INDIA SANITATION COALITION
BUILD • USE • MAINTAIN • TREAT

Business of Change Compendium 2026

REIMAGINING SOLID WASTE AND WATER MANAGEMENT FOR CLIMATE ACTION: PATHWAYS, PARTNERSHIPS AND INNOVATIONS

CONTENTS

Content	Page No.

FOREWORD

Foreword

India stands at an important point in its development journey. Economic growth, urbanisation and rising consumption are creating new opportunities, but they are also placing increasing pressure on our infrastructure , water and natural ecosystems. How we manage these resources will have significant implications for India's future.

Circularity must therefore be understood as much more than a waste-management strategy. It is an opportunity to strengthen **resource security, climate resilience, economic competitiveness, public health and livelihoods,** while reducing the environmental footprint of India's continued growth.

Over the past decade, India has made significant progress in municipal solid-waste management. More than 80 per cent of the municipal solid waste generated in urban India is now reported to be processed—a substantial improvement from where the country stood a decade ago.

The next challenge, however, is to move beyond processing towards genuine circularity.

This means preventing avoidable waste wherever possible, maintaining segregation at source, preserving the value of materials, recovering resources of reliable quality and ensuring that only genuine residual waste reaches disposal facilities. It also means creating markets in which recovered materials can compete, businesses can invest with confidence and circular products can find dependable buyers.

India's evolving policy framework provides an important foundation for this transition. The Solid Waste Management Rules, 2026 strengthen source segregation, accountability and traceability across the waste-management chain. Extended Producer Responsibility frameworks and growing attention to plastics, textiles, construction and demolition waste, are further shifting the conversation from disposal towards resource recovery.

An equally significant opportunity lies in water.

Water cannot continue to follow a linear pathway of **extract, use and discharge.** India is simultaneously confronting increasing freshwater stress and generating enormous quantities of used water. Closing this loop must become an important component of our water-security strategy.

Safely treated used water can substitute freshwater for appropriate industrial processes, construction, landscaping, toilet flushing and other non-potable applications. Where conditions allow, nutrients, biosolids and energy can also be recovered. The opportunity is therefore not simply to treat wastewater, but to recognise used water as a resource that can be safely returned to productive use.

Government policy is increasingly moving in this direction. AMRUT 2.0 has placed greater emphasis on recycling and reuse of treated water, while national and state frameworks are helping create an enabling environment for safe reuse.

The challenge now is **implementation at scale.**

Treatment plants must be connected to functioning collection networks. Recovered materials must meet the requirements of markets. Treated water must be matched with identified users and appropriate quality standards. Operations and maintenance must be sustainably financed. Data must tell us not merely how much waste was collected or how much water was treated, but how much was actually recovered, reused or returned safely to the environment.

Importantly, this transition must also be inclusive.

Waste pickers, sanitation workers, women's collectives, local entrepreneurs and communities already play an indispensable role in India's waste and sanitation systems. A circular economy that improves environmental outcomes without improving the safety, dignity and economic opportunities of the people who make these systems work would be incomplete.

Circularity also offers India an important economic opportunity. New value chains and enterprises can emerge around resource recovery, recycling, repair, reuse, composting, treated-water reuse and other circular services. These can generate green livelihoods while helping cities and industries reduce their dependence on virgin materials and freshwater.

The private sector has a particularly significant role to play in this transition. Industry can contribute not only through investment and corporate responsibility, but as a **technology provider, innovator, purchaser of recovered resources and treated water, and partner in creating viable markets.** Financial institutions can help promising models move beyond pilots. Governments can provide the enabling policy and institutional environment. Civil-society and technical organisations can help ensure that solutions remain grounded in implementation realities and community needs.

The opportunity is therefore to bring these capabilities together.

It is in this context that the **Business of Change Compendium 2026, *Reimagining Solid Waste and Water Management for Climate Action: Pathways, Partnerships and Innovations,*** is particularly timely.

The case studies brought together in this Compendium demonstrate that circularity does not follow a single pathway. It may begin with waste prevention, segregation, reuse, repair, material recovery, composting or biological conversion. In used water, it may involve faecal-sludge management, decentralised treatment, improving the performance of existing treatment infrastructure, or developing service models that connect safely treated water with reliable users.

Just as importantly, these cases remind us that **innovation is not limited to technology.**

Innovation can lie in the way a partnership is structured, workers are organised, finance is mobilised, information is tracked, communities participate or markets are created. Technology becomes transformative when the ecosystem around it enables it to function reliably and at scale.

The Compendium should therefore be read as both **evidence and invitation:** evidence that workable approaches are emerging across India, and an invitation to governments, urban local bodies, businesses, financiers, innovators, technical institutions and civil-society organisations to ask a larger question—**what will it take to move these solutions from successful interventions to systems that can operate at scale?**

That transition will require us to move **from isolated pilots to functioning systems, from waste processing to resource recovery, and from wastewater treatment to safe and productive reuse.** It will also require long-term thinking. Circular systems cannot depend indefinitely on short project cycles or isolated investments. They need appropriate policy, viable business and financing models, institutional capacity, accountable operations and markets capable of sustaining recovered resources.

I would also like to recognise the work that has gone into creating this Compendium. It has been **conceptualised, curated and developed entirely in-house by the Knowledge Management and Research (KMR) team led by Anjali Tripathy and her team member Nikhil Singh at the India Sanitation Coalition.** From engaging with contributing organisations and reviewing submissions to strengthening the case studies, undertaking research, synthesising learning and bringing the publication together, the team has demonstrated the value of building strong knowledge capabilities within ISC.

I would particularly like to acknowledge **Nikhil Singh,** whose dedication and intellectual contribution have been central to the development of this Compendium. His sustained work across the case studies, research, synthesis and overall compilation has contributed significantly to the quality and coherence of this publication. I also commend the wider KMR team for translating diverse experiences from across the sector into a knowledge resource that can inform practice, partnerships and policy.

India has the scale, entrepreneurial capacity and policy ambition to lead the transition towards circularity. What we need now is greater convergence between these strengths.

If we can bring together **policy ambition, implementation capability, innovation, investment and partnerships,** our waste and used-water challenges can become significant opportunities—for climate action, resource security, green livelihoods and more resilient communities.

The task before us is not simply to manage waste better. It is to **retain the value of our resources for as long as possible and build an economy in which growth and resource efficiency reinforce one another.**

The cases in this Compendium show that this transition is already beginning. Our collective responsibility now is to learn from these experiences, strengthen what works and create the partnerships and enable conditions needed to take successful solutions to scale.

Naina Lal Kidwai
Chair, India Sanitation Coalition
Past President, FICCI

Preface

PREFACE

Circularity is often discussed as a question of technology—a better recycling unit, a more efficient treatment plant, an improved composting process, or an innovative product made from waste. Technology is essential, but experience has repeatedly shown that technology alone cannot create circularity.

Circularity depends on the **system around the technology:** how materials and water are generated, segregated, collected, transported and treated; whether recovered resources meet appropriate standards; whether operations and maintenance are adequately supported; whether markets exist for recovered products; and whether residual waste is ultimately managed safely.

For solid waste, this system begins at the point of generation. Organic waste contaminated with plastics cannot reliably produce quality compost. Mixed plastics are difficult and expensive to recover into recyclable fractions. Recycling facilities cannot operate sustainably without predictable quantities of suitable material, trained workers, reliable operations and maintenance, and markets willing to procure recovered outputs.

India's evolving policy framework increasingly reflects this systems approach. The Solid Waste Management Rules, 2026 place greater emphasis on source segregation, accountability and traceability across the waste-management chain. The challenge now is to translate these requirements into routine practice across cities and settlements with widely differing capacities and local conditions.

Used-water circularity presents a similar challenge. Sewage, greywater, blackwater, faecal sludge, septic-tank effluent and industrial effluent are different streams, requiring different treatment approaches and offering different opportunities for reuse. Water does not become a circular resource simply because it has passed through a treatment facility. It becomes one when it is **treated to an appropriate standard, its quality is verified, and it is safely and reliably used for a defined purpose.**

A fit-for-purpose approach is therefore essential. Water intended for industrial cooling, construction, toilet flushing, landscaping or agriculture may require different treatment and monitoring arrangements. Under-treatment can create health and environmental risks, while unnecessary over-treatment can increase costs, energy consumption and emissions. Treatment must therefore be considered alongside storage, safe conveyance, monitoring, end-use arrangements and responsible management of sludge and other residuals.

India's experience also demonstrates that infrastructure alone does not guarantee outcomes. Treatment facilities may remain underutilised because adequate wastewater does not reach them. Plants may struggle to maintain consistent quality because operations and maintenance are inadequately financed. Treated water may remain unused because customers, conveyance systems or offtake arrangements were not built into project planning.

These challenges point to a common lesson across solid and liquid waste management: **we need to move from creating assets to building functioning circular systems.**

Such systems require dependable segregation and collection, technology suited to local conditions, sustainable operations and maintenance financing, measurable service standards, transparent reporting, traceability of recovered resources and residuals, viable markets and clearly defined institutional responsibilities.

