha.

Monitoring and providing technical support from the State level: Jharkhand has developed a grievance redressal cell for providing information and resolving complaints.

Challenges and possible resolutions

Community resistance: Initially community may not accept the change. Massive community mobilization and stakeholder sensitization is the key to resolving issues.

Budgetary issues: Budget is a challenge. This can be resolved at the policy level. 15th FC and MGNREGA are essential schemes to address greywater management plans.

Monitoring: Monitoring the progress is a challenge. This can be addressed through technological support. App-based monitoring can be developed to ensure transparency.

Case study 4

Sustainable greywater management for achieving sustainable development outcomes - UNICEF Gujarat

Context

Vedancha Gram Panchayat is situated in the Palanpur block of Banaskantha District in Gujarat. There are around 926 households in the village. The population of the village as per Census 2011 stands at 4641 and the literacy rate of the village is 88.05%. The economy of Vedancha Gram Panchayat is majorly agrarian.

The groundwater levels change drastically across Banaskantha District. On one side of Palanpur are the blocks of Danta, Amirgadh, and Vadgam which have hilly terrains and groundwater levels ranging between 100 ft and 300 ft BGL (below ground level). While on the other side of Palanpur, the groundwater levels reduce drastically and can reach up to 1000 ft BGL.

It was observed that there was an increase in nitrate and fluoride content in groundwater. Besides, there was no separate provision for groundwater recharge projects till 2020-21. There are two wastewater ponds in the village. Wastewater from 30% of the households is disposed of in one pond, whereas wastewater from the remaining 70% of the households is disposed of in the other pond.

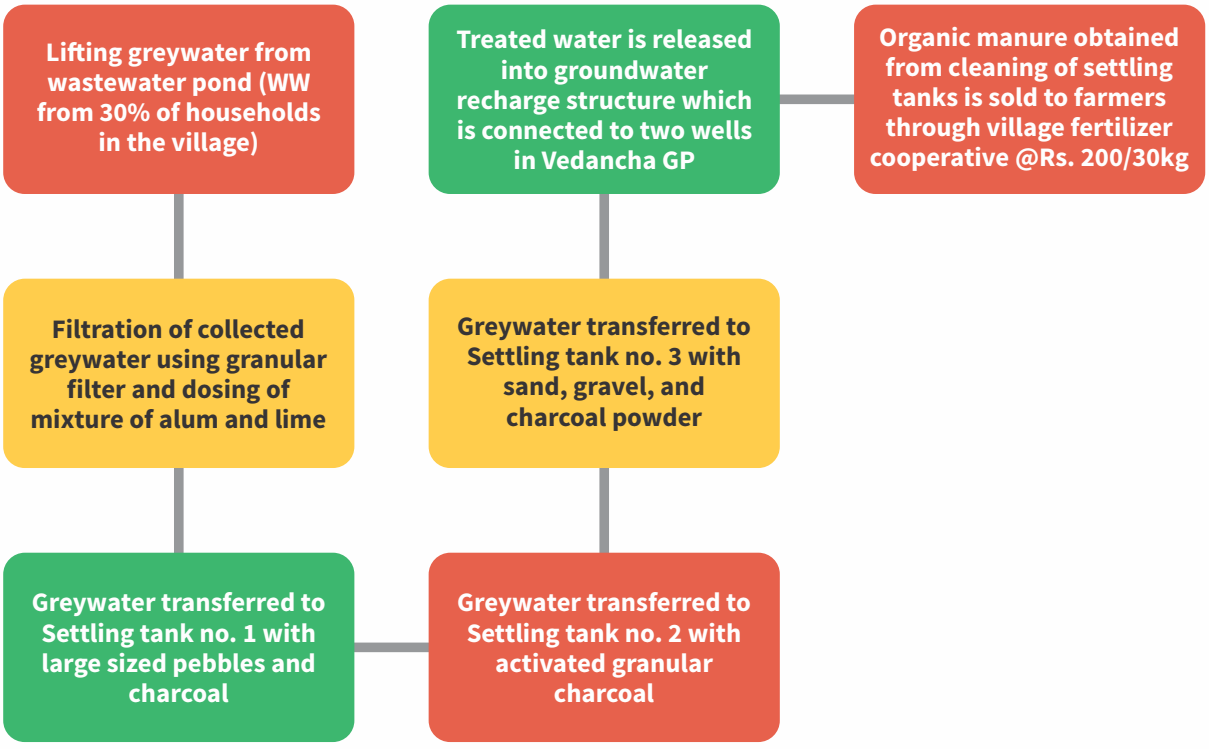
Institutional set-up and planning process

Considering the issue at hand, WASMO (Water and Sanitation Management Organization) and DRDA (District Rural Development Agency) initiated dialogue with GP-level stakeholders for managing greywater in the Gram Panchayat. The Panchayat body welcomed the initiative and agreed to work jointly with DRDA and WASMO to ensure that every drop of water supplied in the village stays in the village itself. Technical support was extended jointly by WASMO, DRDA, and UNICEF for finalizing suitable and cost-effective greywater management technology with GP-level stakeholders.

Operation and technology used

The designs and estimates were developed with a combination of suggested technologies (DEWATS and Waste Stabilization Pond) provided under Swachh Bharat Mission - Phase II guidelines to minimize the operational expenditure. Accordingly, a greywater treatment plant of 200 KLD capacity was devised using funds from the 15th FC and Swachh Bharat Mission – Gramin. The physical structure costs approximately Rs. 6.46 Lakhs and operational costs are taken care of through the selling of organic fertilizer generated from the treatment process every 21-28 days.