They must also place people at their centre. Waste pickers, sanitation workers, plant operators, women's groups, local entrepreneurs and community institutions are not peripheral participants in circularity. Their knowledge, safety, livelihoods, skills and continued engagement determine whether systems remain functional beyond the initial project or investment period.

At the **India Sanitation Coalition (ISC),** we have consistently approached WASH as an interconnected development agenda rather than as a collection of infrastructure projects. As a multi-stakeholder platform housed at FICCI, ISC brings together government, industry, civil society, technical institutions, financiers, innovators and implementation partners to forge partnerships, build knowledge and advance sustainable WASH solutions.

Over the years, our work has extended across inclusive sanitation, solid and liquid waste management, climate resilience, innovation, financing, behaviour change and public-private partnerships. Increasingly, our focus is also on what happens **after infrastructure is created—**whether it is used, maintained and operated effectively; whether waste is treated and resources recovered; and whether the systems created can be sustained and scaled.

This thinking is reflected in ISC's **Build–Use–Maintain–Treat–Reuse** approach. It recognises that circularity must be embedded across the complete WASH value chain. Building infrastructure is only the beginning. Its value is realised when people use it, systems are maintained, waste and wastewater are safely treated, and recovered materials and water are brought back into productive use.

This transition is also important for climate action. Every tonne of material recovered, every quantity of organic waste productively processed, and every unit of treated water that safely substitutes freshwater represents an opportunity to conserve resources, reduce pollution and build more resilient systems. Circularity therefore offers an important bridge between sanitation, resource efficiency and climate resilience.

The Business of Change series forms an important part of ISC's knowledge-building role. It was created to document good practices across the sanitation value chain and enable organisations to learn from one another rather than operate within separate verticals.

For the **Business of Change Compendium 2026,** ISC received 24 case studies from organisations working on solid-waste and used-water circularity. Following a review for relevance and completeness, 22 case studies—16 on solid waste and six on used water—have been included in this edition, *Reimagining Solid Waste and Water Management for Climate Action: Pathways, Partnerships and Innovations*.

The cases span different geographies, waste streams, technologies, institutional arrangements and stages of maturity. Some prevent waste or enable materials to remain in use for longer. Others strengthen segregation, collection and recovery; transform organic and discarded materials into useful resources; strengthen the role and livelihoods of waste workers; manage faecal sludge; improve the performance of existing treatment systems; or connect treated water with productive end uses.

Their diversity is important because there is **no single pathway to circularity in a country as varied as India.**

This Compendium does not suggest that every model presented here can—or should—be replicated unchanged. Instead, it seeks to understand what makes these interventions work and what can be learnt from them. The cases bring forward the problem addressed, the operational pathway, the partnerships involved, the evidence generated, the financing arrangements, the constraints encountered and the support required for further scale.

Across these diverse experiences, one message stands out.

Successful circularity is not measured by the installation of an asset or simply by moving waste away from where it was generated. It is measured by what happens next.

It is visible when materials remain in productive use; when organic matter returns safely to biological cycles; when treated water substitutes freshwater; when pollution is prevented; when workers operate safely and livelihoods are strengthened; and when residual waste reaches environmentally sound destinations.

The opportunity before us is therefore larger than improving individual waste-management projects. It is to create the **institutional, financial, technical and market conditions that allow successful interventions to become reliable systems operating at scale.**

Government has an important role in creating enabling policy and institutional frameworks. Industry can bring innovation, investment, technology and market linkages. Civil society and technical organisations can support implementation, capacity building and evidence. Financial institutions can help move viable solutions beyond pilots. Communities and workers must remain central to how these systems are designed and sustained. Circularity at scale will require these actors to work together rather than in isolation.

We hope this Compendium helps practitioners improve project design, enables governments and urban local bodies to identify workable approaches, helps businesses and financiers recognise opportunities for meaningful investment, and encourages partnerships that connect innovation with long-term service delivery.

Most importantly, we hope the experiences documented here contribute to a larger shift in how we think about waste and water—from **projects to systems, from infrastructure to outcomes, and from managing waste to keeping resources in productive use.**

Natasha Patel
CEO
India Sanitation Coalition

Acknowledgement

ACKNOWLEDGEMENT

The development of the *Business of Change Compendium 2026, Reimagining Solid Waste and Water Management for Climate Action: Pathways, Partnerships and Innovations,* has been a collaborative journey of research, learning and knowledge-building. While the Compendium has been conceptualised, researched, curated and developed entirely in-house by the India Sanitation Coalition, its richness comes from the experiences and knowledge generously shared by organisations and practitioners working across the country.

I would first like to express my sincere gratitude to **Ms. Naina Lal Kidwai, Chair, India Sanitation Coalition and Past President, FICCI,** for her visionary leadership and continued commitment to advancing sustainable WASH and circular-economy solutions in India. Her guidance continually encourages us to connect policy ambition with implementation experience and to build stronger partnerships between government, industry, civil society and practitioners.

I extend my heartfelt thanks to **Ms. Natasha Patel, CEO, India Sanitation Coalition,** for her strategic direction, encouragement and steadfast support throughout the development of this Compendium. Her guidance enabled us to approach circularity not as an isolated waste-management issue, but as an interconnected agenda encompassing solid waste, used water, climate resilience, livelihoods, innovation and sustainable service delivery.

My sincere appreciation goes to the entire **Knowledge Management and Research (KMR) team,** which has driven the development of this Compendium from concept to completion. The process involved defining the theme and scope, developing the questionnaire, reaching out to organisations, reviewing submissions, undertaking research, seeking multiple rounds of clarifications, verifying information, identifying cross-cutting learning and transforming diverse implementation experiences into coherent case studies. This publication reflects the team's collective thinking, persistence and attention to detail.

I would like to place on record my **special appreciation for Mr. Nikhil Singh,** whose contribution has been central to bringing this Compendium together. His sustained engagement across the research, review and development of the case studies, coordination with contributing organisations, synthesis of information and compilation of the publication has contributed significantly to its quality and coherence. His commitment to strengthening each case study and ensuring that the learning behind the interventions was captured meaningfully deserves particular recognition.

I would also like to acknowledge **Ms. Srushti Sarvade, Intern,** for her dedicated and sincere support throughout the process. Her willingness to engage carefully with the material, support the research and review process, and contribute wherever required has been valuable in bringing the publication together.

My thanks also go to the wider **India Sanitation Coalition team** for supporting the outreach for case studies across ISC's platforms and networks. Their efforts helped us connect with a diverse range of organisations and initiatives working on solid-waste and used-water circularity across the country.

Most importantly, I would like to thank **every organisation that responded to our call and entrusted us with its experience.** Preparing a meaningful case study requires considerable effort—from compiling project information and operational data to sharing financial details, evidence and photographs and responding patiently to subsequent questions and clarifications. We deeply appreciate the openness, time and effort invested by every organisation, including those whose submissions could not ultimately be included in this edition.

The real value of this Compendium lies in the knowledge these organisations were willing to share—not only their successes, but also the operational challenges, adaptations and lessons that accompany implementation. It is through such openness that one organisation's experience can become another's learning and that promising approaches can evolve into stronger and more sustainable systems.

This Compendium is therefore a product of both **internal knowledge-building and collective sector learning.** I hope it will encourage practitioners to learn from one another, enable stronger partnerships and contribute to a deeper conversation on how India can move from successful individual interventions towards sustainable and scalable circular systems.

My sincere thanks to everyone who has contributed to making this publication possible.

Anjali Tripathy
Director- Program Implementation,
Knowledge Management and Research
India Sanitation Coalition

List of Abbreviations

Abbreviation	Full Form
ABR	Anaerobic Baffled Reactor
AI	Artificial Intelligence
AIILSG	All India Institute of Local Self-Government
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ATI	Administrative Training Institute
B2B	Business-to-Business
BIS	Bureau of Indian Standards
BMC	Brihanmumbai Municipal Corporation
BOD	Biochemical Oxygen Demand
BORDA	Bremen Overseas Research and Development Association
BWSSB	Bangalore Water Supply and Sewerage Board
C&D	Construction and Demolition
CapEx	Capital Expenditure
CBO	Community-Based Organisation
CCP	Corporation of the City of Panaji
CCTV	Closed-Circuit Television
CEO	Chief Executive Officer
CLDSWM	Community-Led Decentralised Solid Waste Management
CMC	Chhindwara Municipal Corporation / Chintamani City Municipal Council / Chikkaballapura City Municipal Council, depending on the case study
CNG	Compressed Natural Gas
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CSR	Corporate Social Responsibility
CYDA	Centre for Youth Development and Activities
DDWS	Department of Drinking Water and Sanitation
DEWATS	Decentralised Wastewater Treatment Systems
DPIIT	Department for Promotion of Industry and Internal Trade
DPR	Detailed Project Report
DWCC	Dry Waste Collection Centre

Abbreviation	Full Form
EPR	Extended Producer Responsibility
FICCI	Federation of Indian Chambers of Commerce and Industry
FINISH	Financial Inclusion Improves Sanitation and Health
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
FSTP	Faecal Sludge Treatment Plant
GHG	Greenhouse Gas
GPS	Global Positioning System
HDFC	Housing Development Finance Corporation
HDPE	High-Density Polyethylene
HH	Household
HKS	Haritha Karma Sena
HMWSSB	Hyderabad Metropolitan Water Supply and Sewerage Board
HRP	Handmade Recycled Plastic
IDM	Institute of Development Management
IEC	Information, Education and Communication
IIT	Indian Institute of Technology
IoT	Internet of Things
ISC	India Sanitation Coalition
ISO	International Organization for Standardization
IWA	International Water Association
JMB	Jorhat Municipal Board
LDPE	Low-Density Polyethylene
LLP	Limited Liability Partnership
LSG	Local Self-Government Institution
MCF	Material Collection Facility
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MLP	Multilayered Packaging
MoU	Memorandum of Understanding
MQTT	Message Queuing Telemetry Transport
MRF	Material Recovery Facility

Abbreviation	Full Form
NA/N/A	Not Available or Not Applicable, depending on context
NABL	National Accreditation Board for Testing and Calibration Laboratories
NADEP	Composting method named after Narayan Deorao Pandharipande
NCR	National Capital Region
NGO	Non-Governmental Organisation
NGS	Next-Generation Sequencing
NIUA	National Institute of Urban Affairs
NRLM	National Rural Livelihoods Mission
NSRCEL	N. S. Raghavan Centre for Entrepreneurial Learning
NSS	National Service Scheme
O&M	Operations and Maintenance
OPEX	Operating Expenditure
PCB	Pollution Control Board
PCMC	Pimpri-Chinchwad Municipal Corporation
PET	Polyethylene Terephthalate
PGF	Planted Gravel Filter
PMAY-U	Pradhan Mantri Awas Yojana–Urban
PMC	Pune Municipal Corporation
PP	Polypropylene
PPE	Personal Protective Equipment
PS	Polystyrene
Pvt. Ltd.	Private Limited
R&D	Research and Development
RDF	Refuse-Derived Fuel
REAP	Real Estate Accelerator Program
RFID	Radio-Frequency Identification
RRC	Resource Recovery Centre
RRR	Reduce, Reuse and Recycle
RWA	Resident Welfare Association
SA 8000	Social Accountability 8000
SaaS	Software as a Service
SBM-G	Swachh Bharat Mission–Grameen
SBM-U	Swachh Bharat Mission–Urban
SHG	Self-Help Group
SOP	Standard Operating Procedure
STP	Sewage Treatment Plant
SUP	Single-Use Plastic

Abbreviation	Full Form
TIDE	Technology Informatics Design Endeavour
TNCA	Tamil Nadu Cricket Association
TPD	Tonnes per Day
TSS	Total Suspended Solids
UGD	Underground Drainage
ULB	Urban Local Body
UPI	Unified Payments Interface
UV	Ultraviolet
VDC	Village Development Committee
VGF	Viability Gap Funding
VTS	Vehicle Tracking System
WASH	Water, Sanitation and Hygiene
WMC	Water Management Committee

Introduction

Advancing Circularity in Solid Waste and Used Water

India's transition to a circular economy is no longer only an environmental aspiration. It is increasingly an economic, urban-development, public-health and resource-security imperative. Rising consumption, urbanisation and industrial growth are increasing the demand for virgin materials and freshwater while simultaneously generating larger and more complex waste streams. Conventional approaches centred primarily on the collection, treatment and disposal of waste are therefore no longer sufficient. The challenge—and opportunity—is to prevent waste wherever possible, recover value from what is generated, and keep materials, nutrients and water in safe and productive use for as long as possible.

This Compendium brings together 22 case studies—16 on solid waste and six on used water—spanning metropolitan cities, smaller towns, villages, residential communities, institutions and large public events. Together, they demonstrate that there is no single pathway to circularity. The approaches range from avoiding single-use products, enabling reuse and strengthening source segregation to formalising waste workers, improving material recovery, advancing composting and biological conversion, and creating products from recovered materials. In used-water management, the cases cover decentralised sanitation, faecal-sludge management, improvements to existing treatment systems and fit-for-purpose reuse of treated water. Collectively, these experiences illustrate how circularity can be pursued across different scales, contexts and stages of the solid-waste and used-water value chains.

The cases also demonstrate that technology alone does not create circularity. Functioning circular systems depend equally on reliable collection, uncontaminated inputs, skilled operators, worker safety, quality assurance, sustainable financing, traceability, and dependable markets for recovered materials or treated water. A technically sound facility without sufficient feedstock, skilled operations, adequate operations and maintenance financing, or assured offtake may be an asset—but it is not yet a functioning circular system.

Table 1. Case-study portfolio at a glance

Theme	Cases	Illustrative coverage
Solid-waste circularity	16	Prevention and reuse; source segregation; formalisation; sorting and MRFs; organics; material recovery and upcycling
Used-water circularity	6	Faecal-sludge management; decentralised treatment; STP upgrades; captive and off-site fit-for-purpose reuse
Total portfolio	22	Metropolitan cities, smaller towns, villages, residential communities, institutions and large public events

From waste management to circular resource management

Circularity begins by questioning whether waste needs to be generated at all. For solid materials, the preferred hierarchy is to prevent and reduce consumption, followed by reuse and repair, then recycling, composting or other forms of material and biological recovery. Energy recovery and environmentally sound disposal remain necessary for genuinely non-recyclable residues, but they occupy a lower position in the hierarchy. Collection or diversion from landfill is valuable, but it should not automatically be described as material circularity.

Different materials require different pathways. Organic matter can return safely to biological cycles through composting, biomethanation, soil-conditioning products or other processes that recover nutrients and energy. Plastics, metals, glass, paper, textiles and construction materials belong largely to technical cycles, where the objective is to retain their functional and material value through reuse, remanufacturing or high-quality recycling. Mixed or contaminated waste usually loses value and becomes more expensive—and sometimes impossible—to recover.

Water circularity similarly goes beyond sewage treatment. Treatment prevents pollution, but circularity is achieved only when treated water is safely matched with a productive next use, such as toilet flushing, industrial processes, cooling, construction, landscaping or suitable agricultural applications, thereby replacing an equivalent demand for freshwater. The complete system must include collection, treatment, quality verification, storage, conveyance, end-use controls and responsible management of sludge and other residuals.

Circularity does not imply that every material or water stream can be recycled indefinitely. Repeated processing can reduce material quality; water treatment requires energy and chemicals; and every system produces some rejects or residuals. The relevant question is therefore not whether a loop is perfectly closed, but whether the intervention safely preserves more value, displaces virgin-resource consumption, reduces pollution and distributes benefits fairly when compared with the available alternatives.

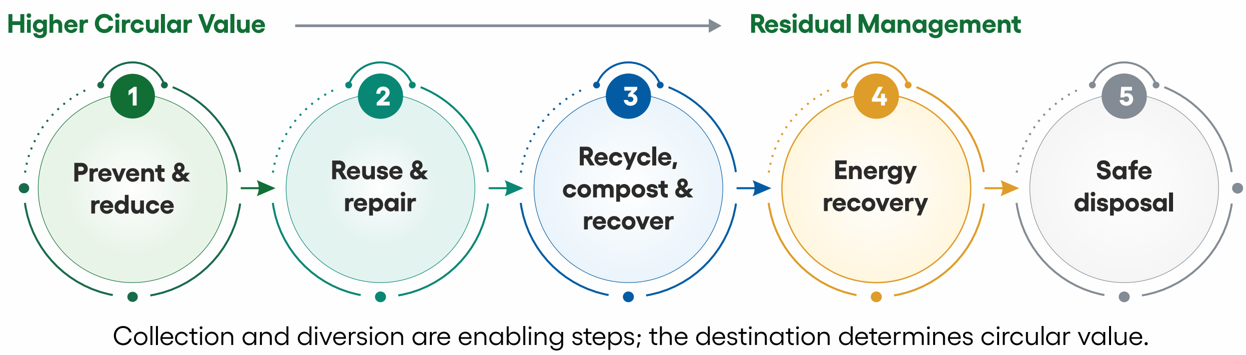


Figure 1. Preferred hierarchy for solid-material circularity. Strategies that preserve value are prioritised before residual management.

India's evolving solid-waste circularity landscape

India has substantially increased the reported processing of municipal solid waste. Government figures released in 2026 indicate that urban waste processing has reached approximately 81 per cent. This is significant progress, but "processing" may include composting, recycling, refuse-derived fuel, waste-to-energy and other destinations of differing circular value. The next phase must therefore focus not only on the quantity processed but also on the quality of segregation, actual recovery of materials, market uptake of outputs and final destination of residuals [1].

The Solid Waste Management Rules, 2026, which came into force on 1 April 2026, strengthen this transition. They require segregation into wet, dry, sanitary and special-care streams; formally recognise material recovery facilities; introduce Extended Bulk Waste Generator Responsibility; provide for digital tracking from generation to disposal; mandate audits; strengthen restrictions on landfilling; and introduce environmental compensation based on the polluter-pays principle. Wet waste is to be directed to composting or biomethanation, while segregated dry waste is to be sorted through material recovery facilities. The Rules also require bulk generators to process wet waste on-site as far as feasible or meet their obligations through the prescribed certificate mechanism [2].