The treated water meets all criteria laid down by Gujarat Pollution Control Board (GPCB) and is fit for both water reuse as well as groundwater recharge.



Particulars	Associated Cost	Monthly	Annually
Capital Expenditure Pump, Granular filter, Screen filter, Cables, Dosing pump, Sintex tank, RCC Construction, and Piping	Rs. 6,46,000	-	-
Operational Expenditure Alum, Lime, Charcoal Powder, Labour for cleaning of settling tanks, Packaging of fertilizer	Rs. 59150 monthly and Rs. 7,09,800 annually	Rs. 59,150	Rs. 7,09,800
Income Selling of organic manure @ Rs. 200 for 30 kg bag – 300 bags monthly	Rs. 60,000 monthly and Rs. 7,20,000 annually	Rs. 60,000	Rs. 720,000
Treated water @ Rs. 100 per hour – 8 hours daily	Rs. 800 daily	Rs. 24,000	Rs. 2,88,000
Capex can be managed under Swachh Bharat Mission - Gramin and 15th FC funds. After covering the costs of OpEx from generated income, the annual profit is Rs. 2,98,200. **The payback period of the project comes to (6,46,000/2,98,200) = 2.16 years**			

Successes and lessons learnt

The installation of a greywater treatment plant ensures efficient and effective use of wastewater. After treatment, approximately 200 KLD of treated water is available for recharging groundwater as well as irrigation purposes. The organic manure as a by-product of the greywater treatment process promotes organic farming in villages. Being a convergent initiative, the project fulfills the objectives of multiple schemes such as Jal Jeevan Mission (JJM), Swachh Bharat Mission – Gramin, Atal Bhujal Yojana, and MGNREGA.

The Gram Panchayat has already piloted a scalable greywater management technology option. Considering the replicability and scalability of the model, the Commissionerate of Rural Development (CRD) Gujarat has planned to set up 364 such units in 33 districts of the state in F.Y. 2022-23.

Vedancha model Grey Water Treatment Unit can be constructed with low establishment cost based on simple indigenous technology, which can be run and maintained by the Gram Panchayat easily. This unit can be constructed using the grants available under SBM-G for the Gram Panchayat along with a contribution from the 15th Finance commission grant. Considering these aspects, the replicability and scalability of this model are easier compared to other technology options available.

Challenges

Vedancha greywater management model has become a case study for other districts of Gujarat. But this piloting came with its own set of challenges:

- The reluctance of Gram Panchayat to take over new projects in the WASH domain
- Unclear roles and responsibilities of stakeholders may hinder proper maintenance of the greywater treatment plant
- Lack of technical know-how of GP-level stakeholders due to the unavailability of sufficient technical resource persons.
- Setting up a system for technical and administrative approval of new works takes time since it requires a convergence of other schemes and funds such as MGNREGA and 15th Finance Commission grants.

Greywater from the drainage line needs to be directly lifted into the treatment plant for further processing. Based on the natural gradient, an additional storage tank might be required on a case-to-case basis which may result in additional space requirements in the Gram Panchayat.

Case study 5

Solar-powered greywater treatment plant in Sinnar, Maharastra by CEPT

Context

Sinnar is a medium-sized town with a population of around 80,000. Sinnar Municipal Council (SMC) with the support of CWAS at CEPT University embarked on its journey towards safe sanitation in 2012. By eliminating the open defecation practice and improving access to toilets, Sinnar achieved its ODF status in 2017. Sinnar is one of the first cities in India to implement a scheduled septic tank emptying service and safely treats all the collected septage at a dedicated FSTP. With this, Sinnar improved sanitation services across the sanitation value chain. However, to improve the city-wide sanitation, it was also important to treat the grey water coming out of the kitchens and bathrooms and septic tank overflow which flowed through the drains and eventually met the river. This untreated liquid waste polluted the river water and endangered the environment and human and animal life. In this context, the city has already developed a citywide settled sewer plan with a treatment facility, however before embarking on this big project, the city wanted to explore a pilot greywater treatment solution.

Initiation and planning process:

With the support of CWAS, the study of drains was initiated in the city. The mapping of drains was taken up and the quality of drain water was tested. Based on the discussions with various stakeholders from the executive and elected wing of the council, it was decided to build a greywater treatment plant for a pilot drain and understand the outcomes. The drain located near the Aishwarya Garden area was finalized for the pilot demonstration. Based on the learnings of the pilot, the scaleup of greywater treatment across the city will be taken up.

The land for the greywater treatment plant was identified in a nearby garden to utilize the treated greywater for watering the landscape and plants of the garden. For the design of the treatment plant, a private consultant was engaged. The city had identified the given treatment option from an array of mechanized and nature-based solutions that were identified. The plant was designed keeping in mind the greywater characteristics, land availability, and quality of treated effluent required. It was ensured that the treated effluent adheres to the disposal norms given by the state pollution control board.

Institutional set-up:

The urban local government along with the support of the Center for Water and Sanitation (CWAS), CRDF, and CEPT University had planned and executed the set-up of the greywater treatment plant. A consultant/ private operator was selected to design and implement the greywater treatment plant based on the quality and quantity of drain water received at the pilot location. The private operator was responsible for the operation and maintenance of the GWTP for six months after its commencement. The local government decided to involve

women Self- Help Groups in operating the GWTP after the contract is completed with the private operator. This would provide an opportunity for livelihood and support in improving the skills of the SHG members.