Stream-specific frameworks complement these rules. Plastic packaging is governed through Extended Producer Responsibility requirements covering recycling, recycled content and, for relevant rigid packaging, reuse. EPR frameworks now also cover batteries, e-waste, tyres, used oil, end-of-life vehicles, construction and demolition waste and non-ferrous metal scrap. The Environment (Construction and Demolition) Waste Management Rules, 2025, effective from April 2026, are particularly relevant to enterprises converting recovered plastic and mineral debris into construction products [3].

For organic waste, initiatives such as GOBARdhan support the conversion of cattle dung, agricultural residues and other biodegradable waste into biogas, compressed biogas and organic manure. Market Development Assistance for fermented organic manure and liquid fermented organic manure seeks to address an important part of the circularity equation: not merely producing a recovered output, but creating demand for it [4].

Textiles represent a major emerging opportunity. The Ministry of Textiles estimates that India generates approximately 70.73 lakh tonnes of textile waste annually. More than 95 per cent of pre-consumer waste is reported to be recovered, while only about 55 per cent of post-consumer textile waste is diverted, largely through informal networks. The distinction is instructive: clean, homogeneous waste generated near a manufacturing process is relatively easy to recover; dispersed, mixed and poorly documented post-consumer textiles are considerably harder [5].

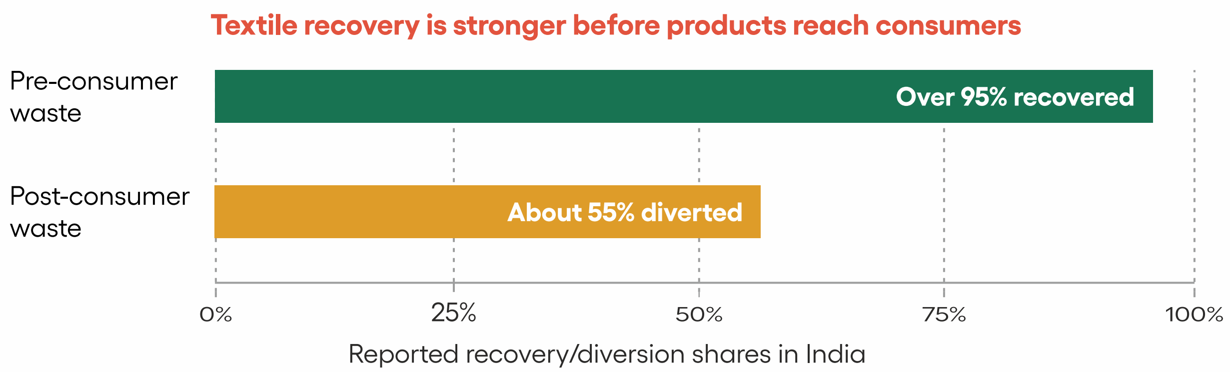


Figure 2. Reported recovery/diversion of pre-consumer and post-consumer textile waste in India [5].

Unlike plastic packaging, textiles do not yet appear in the Centre's listed EPR waste regimes. This presents an opportunity to develop a textile-specific framework incorporating durable product design, repair and reuse, collection systems, fibre identification, producer responsibility, recycled-content demand and fibre-to-fibre recycling. Refuse-derived fuel may provide an outlet for non-recyclable textile residues, but reusable garments and recyclable fibres should not be prematurely lost to combustion [3], [5].

Across all these streams, policy implementation must guard against equating compliance certificates or waste movement with verified recycling. EPR and digital platforms can create powerful incentives, but their credibility depends on mass-balance checks, prevention of double counting, functioning facilities, traceable end destinations and independent verification.

Circularity in used water

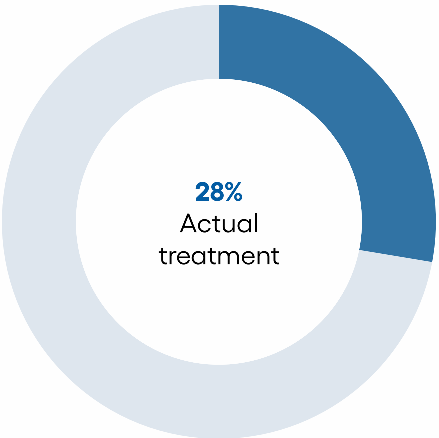
India's water challenge has two connected dimensions: inadequate treatment of used water and increasing pressure on freshwater sources. The most recent nationally consolidated CPCB inventory publicly cited in research relates to 2020–21. It estimated urban sewage generation at 72,368 million litres per day, against actual treatment of approximately 20,236 MLD—about 28 per cent. Treatment capacity has expanded since then, including through AMRUT, SBM-U 2.0 and Namami Gange, but the age of the national inventory also exposes an important data gap: India needs regularly updated, comparable information on water generated, collected, treated to standard, and actually reused [6].

The policy direction is increasingly supportive of circular water management. AMRUT 2.0 established the objective of recycling treated used water to meet 20 per cent of total city water demand and, in aggregate, 40 per cent of state-level industrial water demand. It also promoted city water-balance plans, identification of bulk users and end-to-end reuse projects [7].

Swachh Bharat Mission–Urban 2.0 extends the used-water agenda to cities with populations below one lakh, including sewerage, septage, greywater and blackwater management. Its emphasis on safe containment, collection, transport and treatment is especially important in non-sewered settlements, where faecal-sludge treatment plants, scheduled desludging and decentralised treatment can be more appropriate than conventional sewer networks [8].

The National Framework for Safe Reuse of Treated Water provides guidance for state policies and city-level reuse planning. Several states already have their own reuse policies. By March 2026, Uttarakhand and Uttar Pradesh had also progressed policies aligned with the national framework, while Bihar and West Bengal were in advanced stages of finalisation. City-level reuse plans have been developed or initiated for Agra, Prayagraj, Varanasi and Kanpur, covering available treated-water volumes, nearby demand centres, conveyance infrastructure, tariffs, monitoring and institutional responsibility. Existing industrial reuse arrangements—including the supply of treated water to power plants and refineries—show that large, creditworthy users can anchor municipal reuse systems when quality and supply are contractually assured [9].

Yet the gap between policy and implementation remains substantial. A study of 503 urban local bodies across ten states found that financial planning and investment in used-water management were still nascent in 90 per cent of the cities assessed. Governance, public data, treatment-plant utilisation, energy efficiency and treated-water quality also required considerable improvement [10].



Urban sewage treatment gap, 2020-21

72,368 MLD
Urban sewage generated

20,236 MLD
Actual treatment

The nationally consolidated inventory cited in the text relates to 2020-21; regular updates remain essential

Figure 3. Reported urban sewage generation and actual treatment in India, 2020–21 [6].

Clarifying blackwater, greywater and brownwater

The language used to describe domestic water streams matters because each carries a different risk profile.

Blackwater generally refers to toilet wastewater containing faeces, urine, flushing water and, where applicable, anal-cleansing materials. It has a high pathogen load and can also contain recoverable nutrients and organic matter [12].

Greywater refers to domestic water from bathing, washbasins, laundry and similar non-toilet uses. Definitions differ on whether kitchen water is included because oils, food particles and detergents can significantly alter its characteristics. Greywater generally carries a lower faecal load than blackwater, but it is not automatically safe: it may still contain pathogens, surfactants, salts, oils, microfibres and household chemicals [11].

In source-separated sanitation literature, brownwater usually refers to faeces and flushing water where urine has been collected separately. The term is not used uniformly in Indian programmes and should therefore be applied only where a project clearly defines the stream. Blackwater, brownwater, greywater, septic-tank effluent, faecal sludge, municipal sewage, industrial effluent, stormwater and reverse-osmosis reject are not interchangeable terms [12].

Table 2. Domestic water streams and reuse implications [11], [12]

Stream	Typical source	Circularity and reuse implication
Blackwater	Toilet wastewater containing faeces, urine and flushing water	High pathogen load; reuse only after robust treatment and verification for a specified end use
Greywater	Bathing, washbasins, laundry and other non-toilet domestic uses	Lower faecal load than blackwater, but pathogens and household chemicals may remain; treatment must be fit for purpose
Brownwater	Faeces and flushing water where urine is collected separately	Not used uniformly in Indian programmes; define the stream and its treatment requirements project by project
Treated water	Used water processed to meet defined quality requirements	May replace freshwater for specified non-potable uses when quality, storage, conveyance and end-use controls are verified

Most importantly, raw blackwater or brownwater should not be described as water for direct reuse. The reusable product is treated water that has been demonstrated to be suitable for a specified end use. The correct policy question is therefore not simply, “Can black or grey water be reused?” It is: “What is the source and contaminant profile, what treatment and safeguards are required, and for which end use can the resulting water be safely and reliably supplied?”

A fit-for-purpose approach avoids both under-treatment and unnecessary over-treatment. Water required for toilet flushing, cooling towers, construction, landscaping or restricted irrigation does not always need to be treated to drinking-water quality, but it must meet parameters relevant to that use. Treatment should be accompanied by accredited laboratory testing, calibrated flow measurement, control of cross-connections, clearly identified non-potable networks, safe storage, operator training and monitoring at the point of use—not only at the treatment-plant outlet.