Operations and technology used:

A 60 KLD Solar powered Grey Water Treatment Plant based on the Moving Bed Bio-Reactor was Designed, engineered, and customized based on an activated sludge process where the Bio-media provides additional surface area for the growth of the bacteria. The area occupied by this treatment facility is 80 sqm.

The treatment starts with the oil and grease trap unit which helps to make sewage/greywater oil and grease free and flows towards the next unit in gravity. The second unit is the equalization tank where the agitation is provided to the sewage for proper equalization. The equalized sewage from this tank is then pumped into the aeration tank. The biological treatment in this tank is based on the Moving Bed Bio-Reactor (MBBR) technology. The objective of this technology is to reduce organic matter in a compact structure as compared to the conventional system. The overflow from the tank will flow by gravity towards the settling tank containing tube settler media/tube settler.

The biomass in the aerated sewage gets settled here effectively through the tube settling media and the clear supernatant from the top flows towards the next treatment unit. The part of the settled biomass gets re-circulated into the aeration tank and the rest gets collected in the sludge holding tank. It is further sent to the filter press for treatment and disposal. The sewage from the filter press is sent back to the equalization tank.

The disinfection of the supernatant from the settling tank takes place in the chlorine dosing tank with the addition of chlorine. The sewage after the disinfection process is pumped to the tertiary unit for further treatment. The secondary treated sewage gets pumped to the pressure sand filter for filtration and removal of trace organics as well as suspended solids. The filtered sewage from this filter gets pumped into an Activated Carbon Filter for the final treatment. The filtrate from the PSF passes through this filter for the removal of free chlorine, odour, etc. The effluent received after this treatment gets stored in the treated sewage storage tank. The

final treated sewage is stored in the storage tank and utilized for watering 2000 sqm of landscaping at the Aishwarya Garden.

The whole operation of the treatment facility is powered by an off-grid Solar system of 7Kva. Besides, an option has been given to switch the operations to regular Maharashtra State Electricity Board (MSEB) electricity in case of rainy days or solar plant maintenance.

Financial and business model:

The pilot greywater treatment plant is funded under a project by CWAS, CRDF, and CEPT university. The treatment plant will be handed over to the council for its further operations. To minimize the operation cost, the treatment plant is supported by solar panels. This helps in reducing electricity consumption and brings down the cost of operations. The remaining operations cost is taken care of by the council itself from its own municipal budget. The council has also planned to engage the women's Self-help group to operate the greywater treatment plant based on the SHG engagement that the council had for maintaining the urban forest and landscape at Sinnar's Faecal Sludge Treatment Plant. The tender is prepared for involving the SHGs in the work. The reuse of the treated wastewater from the greywater treatment plant at the garden will also be taken care of by the SHG group.

Successes and lessons learnt: The most crucial learning from this project is the characterization of the greywater treatment and management system. It is important to identify the characteristics of greywater as it is very different from sewage. This helps in identifying the treatment technology and the customization of the units in the technology.

For many cities, land is a big constraint to build treatment plants. Either land availability/size of the land is the challenge, or the NIMBY (Not in My Backyard) concept holds as a challenge. This case is a perfect example to overcome both these challenges. With proper consultation and discussion with the council members as well as other stakeholders, the land was finalized in the garden area. This technology can be adopted by cities that face land constraints.

Sustaining the operations and maintenance of the treatment plant is crucial. The greywater treatment plant in Sinnar has solar panels installed to mitigate the high electricity cost for mechanized treatment plants.

For proper operations and maintenance of the treatment plant, a Standard Operating Procedure (SOP) has been prepared to train the women's self-help groups once the treatment plant is handed over to them for operations. Also, SHGs would be responsible for the reuse of all treated wastewater from the treatment facility in the garden

Challenges and possible resolutions:

Land for a treatment plant stands as one of the major hindrances to implementing the project. Sinnar also faced a similar issue with the NIMBY concept as well as the limited availability of government land parcels. It was resolved through rigorous consultation and engagement with various stakeholders involved in the council. Along with this, the technology adopted was customized considering the land availability.

The involvement of women SHGs sometimes poses a challenge due to a lack of technical skills. To overcome this constraint, it is planned to give handholding support to the SHGs in the initial months for them to understand the entire operations and maintenance process. A detailed standard operating process of the treatment plant is prepared which will guide the SHGs for operations. Pictorial representation and ease of language are also particularly adopted in the SOP, which will ease the understanding of the SHGs.

Case study 6

Greywater Management by Ambuja Cement Foundation

Context

Mangi Budruk village is located in Rajura tehsil of Chandrapur district in Maharashtra, India. It is situated 20 km away from the sub-district headquarters Rajura and 46 km away from district Chandrapur with a total population of 848 people, out of which the male population is 437 while the female population is 411. There are about 200 households in Mangi Budruk village. Major issues faced in the village include:

- Decrease in groundwater level
- Open or surface drainage being used for liquid waste management
- Indiscriminate disposal of wastewater
- Wastage of water used for all household work.
- Unpleasant village surrounding
- Pollution of water bodies
- Spread of various waterborne diseases.
- Open defecation on roads outside the village

These problems have led to an urgent requirement for an intervention to improve the village life of its residents. Hence, Ambuja undertook the project to address the most pressing needs of the village - water poverty, open defecation, and the deplorable lack of cleanliness and sanitation.

Initiation and planning process

Ambuja Cement Foundation (ACF), the CSR arm of Ambuja Cements, had just completed work on Greywater management in Mangi's neighbouring village 'Kukudsath'. This village had progressed quickly such that every household had a soak pit, and the village also won the SMART village award. At that time, ACF was looking at replicating the greywater management initiative in other villages when it reached out to the people of Mangi. They instilled confidence in the community members which is a conscious step taken to make progress sustainably and positively. Through capacity-building measures, the community members were enabled to make informed decisions through education and training. It was a daunting task but ACF with its various IEC activities has started building trust by involving the community right from the planning stage as it is only people that can drive both economic and social change.

In 2012 (two years before the launch of the Swachh Bharat Abhiyaan), the Foundation initiated a Community Led Total Sanitation (CLTS) and formed a Village Development Committee (VDC), which included community members and Gram Sevaks to take the lead on the program. The first activity was to take the VDC members on exposure visits to 'Model villages' like Hiware Bazaar which proved to be an 'eye opener' for the local community. With the assurance of ACF's complete support and involvement, the VDC members were determined, energized, and motivated to develop a vision for Mangi to be held up as an example of development.

Greywater is described as wastewater that comes from sources such as the bathroom, kitchen, and laundry. Unlike blackwater which contains faeces, it is relatively clean and does not necessarily have to go into the sewage system. It can be treated and reused for kitchen garden irrigation or channelled into soak pits that will help replenish the groundwater table.

The idea of constructing soak pits was mooted due to the generation of huge quantities of greywater every day from cooking mid-day meals, washing utensils, etc. The construction of soak pits in the washing area would also help in water conservation requiring proper maintenance to ensure that no solid waste goes into them. Thus, the two initiatives decided were:

- Decentralized System: Household management soak pits
- Community Level: Soak pits at public water points

Once the community members agreed, the question was who would fund both initiatives. While the gram panchayat cited a lack of funds and ACF was committed to only supporting the community, the VDC was tasked with raising the funds. But through convincing, awareness sessions, and seeing the outcomes, the communities changed their minds and gladly contributed a few hundred rupees combined with Shram Daan.

Today, the system is effectively managing the wastewater that is generated, and by doing so, it is improving the groundwater table. About 90% of households today have soak pits contributing to the increase in the groundwater table.

Institutional set-up

Village Development Committee: People's institutions are the ones that help sustain projects especially if there is 100% community-based participation. In this initiative, the Village Development Committee played a key role in executing the project leading to about 90% of households using water efficiently and installing soak pits.

Panchayat Samiti: The Panchayat Samiti is the governing body at the Block Level that acted as a facilitator in granting available schemes to the community. On the other hand, Mangi village was also applying for a SMART village award but unfortunately was not qualifying due to low marks scored in sanitation. At this time the Panchayat Samiti intervened and facilitated in availing the MGNREGS scheme which was providing a subsidy to households agreeing to build soak pits.

Community Health Volunteers: ACF's community health volunteers also known as Sakhis were instrumental in raising awareness about the importance of soak pits, and the possibilities of diseases and guiding households during construction.

Cleanliness Group: A group of youth was chosen by the Village Development Committee to take ownership of frequently cleaning and maintaining the community soak pits. This group of individuals was fully committed to their roles and ensured the area around the water points always remained dry.

Operations and technology used

The team followed the Magic Soak Pit of Nanded pattern wherein instead of having traditional slopes to the gutter, it would be stopped and treated in this system. This soak required a cement tank to be built but due to the additional expenses, ACF suggested using plastic drums. Ambuja Cements willingly provided empty plastic oil drums which were used by the households. This was an easier method for maintaining and cleaning it.

Once the individual is convinced to build a soak pit, he/she follows the undermentioned to build it:

- Excavation: Excavating the earth for all sorts of soil & silt, lime, shadu, and sand up to 10m, and laying or spreading or filling in furrahas in layers of 30cm thick up to lift of 1.50m.
- RCC Round Tank: P/F reinforcement cement concrete round tank with 0.60 diameters and 0.90 height with cover inserted
- Filling: Preparing 80mm to 100mm size metal from stone/boulders of size 20cm to 30cm in general made available at stone quarry site or roadside, already blasted, and broken and stacking the same on a spot or filling in furrah.
- Supply Sand: Supplying sand at the roadside, including conveying and sectioning.
- Spreading: Conveying soft/hard murum/silt/sand/grit or all sorts of soil with spreading, laying, and sectioning/dressing.
- PVC Pipe: Providing, laying & fixing PVC pipe of 75mm diameter with fitting such as bends, tees, reducer, clamps, etc including necessary excavation, trench filling, etc.

Two different management systems adopted for the soak pits developed are:

- Decentralized System –Household-level management
  - Bathroom/Utensils Drainage flowing through soak pits for groundwater recharge
  - Laundry Draining flowing through soak pits for fertilization for kitchen gardens
- Community Level Management -Management of greywater at the community level of excess water near community water points. Excess water flows through the soak pits for groundwater recharge.

Financial and business model:

The cost of building a soak pit at a household level is about Rs. 4000 for a 3x3 meter pit. Once built it is up to the

household to maintain the soak pit. On a community level, the cost of building it near a bore well or community water point would be approx. Rs. 8,000-10,000 depending on the size of the water source. In such cases, the cleanliness group assigned by the VDC takes charge of maintenance and cleaning purposes.