Agricultural reuse requires particular care. Nutrients in treated water can reduce fertiliser demand, but salinity, sodium, boron, pathogens, heavy metals and emerging contaminants can affect soils, crops, workers and consumers. Safe agricultural reuse may therefore require crop restrictions, suitable irrigation methods, withholding periods, soil and water monitoring, farmer advisories and occupational safeguards. Nutrient value must never be treated as proof of sanitary safety.

What the case-study portfolio reveals

The solid-waste cases cover several levels of the circularity hierarchy. Thaila and Bartan Banks demonstrate prevention and repeated use. The Plastic Lao, Compost Pao initiative shows how incentives can motivate segregation, although its compost and plastic streams remain operationally distinct. The Kabadiwala and Smart Sort cases demonstrate the importance of digitalisation, training, aggregation and market linkages. The Dapodi MRF, Jorhat, Dumad, Hardoi and Chintamani cases show how local infrastructure, community participation and worker-centred operations can strengthen municipal systems. Wricks and PoshBag illustrate material transformation and upcycling, while Daily Dump and PraanaPoorna demonstrate product-led approaches to biological circularity.

The used-water cases likewise cover different points in the sanitation-to-reuse chain. Rudrapur addresses regional faecal-sludge collection and treatment. The Pinangwan and Kandavara cases demonstrate decentralised treatment linked to nearby irrigation, landscaping, toilet cleaning and construction use. The Chepauk case concerns improvement of an existing institutional STP and captive reuse. BOSON White Water demonstrates a service model for tertiary treatment and both on-site and off-site supply. The septic-tank bioremediation case is best understood as an asset-maintenance and sanitation-performance intervention rather than a treated-water reuse case.

This distinction is useful. Some cases produce a direct circular outcome; others provide enabling infrastructure or behaviour change; and some perform necessary treatment or residual-management functions. All can be valuable, but they should not be measured by the same indicator.

Several cross-cutting lessons emerge:

- Source segregation is foundational. Clean organic waste, sorted plastics, identifiable textiles and separately managed water streams produce higher-value and safer outputs. Once streams are mixed, recovery costs rise and quality declines.
- Decentralisation works when responsibility is local and explicit. Several cases demonstrate the value of household, community, institutional or ward-level systems. Their long-term performance, however, depends on an identified operator, routine maintenance, access to spare parts, monitoring and a secure budget.
- Markets determine whether recovery becomes circularity. A recovered material with no buyer remains a stored waste. Compost, recycled polymers, upcycled products, recovered aggregates and treated water all require consistent quality, competitive pricing and dependable offtake.
- Social infrastructure is as important as physical infrastructure. Waste pickers, kabadiwalas, sanitation workers, women's self-help groups, volunteers and community committees are central to many of the models. Formal recognition, fair remuneration, social protection, occupational safety and participation in decision-making are therefore core circular-economy requirements.
- Viability rarely comes from recovered-material sales alone. The Dapodi MRF, for example, reports meaningful recyclables revenue but not full recovery of operating costs. Other cases combine user charges, municipal contracts, CSR or grant capital, service fees and product sales. Such blended models should not be interpreted as weakness; waste management creates public benefits that commodity markets alone do not pay for.
- Appropriate technology is more valuable than maximum technology. Passive composters, retrofitted material-recovery facilities, decentralised wastewater systems and biological upgrades can be effective where they match local skills, land, climate, feedstock and operating capacity. Sophisticated systems without reliable operation may perform worse than simpler, well-maintained alternatives.
- Evidence quality is uneven and must be made visible. The portfolio includes measured site-level flows, transaction data, self-reported organisational totals, estimates and projections. Rated capacity is not the same as actual throughput; collection is not the same as recycling; treatment is not the same as reuse; and projected environmental savings are not realised impacts.

The cases should therefore not be aggregated into a single tonnage, water volume or emissions figure. Their reporting periods, geographic boundaries and measurement methods differ. Nor should they be read as a statistically representative assessment of India. Their value lies in revealing mechanisms that work, conditions that enable them, barriers that remain and questions that future replication must answer.

Support required to move from pilots to systems

The policy environment is becoming progressively more favourable. The greater challenge is converting rules, targets and promising projects into dependable circular services at scale. Several forms of support are particularly important.

1. Assured demand and responsible procurement. Governments, urban local bodies, infrastructure agencies and large companies can create markets by specifying qualified recycled materials, compost, recovered aggregates and treated water in procurement. Long-term treated-water offtake agreements and carefully designed freshwater-substitution requirements can provide revenue certainty for reuse projects. Quality and safety must remain the basis for procurement; mandates should not compel the use of unsuitable outputs.

2. Financing the missing infrastructure. Collection and treatment assets receive more attention than sorting, storage, pipelines, pumping, last-mile distribution, laboratories, digital monitoring and residual management. In water reuse, conveyance can cost more than tertiary treatment. Viability-gap funding, blended finance and performance-linked public payments should therefore consider the complete service chain rather than only plant construction.

3. Dedicated operations and maintenance finance. Capital grants do not ensure sustained operation. Projects need realistic estimates of electricity, consumables, labour, testing, repairs and sludge or reject management. Contracts should link payments to verified service outcomes while protecting operators from risks—such as absent sewer connections or unavailable offtakers—that they cannot control.

4. Fit-for-purpose water-quality standards and clear liability. Reuse frameworks need end-use-specific quality requirements, monitoring frequency, sampling protocols and enforcement. Responsibility must be allocated across the treatment-plant owner, tertiary operator, transporter, distribution-network operator and end user. Tanker-based supply requires manifests, verified destinations, tanker hygiene and chain-of-custody controls.

5. Reliable measurement, reporting and verification. Solid-waste systems need calibrated weighing, material-specific mass balances, recycler receipts and transparent accounting for rejects. Water systems need inlet, outlet and reuse meters; accredited laboratory results; uptime records; and separation of installed, operational and actually utilised capacity. Public reporting should distinguish generated, collected, treated, recovered, sold, reused and finally disposed quantities.

6. Markets and standards for recovered products. Recycled materials must be trusted by buyers. This requires product standards, contamination limits, testing facilities, certification, stable feedstock and design for recycling. Organic outputs require quality assurance and agronomic guidance. Textile circularity needs better fibre identification, collection and sorting, design for durability and greater investment in fibre-to-fibre recycling.

7. Formal and fair inclusion of workers. Waste workers should be integrated into municipal and producer-responsibility systems without destroying existing livelihoods. Support should include identity and registration, contracts or recognised service arrangements, transparent payment, protective equipment, mechanisation of unsafe tasks, technical & occupational capacity building, health and social-security coverage, accessible facilities and opportunities for women to move into supervisory, technical and enterprise roles.

8. Spatially informed planning. Circularity is local as well as sectoral. Materials and water should be matched with nearby recovery facilities and users wherever feasible, reducing transport, pumping and storage costs. City reuse plans should map seasonal water availability and demand, industrial clusters, construction activity, parks, railway facilities, power plants and agricultural areas while considering elevation, energy use and climate risks.

9. Public confidence and risk communication. Households must trust segregation systems enough to participate consistently, and water users must understand what treated water can and cannot safely be used for. Public communication should be supported by transparent test results, grievance mechanisms and credible regulatory oversight rather than generic claims that recycled outputs are universally safe.

10. Complete management of residuals. Circularity must not transfer pollution from one medium to another. Compost rejects, non-recyclable plastics, MRF residues, screenings, grit, sludge, concentrates and spent treatment media need documented and environmentally sound destinations. Water reuse is incomplete if treated water is sold while sludge is dumped, just as material recovery is incomplete if rejects disappear from the reporting boundary.

11. Replication support based on readiness. Successful replication requires more than copying equipment. It requires assessment of waste composition or water quality, land, user demand, operator capability, commercial structure, community acceptance and regulatory permissions. Technical-assistance facilities, model contracts, standard operating procedures, peer learning and independent performance validation can help smaller urban local bodies and panchayats make informed choices.

Eleven priorities, four enabling pillars
Scaling depends on a complete delivery system-not a technology alone.