Successes and lessons learnt:

The project impacted about 140 households with soak pits built in 6 water points across the community. This has helped in groundwater recharge from the wastewater generated every day in village households through the washing of utensils, groceries, and water wasted near drinking water sources and has also helped recharge excess rainwater.

Best of all, it has helped sensitize the young children of the village about water conservation as this model serves as a live demo about it and the importance of doing so. In turn, this process has helped the villagers realize the relevance of soak pits in their houses. While gradually replenishing groundwater, the initiative will do away with the breeding of mosquitoes and vector-borne diseases and ensure hygiene.

With the improvement of sanitation in the village, this initiative helped the village to earn the Sant Gadgebaba Gram Swacchta Puraskar with a cash award of Rs. 25,000 for being the cleanest village in the Rajura block. In the same year, the village also won the second prize district level Sant Gadgebaba Gram Swacchta Purashakar with an additional Rs. 3 lakhs. The village also won a Wastewater Management Award worth Rs. 20,000 for its efforts in having soak pits in the community.

Learnings from the project:

- Developing people's institutions that are managed by themselves is an important function in making development people-centric and sustainable. Due to the confidence of each other, such institutions are localized and bring transformation in the communities.
- Program interventions when worked with like-minded organizations and government schemes lead to transformation quickly and prosperity in the communities.
- On the other hand, regarding the greywater management system, the construction of soak pits in the village will create curiosity and interest among the community about innovations. Soak pits or magic pits constructed within the village will be maintained efficiently by the community themselves. To some extent, the soak pits will help curb water wastage and get rid of stagnant water. Judicious use of fresh water will result in the generation of a minimum quantity of Greywater.

Challenges and possible resolutions:

Drainage cleaning in villages came at a very high cost by the panchayat which led to ignorance by the community and sanitation becoming a critical issue. People were not convinced that even soak pits would help.

This was until ACF started awareness campaigns in villages, conducted visits to Kukudsath, and built the first soak pit at a community water point. The transformation seen with groundwater recharge and no excess water around the area led to people changing their minds and agreeing to build soak pits at a household level.

The community also decided to eradicate the common drainage line by linking their household wastewater to the plastic tanks and further into the soil. This setup is less costly and easier to maintain.

Case study 7

Greywater Management by Water for People

Context

In Birbhum District of West Bengal, Khoyrasole, and Rajnagar, both blocks severely lack wastewater management, leading people to live unhygienic lifestyles and resulting in dirty roads. Both the blocks are water scarce as far as groundwater is concerned and ponds play a very important role in most of the villages.

Almost 90% of surveyed households in Khoyrasol block and 80% of surveyed households in Rajnagar block allow untreated greywater to various pond drains (whether to carry greywater or stormwater are largely absent in both blocks). A significant proportion of greywater is produced at the community-level water source as well as the household level and is poorly managed in both scenarios. Moreover, as JJM operationalizes, managing the wastewater flow from households also will be a challenge.

Most households throw their grey water in the open or channel it to nearby ponds. Eventually, ponds get contaminated, and it was imperative to address the wastewater flow in the villages. Therefore, Water for People (WFP) promoted models of low-cost technologically viable soak pits at the community level for grey water management with the support of the National Stock Exchange Foundation.

Initiation and planning

With the support of the National Stock Exchange Foundation from 2019 onwards, WFP created water sources in selected hard-to-reach communities and need-based public institutions to ensure access to improved drinking water facilities. The model of water points installed comprised platforms with soak pits as an integral component of the implementation strategy to address water stagnation and help in water recharge.

Ensuring the collection of wastewater from the tube well and in Schools and Anganwadi centers in a hygienic manner, thereby not letting it flow down the roads and open public places is the prime objective of this initiative.

Till August 2022, 234 soak pits have been constructed near handpumps in the community and 143 soak pits in public Institutions at Rajnagar and Khoyrasol Block with the support of the local government and the community.

Operation and technology used:

These soak pit designs are unique and are basically pits covered by porous-walled chambers that allow water to slowly soak into the ground. Soak pits constructed at the community level are of dimension 1.5m X 1.5m X 1.2m. The discharge pipe is extended right at the middle of the pit, with a honeycomb design, to allow faster water seepage, and a smaller pit, at the bottom. The pit is filled with gravel and burnt bricks, to increase the surface area

for water soaking. The bricks used in the pit, are of poor quality, but that is why its purpose is low-cost bricks, making the cost of the soak pit low. An inspection is also designed to allow solid particles to settle at the bottom of the chamber, which is periodically removed. The cost of the soak pit model is around Rs 8000.

The objective is to allow the settlement of smaller particles of effluents at the bottom which are digested by microorganisms and then degraded. The filtered water is then discharged out through the porous wall of the soak pit. The pits are constructed two meters above the groundwater level, at a safe distance from a drinking water source (ideally more than 30 m).

Successes and lessons learnt:

Project implementation in Birbhum district is done in close coordination with government officials and the design of the soak pit has been shared with the block. The design has been appreciated and has been put forward for approval to be replicated in government-sanctioned projects, through Gram Panchayat Development Plan across Rajnagar and Khoyrasol Block.

Construction of soak pits has been extensively implemented in Khoyrasole Block of Birbhum district under School, Anganwadi center, and near the community Tubewell. The School, Anganwadi center, and Community do not have to worry about water stagnation which is the primary reason for waterborne diseases and epidemics. This is also indirectly helping the groundwater recharge process, hence increasing the water availability in the area.