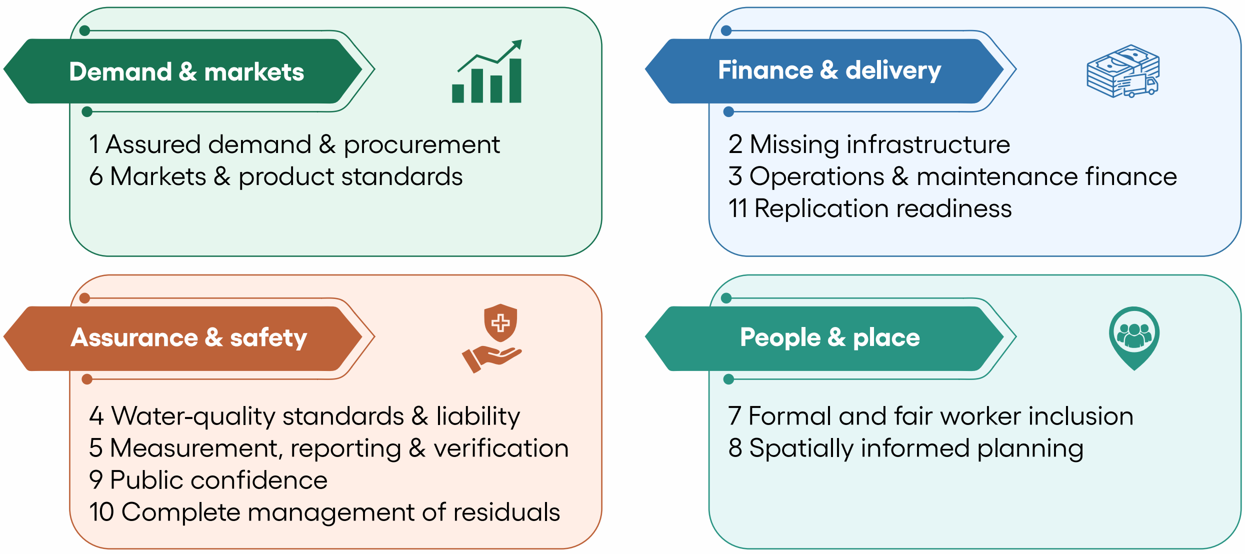


Figure 4. Eleven priorities for moving from pilots to dependable circular systems.

Towards integrated circular resource systems

Solid waste and used water are frequently managed by separate departments, programmes and professional communities, but their circular pathways are closely connected. Organic waste, sewage sludge and agricultural residues intersect through nutrient recovery and bioenergy. Poorly managed solid waste blocks drains and contaminates water bodies. Reused water can support urban landscaping, construction and biological processing, while treatment residuals require safe material-management pathways. Planning these systems together can reduce duplication, identify industrial symbiosis opportunities and prevent the transfer of environmental burdens.

The central lesson from the case studies is that circularity is not a single technology, facility or recycling target. It is an operating system connecting responsible consumption, segregation, logistics, infrastructure, markets, finance, regulation, data and people. Its success should be judged by verified reductions in waste generation, virgin-material and freshwater consumption, pollution and unsafe work—alongside improvements in resource productivity, livelihoods, public health and resilience.

The purpose of this compendium is therefore not merely to celebrate individual initiatives. It is to identify the conditions under which promising practices can become reliable systems. The cases show that workable solutions already exist at different scales. The next task is to connect these solutions to stronger demand, transparent evidence, long-term finance, capable institutions and enforceable safeguards so that circularity moves from exceptional projects to normal practice.

Policy and status references in this draft are current to August 2026.

Case Studies

Solid Waste

Wricks®: Circular Construction Materials for Sustainable Infrastructure

Angirus Ind Pvt Ltd | Udaipur and Bengaluru | Continuing since January 2021

WASTE RECOVERED >1,200 tonnes reported	CIRCULAR PRODUCTS >400,000 Wricks® deployed	CLIMATE RESULT >220 tonnes CO_2 avoided
DIRECT REACH >2,000 individuals	INDIRECT REACH >10,000 individuals	CORE FEEDSTOCKS Low-value plastic + C&D waste

Case in brief

Angirus converts difficult-to-recycle plastic fractions and construction and demolition (C&D) waste into Wricks®, a waste-derived construction material. Its proprietary thermo-mechanical process uses controlled heating, extrusion, compression and cooling without cement, process water or kiln firing. The product is designed for construction applications that demand low water absorption and durability, including toilets, septic systems, underground water tanks, sewage treatment plants and other water-retaining structures. The model connects waste recovery directly with a commercial end market, moving material that may otherwise be dumped, burned or landfilled back into infrastructure.

Problem and circularity opportunity

Mixed flexible packaging, multilayer plastics and other low-value plastic fractions have limited conventional recycling routes. C&D waste also remains under-recovered in many urban areas. At the same time, conventional sanitation and construction systems depend on fired clay bricks, cement blocks and other resource- and carbon-intensive materials. Angirus addresses both sides of this gap: it creates demand for difficult waste streams and uses the recovered material to displace part of the virgin-material demand in new construction.

What makes the model distinct

- Material innovation: combines difficult-to-recycle plastic with processed C&D material in a standardized construction product.
- Process design: cement-free, water-free and kiln-free thermo-mechanical manufacturing.
- Sanitation relevance: low water absorption and waterproof performance for toilets, tanks, septic systems and STPs.
- Commercial circularity: product sales create a revenue-backed end market for recovered waste.
- Decentralized scale: modular manufacturing close to waste sources reduces haulage and supports local production partnerships.

Circular value-chain partners

Waste management organisations, recyclers and aggregators supply plastic feedstock; construction sites and recycling facilities supply C&D material. Swaaha Resource Management is named as a waste-supply partner. Biome Environmental Solutions, CoEvolve Estates and SHK Contractors have supported commercial deployments. Research institutions and accredited laboratories provide testing, while NSRCEL, IIM Bangalore and Brigade REAP have supported incubation, market access and business development.

Operation and processing sequence

Stage	Technology / activity	Role in the material flow
Feedstock sourcing	Plastic from waste organisations, recyclers and aggregators; C&D waste from sites and recycling facilities	Secures two locally available waste streams that otherwise have limited productive end uses.
Sorting	Removal of unsuitable or contaminating material	Creates a controlled input stream for repeatable production.
Cleaning	Cleaning of recovered plastic and mineral fractions	Reduces contamination before mechanical processing.
Size reduction	Shredders and waste-preprocessing equipment	Produces particle sizes suitable for consistent blending and extrusion.
Input quality checks	Material characterisation and feedstock inspection	Manages variations in plastic composition and C&D material quality.
Blending	Mixers and proprietary material formulation	Combines the prepared waste fractions in a controlled mix.
Thermo-mechanical forming	Controlled heating, extrusion, moulding and mechanical compression	Shapes and densifies the waste-derived mix without cement, process water or kiln firing.
Cooling and finishing	Cooling units and product finishing	Stabilises the moulded product and prepares it for inspection and dispatch.
Quality assurance	Batch-wise testing and accredited laboratory validation	Checks strength, durability, dimensional consistency and water absorption before deployment.
Product deployment	Sale and installation of Wricks® in construction	Returns recovered material to productive use in sanitation, residential, commercial and community infrastructure.
REQUIRED INFRASTRUCTURE	Waste-preprocessing and shredding equipment, mixers, extrusion and compression systems, moulds, cooling units, material-storage space and quality-testing facilities. Trained operators, defined SOPs and batch controls are required to manage heterogeneous feedstock.	

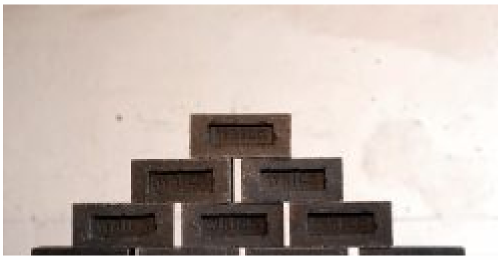
From recovered waste to sanitation infrastructure

Reported application	Circular value created
Toilets and utility structures	Masonry / construction application using waste-derived units
Underground water tanks	Low water absorption and waterproof construction performance
Septic systems	Durable material for below-ground sanitation structures
Sewage treatment plants	Application in STP and water-retaining infrastructure
DECENTRALIZED MANUFACTURING	The scale-up model places modular processing units closer to waste-generation centres and works through local manufacturing partners. Local sourcing and production can reduce transport cost and emissions; standard equipment, SOPs, batch testing and laboratory checks are intended to maintain product consistency across locations.

Results, commercial model and scale

Result area	Reported achievement
Material recovery	>1,200 tonnes of plastic and C&D waste reported as recycled
Products placed in use	>400,000 Wricks® across residential, commercial, institutional and community infrastructure
Climate outcome	>220 tonnes of CO_2 emissions reported as avoided through waste diversion and material substitution
Reach	>2,000 direct and >10,000 indirect beneficiaries
Establishment reach	Schools/institutions, markets/commercial sites and industries/worksites
Waste-worker linkage	Waste workers and aggregators participate in sourcing; capacity building for waste workers is reported

Market-led revenue model



Angirus operates a B2B model designed to sustain operations through product sales rather than continuing project grants. Current revenue is generated through sales of Wricks® and other circular construction products to real-estate developers, contractors, infrastructure companies, institutions and sanitation implementers. The questionnaire also records CSR funding, institutional grants, government financing or scheme support, and impact or venture investment received during the intervention. Future revenue options are technology licensing, decentralized manufacturing partnerships and carbon finance. The main operating costs are waste collection and preprocessing, manufacturing, logistics, quality assurance and plant operations and the reported development cost is INR 12 per unit.

Replication pathway

The proposed replication mechanism is modular and partner-led: identify a local plastic and C&D feedstock base; install preprocessing, extrusion, compression and cooling equipment near the waste source; train local operators; apply Angirus' formulation and SOPs; validate each batch; and build demand through developers, municipalities and sanitation programmes. The model is positioned for urban and peri-urban regions where both difficult waste and infrastructure demand are concentrated.

CLIMATE AND RESOURCE VALUE	The process avoids cement, process water and kiln firing; diverts plastic and C&D waste from disposal; and substitutes waste-derived material for part of conventional construction demand. Durable, low-absorption products can also reduce maintenance requirements in water-retaining sanitation assets.

Technical and market challenges addressed

- Heterogeneous feedstock: extensive R&D, material characterisation, formulation control and process optimisation were used to stabilise product performance.
- Market confidence: third-party testing, pilot demonstrations and deployments in water-retaining structures were used to establish proof of performance.
- Reliable waste supply: partnerships with waste organisations, recyclers and aggregators support feedstock availability and preprocessing quality.

For more information

Contact person	Email	Website
Kunjpreet Arora	kunjpreet@angirusind.co	https://www.angirusind.com/

From Roadside Callers to Digital Entrepreneurs

Formalizing India's Informal Kabadiwala Network

Asar Green Kabadi Pvt. Ltd. (The Kabadiwala) | Social enterprise | Operating since 2014

REPORTED MATERIAL HANDLED	REPORTED NETWORK	REPORTED FOOTPRINT
45,000+ MT since inception	**5,000+ digitised kabadiwalas**	**15+ cities;**
PLATFORM REACH **4 lakh+ users**	DIRECT ENGAGEMENT **900+ waste workers; 150+ women**	DOWNSTREAM / CLIENTS **100+ recyclers; 500+ corporate clients**

Case in brief

The Kabadiwala combines doorstep collection, digital business tools and downstream recycling linkages to bring informal scrap collectors into a more documented circular value chain. Customers request pickups through an app. Verified kabadiwala partners receive jobs, navigate to the customer, weigh the material, generate a digital bill and make payment through UPI. Material is then logged, sorted and graded at regional facilities before dispatch to reported authorised recyclers. The distinguishing feature is the partner-facing system: it seeks to equip kabadiwalas with customer access, transaction records, earnings history, inventory tools and opportunities to handle more material categories or build small teams. The submission therefore presents circularity as both material recovery and workforce formalisation.

The problem addressed

India's scrap recovery system depends heavily on informal collectors, yet the submission describes a workforce operating with unpredictable earnings, cash-based transactions, limited documentation and little access to business tools or formal finance. Households and businesses, meanwhile, may struggle to find a collector when recyclable material is ready for disposal and may hesitate to allow unverified collectors into residential premises. These gaps can reduce recovery and send valuable dry waste into mixed-waste streams. The intervention was established in Bhopal in 2014 to address the mismatch in access and trust; since 2021, its stated focus has been workforce formalisation and national scale-up. The submission's estimate of more than one million kabadiwalas and waste pickers is not sourced and should not be published as a verified national figure.

What formalisation means in this model

1. Identity and trust: partner verification, ratings and GPS-tagged service records.
2. Digital transactions: bills, pre-loaded material rates, UPI payments and order or earnings history.
3. Business capability: route support, material-category training, inventory records and team-management tools for higher-volume partners.
4. Circular linkage: documented sorting and sale of recovered material to downstream recyclers or manufacturers.

Geographic and operating scope

The submission reports a hybrid model across 15 cities. Some of the major cities where in-house operations are operational are: Bhopal, Indore, Lucknow, Nagpur and Raipur; partner-led presence is named in NCR, Bengaluru, Mumbai, Hyderabad, Pune, Chennai and Ahmedabad. Five regional facilities with a combined area of 25,000 sq. ft. reportedly support sorting and dispatch. The case covers urban and peri-urban households, markets, commercial establishments and industrial or manufacturing clients.

How the collection-to-recycling model works

1. Pickup request: the customer selects a date, uploads a material photograph and chooses a digital payment method.
2. Verified collection: an available partner accepts the request, uses in-app navigation, weighs the material and generates a digital bill; the customer is paid through UPI.
3. Sorting and documentation: collected material is transported to a regional facility and logged by material type, weight and quality grade.
4. Downstream sale: sorted material is dispatched to reported CPCB-authorised recyclers or manufacturers with a sales document and transaction record.

Digital formalisation and traceability architecture

Layer	Reported function	Evidence needed
Customer application	Pickup scheduling, material photograph, payment preference, ratings and transaction-level impact report.	User definition, active users, repeat use and impact-factor methodology.
Partner application	Job acceptance, GPS navigation, material rates, weighing, billing, UPI payment and earnings/order ledger.	Whether weighing is scale-integrated; calibration, adoption and transaction-completion records.
Business tools	Inventory and seller records; team management for higher-volume kabadiwala partners.	Number using each tool, team growth, retention and business-performance change.
Regional facilities	Intake logging, segregation by grade, storage and dispatch across five facilities covering 25,000 sq. ft.	Facility locations, authorisations, capacity, throughput, rejects and material balance.
Recycler linkage	Formal sales documentation and recorded transfer to downstream recyclers or manufacturers.	Authorisation numbers, material-wise buyers, volumes, prices and chain-of-custody audit.

Workforce pathway and behaviour change

Kabadiwala partners receive hands-on onboarding in the digital workflow and in handling a wider range of recyclable materials. For consumers, verification, ratings, GPS visibility and digital records are intended to address safety and reliability concerns. After each transaction, the customer reportedly receives an environmental impact statement covering indicators such as trees, landfill diversion, emissions and water. The submission also reports that higher-volume partners can form small teams.

Partnerships and operating roles

Kabadiwalas are positioned as verified business partners rather than only pickup labour. Households and businesses provide segregated recyclable material; local operators replicate the model in partner-led cities; regional facilities sort and document material; and downstream recyclers or manufacturers purchase recovered outputs. The submission reports 500+ corporate and institutional clients and 100+ authorised recyclers.

Monitoring

Digital records reportedly cover the customer request, pickup, weight, payment, partner earnings, centre intake and recycler dispatch. This could support transaction-level monitoring of material flows and partner activity. However, audit controls, data reconciliation, reporting periods and independent validation are not described. Reportedly, there have been 100+ authorised recycler relationships, and 500+ corporate clients.

Reported reach and outcomes

Indicator	Reported value
Material handled	45,000+ MT since inception
Kabadiwala network	5,000+ digitised; 900+ directly engaged through structured onboarding or higher-tier partnership
Users and business clients	4 lakh+ platform users; 500+ corporate and institutional clients
Women	150+ reported as employed or engaged; role and employment status are not specified
Partner earnings	Reported increase from INR 10,000-15,000 to INR 35,000-40,000 per month among onboarded kabadiwalas
Processing and offtake	Five facilities; 25,000 sq. ft.; 100+ reported authorised recyclers

Evidence boundary: *The figures are self-reported.*

Financial and revenue model

1. Primary revenue: margins on recovered material sold to recyclers or manufacturers, plus corporate and institutional collection contracts.
2. Capital support: the submission selects self-funding and impact or venture investment but does not identify investors, amounts or terms.
3. Partner income: kabadiwalas reportedly earn material-sale margins and receive digital payments; commission rates and net earnings after transport or operating costs are not stated.
4. Financial evidence needed: revenue mix, transaction value, processing and logistics costs, facility economics, payment flows and the meaning of the selected user-fee option.

Challenges and response

Three constraints are described: kabadiwala mistrust of digital systems, household safety concerns and the difficulty of maintaining consistent service across in-house and partner-led cities. The reported responses include hands-on onboarding, faster digital payments, partner verification, ratings, GPS visibility, standardised training and an in-house technology platform.

Sustainability and pathway to scale

The model is designed to sustain operations through transaction volumes rather than recurring grants. Core-city operations establish the playbook, while partner-led operators extend it to new locations. Replication requires sufficient recyclable volumes, partner density, verified weighing and payment processes, sorting capacity, compliant storage and transport, stable recycler demand, working capital and data-quality controls.

Transferable lessons

1. Design technology for the kabadiwala's business needs, not only for customer convenience.
2. Link digital transactions to verified physical material flows and downstream buyers.
3. Separate platform reach, active partners and directly supported workers in reporting.
4. Measure net livelihood change and material recovery by cohort, city and waste stream.

Contact person	Email	Website
Anurag Asati	anurag@thekabadiwala.com	https://www.thekabadiwala.com/

Plastic Lao, Compost Pao

Ayya Waste Management | Panaji, Goa | 2025 pilot; scale-up preparation reported for 2026

RECYCLABLES RECOVERED	COMPOST DISTRIBUTED	DIRECT REACH
Approx. 15 t reported in 2025	**Approx. 10 t; CCP-sourced**	**1,000+ people reported**
EDUCATIONAL INSTITUTES	DIGITAL ENGAGEMENT	PHYSICAL MODEL
15+ reported	**About 250,000+ reported**	**Dona Paula shed + outreach stalls**

Case in brief

Plastic Lao, Compost Pao is an incentive-based exchange model that links two material streams. Citizens bring clean, dry plastic or other accepted recyclables to Ayya Waste Management's Dona Paula shed or temporary outreach stalls. Staff inspect, weigh and record the material, then offer compost, cash of equivalent value, or a combination as the reward. The collected dry material is stored and routed to authorised recyclers. During the 2025 pilot, the compost was sourced from the Corporation of the City of Panaji (CCP), packed partly in donated quick-commerce bags and distributed through the exchange. This creates a practical link between plastic segregation and compost use, but the two streams remain operationally distinct: Ayya did not use a composting technology in the 2025 exchange, and participant-produced compost buy-back is described as a future or expanding pathway rather than a quantified pilot result.