Challenges and possible resolutions:

Water For People India Trust introduced the low-cost soak pit model at Birbhum in both the Rajnagar and Khoyrasol blocks. At the initial level, it was difficult to convince the local government for mobilizing contributions in the form of cash or kind as a process for ensuring sustainability with the involvement of the community and local government in the implementation of greywater management at the community level. They also had the misconception that the minimal model might not succeed and that the pit would be filled up within a few days.

However, post the construction of two/three soak pit models, it was observed that the pit was working properly, and therefore the apprehension about the functionality of the model completely disappeared among the community and the local government. The gram panchayats willingly extended their support towards contributing co-finance. Gradually, the gram panchayats came forward and expressed their interest in understanding the low-cost soak pit design to incorporate these designs into their respective GPDP. On sharing the pit design with the Panchayats and the local govt, the design has been appreciated and forwarded for approval which can be replicated in Government sanctioned projects through Gram Panchayat Development Plan across Rajnagar and Khoyrasol Block and it was a great success for us.

Case study 8

Greywater Management-HCL Samuday

Context

Domestic wastewater from households in rural areas is of two types., viz. greywater, and black water. Black water is wastewater from toilets containing faecal matter, and Greywater is wastewater from bathrooms or kitchens. Greywater generally contains fewer pathogens than black water. Black water is water that has been mixed with waste from the toilet and requires biological or chemical treatment and disinfection before re-use. Greywater requires less treatment because it is the least contaminated sort of wastewater. Greywater contains organically degradable solids and inorganically dissolved materials, mostly sand and grit. For proper drainage and discharge of wastewater from the households, the HCL foundation is working on Liquid Waste Management in three blocks and pond rejuvenation in 2 blocks of the Hardoi district of Uttar Pradesh.

Initiation & planning

Liquid waste Management

If untreated sewage is discharged into river bodies, it increases the Biochemical Oxygen Demand (BOD) load and depletes the Dissolved Oxygen (DO). Treatment at the latter stages requires 40-50 times more clean water. Thus, if treatment is done at the source, the negative impact and burden of treatment at a later stage can be avoided. Mosquito breeding becomes a problem if the wastewater is not managed well. Gases like methane, sulphur dioxide, etc. escape from stagnant/ unmanaged wastewater into the atmosphere and cause increased global warming via greenhouse gases. The release of wastewater directly into open water bodies could lead to diseases like cholera, typhoid, gastroenteritis, amoebic dysentery, and diarrhoea. Approaches to managing liquid waste are decided on the type of liquid waste (black/grey), the quantity of liquid waste, the technology available, finance, geography, and geology.

Pond Rejuvenation

Most water bodies in India have been destroyed by anthropogenic activities. The key issues behind water pollution in ponds include direct discharge of wastewater, dumping of unregulated solid and liquid waste, and eutrophication due to commercial farming. After assessing the situation of the selected ponds, it was found that solid and liquid waste was being dumped into the ponds by people residing in the area thereby polluting them. These small water bodies had not been used for many years, which in turn impacted the environment, community, and non-human species in the region. Ideally, the water in ponds should be clean, and fresh, for the aquatic flora and fauna to flourish. The natural waste from the living and dead organisms inside a pond gets naturally recycled by bacteria but it requires a lot of oxygen to break down the natural waste.

Another major source of pollution is commercial farming, through which chemical fertilizers rich in nitrogen get washed off in nearby ponds through rain and increase the growth of algae which uses plenty of oxygen, leaving none for the other plant species and thus causing eutrophication later. Thus, this project by HCLF aimed at improving accessibility to nearby small water bodies in a planned, sustainable manner by taking up a mixed approach viz., scientific treatment of ponds and actively involving the community in the long run for its smooth operation and maintenance.

For Pond Rejuvenation, a private-private partnership model was taken up for the rejuvenation and beautification of ponds.

Institutional set-up

At the village level, the Gram Panchayat water supply and sanitation committee (GPWSC) functions as a governing body. GPWSC is an important component of the water supply scheme. It was entrusted with the responsibility of planning, implementing, operating, and maintaining the water supply, sanitation, and drainage schemes.

Conducting training for the capacity building of GPWSC members for strengthening the planning, maintenance, and operation of water supply schemes: HCL foundation has been conducting training of operators at each water site for smooth maintenance/handling of water pump houses and maintaining documentation of the pump houses. All households in the village pay a tariff (contribution) to the pump operator. This money is used to run and maintain the water treatment plants. They have been strengthening the capacity of Pradhan and the secretary to include the pond in GPDP for allocating the budget to the operation and maintenance of the pond. Besides, the capacity building of people who live near the pond was done regarding the cleanliness of the pond and watering of plants.

Operations and technology used

Approximately, twenty thousand to thirty thousand litres of wastewater per day is generated in a village. HCLF is managing the wastewater in the project villages by connecting all households in the village to the drainage network system and implementing the ponds rejuvenation project. Earlier, untreated wastewater was disposed of in ponds or nearby areas. Post the intervention, a drainage network was created in the village, and just before the drains reached the pond, a filtration chamber was constructed where all the drains meet and solid waste materials like plastic bottles, etc. are filtered. After this initial filtration, the wastewater goes into the pond through a reed bed. The pond rejuvenation project is beneficial for water conservation and ecological sustainability.

Before starting the pond rejuvenation project, an assessment of the pond was conducted and the pond was selected as per its measurement area (1200 sq. m.), availability of the inlet and outlet, and availability of area for vehicle movement.

The team faced various issues during the pond rejuvenation project. One of the major issues faced was the non-responsiveness of the community to the awareness events or programs. Therefore, several community meetings were held on various topics such as waste management and plantation protection, and the presence of the community members was ensured through door-to-door invitations.

Financial and business model

Under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), the Repair, Renovation, and Restoration (RRR) of the water bodies scheme of the Department of Water Resources, River Development and Ganga Rejuvenation is an important intervention. The scheme emphasizes the development of catchment areas, de-siltation, and command area development in respect of water bodies. MGNREGA has provisions for the construction and/or repairs/ renovation/ restoration and desilting of traditional water bodies/tanks. MGNREGA and various forestry schemes help in taking up water storage and conservation structures in rural areas. The labour cost of any recharging system/surface water impounding structures can be met from Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)/Integrated Watershed Management Programme funds, as far as possible. Desilting of ponds is to be done only with MGNREGA funds. The only material component of the conversion of existing village ponds into recharge/ collection structures can be funded under the sustainability scheme. In line with the 73rd Amendment to the Constitution of India, the 15th Finance Commission has recommended grants to Rural Local Bodies/ Panchayat Raj institutors (RLBs/ PRls) for the next five years. It has also identified drinking water supply and sanitation as national priority areas for RLBs and therefore 60% of the fund is provided as a tied grant meant for a.) supply of drinking water, rainwater harvesting, and water recycling and b.) sanitation, etc.

Success and lessons learnt

Earlier, the ponds were a dumping site for the communities in gram panchayats. They were neither beneficial for the community nor the species as they were covered with aquatic weeds, and solid waste and the soil was covered with silt. Now, the condition of water and soil present in the ponds has improved significantly and it has become a recreational site for the community in gram panchayats. Through behaviour change communication activities, the community and GPWSC have been triggered and mobilized for pond management at all pond sites. Now, the community and GPWSC do not pollute the pond with solid waste and rather worship it as it is a local water body which has increased the aesthetic value of the gram panchayat. The project has significantly improved liquid waste management through a scientific approach and active involvement of community institutions, and panchayats, in 6-gram panchayats of the Hardoi district of Uttar Pradesh. Through this, the ecosystem around the pond has been improved, and the quality of water and soil has also been improved through de-silting, grass, and sapling plantation. Through Information, education, and communication (IEC), the knowledge of the community has been increased on Pond management which will further ensure sustainability in terms of the protection of the pond's ecosystem.

Challenges and possible resolutions

During the initial phase of the pond rejuvenation project, HCLF faced many challenges from the selection of the pond till its finalization, during the mobilization of people, changing their perspective towards the pond, and coordinating with Pradhan and the secretary. HCLF resolved these issues with the help of community leaders, and PRI members by arranging discussions on these topics with the community. Some of the challenges are mentioned below:

Community mobilization: Earlier, a small number of people from the community participated in their meetings and events.

Behavioural change: This was an important challenge from a sustainability point of view. People were used to practising the same habits regularly, so they did not want to change suddenly.

Working with functionaries: Working with the existing functionaries was one of the challenging things for the team as it needed a lot of paperwork.

Solutions:

- Regular field visits and holding meetings with the community and actively participating in them.
- Use of IEC/BCC activities and campaigns for mobilization and awareness.
- Triggering activities, campaigns, audio-visual activities, awareness rallies, etc. helped in encouraging people and it also motivated them to participate.
- Alignment with the Amrit Sarovar guidelines helped in coming to a point of common interest with the functionaries and helped liaise effectively.
- Training and capacity building of pump operators, community people, and other stakeholders.

Case study 9

Chamakhandi Gram Panchayat: Greywater Management in Rural India: Success around Technology, Approaches, Sustainability, and Impact - UNICEF Odisha

Context

Greywater is wastewater that is not contaminated with faecal matter or urine. This includes used water from bathing, washing dishes, kitchen etc. About 80% water supplied to a household comes out as wastewater. For rural communities to grow sustainably, improved sanitation and hygiene through appropriate greywater management are essential. The threat of increasing environmental deterioration brought on by mismanaged greywater can be addressed through local community's involvement combined with scientific greywater management.

Chamakhandi GP presents a sustainable solution to the problem of greywater coming from rural regions and has been developed using a combination of technological solutions and wise management that is connected to local livelihoods.

Chamakhandi Gram Panchayat is a picturesque GP located in Chatrapur Block of Ganjam District of Odisha which is 100% Open Defecation Free (ODF) and covered with 100% household water supply under Jal Jeevan Mission (JJM) / BASUDHA. Chamakhandi Gram Panchayat comprise of 4 villages with 1294 households and with a population of 5,846 nos (Source: JJM-IMIS, GoI). Every day, about 4,00,000 litres of water is consumed by the households of which 80 per cent becomes grey water that amounts to about 3.2 lakh litres per day.

Greywater and impact of improper rural wastewater management on health and hygiene

In the absence of a proper greywater management scheme, the health, hygiene, and environment of Chamakhnadi GP was suffering. Pest and vector-borne diseases were impossible to eradicate in the absence of a proper greywater management program. Drainage network at community level and soak pits at household level along with community engagement for maintenance of these infrastructures is a prerequisite of any rural greywater management scheme. The focus is on local and indigenous, low maintenance technological options which are sustainable and easy to maintain.

Initiation and planning

Before the initiative was implemented, greywater was frequently thrown on the roads, resulting in stagnant water, especially in the lower levels of hamlets which served as a breeding ground for parasites and mosquitoes increasing the prevalence of vector-borne diseases. Wastewater pools on the streets also made walking inconvenient and were ruining the beauty of village. The neighbourhood was also ignorant of the fact that treated greywater may be used to alleviate severe water stress. Therefore, the Greywater Management project was undertaken in Chamakhandi Gram Panchayat with the following objectives:

1. Constructing a greywater management system for houses that are connected to a centralized drainage system so that final disposal of greywater is scientific and environmentally sound.
2. Enabling scattered households that are disconnected from centralised drainage system to have household level technical solution can ensure scientific disposal of greywater from the bathrooms and kitchens.
3. Making way for greywater reuse for purposes such as improving groundwater recharge and / or expanding green cover in the village

All the households (1294) in this GP and the expected rise in households over the next 20 years was taken into consideration while designing the Greywater Management project. Earlier, there was no drainage infrastructure in the village that connected to the households. Domestic wastewater was being haphazardly disposed of, frequently stagnating at one end of the hamlet while flowing in the common field. The direction of precipitation was taken into consideration when building the current drainage system.

At the ultimate disposal point and a percolation pond or recharge well, which assisted groundwater replenishment, the rainwater mixed with the greywater. However, construction of storm water drainage was combined with greywater management and the problem of haphazard disposal of grey water was specifically looked into.

Institutional set-up

While the Gram Panchayat invested in terms of physical infrastructures with program funds from MGNREGS and SBM (G) 2.0, VWSC took care of the operation and maintenance of the system, the community was encouraged to follow certain precautions to ensure better management. This included ensuring that waste was not dumped into the drainage channel; desilting was carried out to prevent stagnation of grey water and cleaning of the stormwater drain on a regular basis.

The VWSC played a crucial role in creating awareness about the importance of solid and liquid waste management, highlighting the need for greywater management in the village.

Operation and technology used

Greywater is occasionally used by farmers because it offers nutrients, is more dependable, and/or is less expensive than other water sources. Kewra Plant /Fragrant Screwpine were primarily grown by Chamakhandi GP's communities as well as individual households. For healthy growth, these plants needed a lot of water and consistent wetness. Diverting community greywater to these fields of fragrant screwpine, both at the family level in kitchen gardens, as well as households growing fragrant screwpine at the household level and at the community level, was one of the solutions to the final disposal of greywater.

The Village Water Sanitation Committee (VWSC) in consultation with the engineers of Rural Water Supply and Sanitation (RWS&S) along with Gram Panchayat took strong steps to address the problem of greywater flowing into the open. It was a muti-pronged approach

1. Household level leach pits for scattered households:

Leach pits were constructed for households that were scattered / not connected to the existing centralised sewerage system. Individual household soak pits which are suitable for managing greywater at individual household level were constructed in 293 households at a cost of Rs. 3000 each from MGNREGS. Under this system greywater can be treated at source, preventing the flow of greywater onto the village paths, open land or stagnating in low lying areas. Further, 12 community soak pits were constructed at disposal points of drainage systems at a cost of Rs. 22,000 each. Additionally, one community soak pit with a vertical filter was constructed at a disposal point.

2. Greywater for kitchen garden / household level farming

Communities were asked to manage the grey water on their own property. More than 35% of the households started using greywater for irrigation in their backyard kitchen gardens. Kewra is also grown by households in their backyards. Additionally, greywater was directed toward these tiny plots of soil. Kitchen gardens with ridges and furrows were used to direct water from bathrooms and kitchens.

3. Community Drains leading to wetlands / Kewra fields

More planning was done at the request of the Gram Panchayat. A map of the village was created showcasing the location of houses, arrangement of drains, and any existing restrooms and toilets (at the individual and the community levels). RWS&S and Panchayat engineers helped the GP. At the end of the drain, the panchayat built a horizontal soak pit system. A filter separated the greywater from 854 homes before being transported to this horizontal soak hole. To catch solid particles, an inspection chamber was positioned near the endpoint of the drain. Next, the suspended solid particles and grey water moved to a horizontal filter bed, from where the treated greywater was directed to the ground through ridges and furrows.

Horizontal soak pits were built in the village of Chamakahnadi because they are suited for locations with high water tables where the treated water may be retrieved and utilised again for agricultural purposes. Conversely, vertical soak pits can be built in low-water-table places where the treated water will assist re-fill the ground water table and require less acreage than horizontal soak pits.

Solid waste is easily trapped in the inspection chamber of the horizontal soak pits. The soak pits require cleaning at least once in two weeks.

Success and lessons learnt

Chamakhandi GP on the Ganjam National Highway is a model for greywater management in Odisha. The maintenance cost for this project is negligible and it is purely community managed.

But the Gram Panchayat hasn't stopped with just that. It has now set up a Micro Composting Centre (MCC) for solid waste management. The initiative not only solved the problem of water stagnation but also improved the overall sanitation, provided local livelihoods and helped in greywater management. People were made aware of what constituted greywater and the hazards of improper management of grey water. Households now take care of their own soak pits.

Expected Benefits of the Project

- It will help improve overall sanitation, and the quality of life in the village.
- Reduction in water-borne diseases.
- System such as Wetland System for the agricultural fields can render greywater to be reused for livelihood, kitchen gardens etc.
- Groundwater recharging can reduce the chances of water scarcity in the village.

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