Problem and circularity opportunity

Panaji's limited land availability increases the value of reducing mixed waste and recovering materials before they enter centralised systems. The submission identifies inconsistent segregation, contamination of dry recyclables and continued transport of organic waste as key gaps. Plastic Lao, Compost Pao uses a tangible reward to make segregation worthwhile for citizens, while placing compost in households, gardens and community spaces. The model's circularity rests on verified downstream recycling of the collected material and productive use of the distributed compost - not on the exchange transaction alone.

Implementation footprint

The exchange was anchored at Ayya's Dona Paula shed, reported as open daily from 9:00 AM to 1:00 PM and 3:00 PM to 5:00 PM. Additional outreach was conducted at the Panaji Municipal Market on 9 August 2025 and through a Ganesh

Chaturthi stall at the Panaji Municipal Garden from 27-31 August 2025. Schools, colleges, religious institutions, RWAs and community groups were also engaged, although the submission does not list the individual institutions.

Delivery architecture

- **Ayya Waste Management:** programme design, collection-point operation, weighing and records, community mobilisation, incentive redemption, temporary storage and recycler linkage.
- **Corporation of the City of Panaji:** municipal partner and reported source of the compost distributed during the pilot.
- **Rotaract and community partners:** event and volunteer support; schools, colleges, RWAs, religious institutions and community groups host outreach and promote segregation.
- **Authorised recyclers:** receive collected dry material for downstream recycling;

Actual pilot versus proposed scale-up

Status	Scope
Reported in 2025	Manual inspection, weighing and logbook/Excel records; low-tech exchange; CCP-sourced compost; reused packaging; physical events and 12 social-media posts.
Proposed / Pilot	Buy-back of surplus compost from participating institutions; IoT composting bins, sensors, automated mixing, mobile application, real-time GHG estimates, carbon credits and replication through RRR Centres.

How the 2025 exchange model operated

The case study supports the following low-technology operating sequence. It does not establish a formal processing line, category-wise sorting system or complete chain-of-custody protocol.

- **Citizen segregation and delivery.** Participants separated clean, dry plastic or other accepted recyclable material and brought it to the Dona Paula shed or a temporary outreach stall.
- **Visual inspection.** Ayya staff checked the incoming material for contamination. Direct interaction at the exchange point was also used to explain segregation and composting practices.
- **Weighing and recording.** Accepted material was weighed and entered in a physical logbook or Excel sheet.
- **Choice of incentive.** Participants selected compost by weight, cash of equivalent value, or a combination of the two.
- **Compost distribution.** The compost distributed during the pilot was sourced from CCP. Ayya reports using donated quick-commerce bags for some packaging.
- **Temporary storage.** The collected recyclable material was stored at the exchange operation before being sent onward.
- **Recycler linkage.** Ayya states that the collected material was channelled to authorised recycling facilities.

Transaction and outreach monitoring. The team tracked plastic collected, compost distributed, participants and campaign activities through the logbook, Excel sheet and social-media analytics.

Review and learning. Feedback from the shed, market and festival events identified inconsistent participation, contaminated material and packaging limitations, informing changes proposed for the next phase.

TWO LINKED FLOWS	Dry material moves from citizen to Ayya to an authorised recycler. Compost moves from CCP to Ayya to the participant. The exchange connects these flows economically and behaviourally, but it does not by itself prove a closed material loop.

What was not part of the 2025 pilot

Ayya explicitly states that no technology was used during the 2025 run. IoT-enabled composting bins, moisture and temperature sensors, automated mixing, a mobile application, real-time GHG estimates and carbon-credit generation are future ideas. The submission also envisions buying surplus compost from participating institutions.

Reported results and evidence status

Indicator	Submission
Recovered material	Approx. 15 tonnes in 2025
Compost distributed	Approx. 10 tonnes in 2025
Direct reach	1,000+ people
Institutions	15+ educational institutes
Digital outreach	About 250,000+ engagement; 12 posts
Behaviour change	Improved segregation and compost adoption claimed
Closed loop	Exchange and authorised recycler pathway described
Livelihood result	Improved waste-worker income selected
Climate result	Quantified GHG reduction selected

Financial and operating model

The form identifies the pilot as self-funded. The narrative states that sale of recovered recyclables and compost supports routine operations, while grants, CSR and government partnerships would be required for larger outreach and digital development. The model also pays cash incentives and distributes compost, creating direct costs that must be reconciled against material value. No rupee figures were supplied for material sales, compost procurement or sale, incentive payouts, staffing, transport, storage, packaging, IEC or administration. Carbon credits are a future possibility, not current revenue. Publication should therefore describe the finance model as an emerging mixed-revenue design rather than a proven self-sustaining enterprise.

Sustainability and replication

The exchange is operationally simple and can use an existing shed, temporary stalls or an RRR Centre. Replication depends on predictable compost supply, clear exchange rates, a market for sorted materials, adequate storage, authorised recycler access, contamination control, recurring working capital and transparent transaction records. Ayya reports that revenue currently covers routine operations but that scale requires external support. The 2026 phase should first demonstrate viable unit economics and material traceability in Panaji before expanding to other Goa municipalities or adding smart composting technology.

COMPENDIUM FIT	The case has a clear circularity proposition: a locally accessible exchange improves dry-material recovery while using compost as a behavioural and material incentive. Its strongest publishable evidence is the reported 2025 pilot scale. Claims of a fully closed loop, financial self-sufficiency, livelihood improvement and quantified climate impact require additional documentation.

Contact Person	Email	Website
Aarushi Doshi	aarushidoshi9@gmail.com	https://www.awm.co.in/

From Plastic Waste to Circular Livelihoods: PoshBag and Hunar in Baramulla

Conserve India | Chinar YUVA Centre, Baramulla, Jammu & Kashmir | February 2023-ongoing

PLASTIC UPCYCLED **More than 4,600 kg**	DIRECT PARTICIPANTS **65 people**	COMMUNITY REACH **1,500+ people**
ENTERPRISE PATHWAYS **PoshBag and Hunar**	SWACHHAGRAHIS **20, included within the 65**	CLIMATE ESTIMATE **About 12 tCO2e avoided***

Case in brief

Conserve India's Baramulla initiative links local plastic-waste recovery with vocational training, product manufacturing and micro-enterprise development. Operating from the Chinar YUVA Centre, the model uses two complementary enterprises: PoshBag upcycles flexible LDPE into recycled plastic sheets and stitched lifestyle products, while Hunar converts rigid HDPE, polypropylene and polystyrene into moulded utility and gifting products.

The intervention was initiated in February 2023 with support from HDFC Bank Parivartan and later expanded through SBI Foundation's Livelihood and Entrepreneurship Accelerator Programme. The Indian Army provides the local institutional platform through the Chinar YUVA Centre. Conserve India reports that more than 4,600 kg of plastic has been recovered and upcycled, 65 people have been directly engaged and more than 1,500 community members and stakeholders have been reached through awareness activities.

The linked waste and livelihood challenge

1. **Low-value plastic flows:** locally generated flexible and rigid plastics had limited segregation, processing and value-addition pathways within the district.
2. **Limited enterprise opportunities:** women and youth faced gaps in market-oriented skills, production infrastructure, business support and access to buyers.
3. **Training-to-income gap:** conventional skilling could stop at course completion without connecting participants to equipment, products, quality systems or sustained markets.
4. **Border-district context:** mobilisation and continuity required trusted local institutions, security coordination and repeated community engagement.

Two complementary upcycling enterprises

Enterprise	Material and processing route	Product pathway
PoshBag	LDPE processed through Conserve India's Handmade Recycled Plastic (HRP) sheet-making technology	Sheets are cut, stitched and finished into fashion and lifestyle products
Hunar	HDPE, PP and PS processed through a compact injection-moulding system	Moulded daily-utility products and a sustainable gifting range

Partnership architecture

Fig: Products

1. **Conserve India:** programme design, technology, training, production systems, product development, monitoring and market linkages.
2. **HDFC Bank Parivartan and SBI Foundation:** CSR support for the PoshBag and Hunar pathways, including infrastructure, machinery, skills and enterprise development.
3. **Indian Army:** production space, infrastructure, logistics, mobilisation and operational continuity through the Chinar YUVA Centre under Operation Sadbhavana.
4. **Local ecosystem:** district and municipal authorities support coordination; Swachhagrahis support collection and preliminary segregation; trained participants undertake production and enterprise activities.

Plastic-to-product operating sequence

The submission describes one shared material-recovery and enterprise system with two polymer-specific processing routes.

1. **Source plastic waste.** Community collection networks, Swachhagrahis and municipal linkages bring locally generated material into the programme.
2. **Receive and record.** Waste-processing and production registers are used to track programme activity and material handled.
3. **Segregate the feedstock.** Plastic is separated by polymer type, colour and processing suitability so flexible and rigid streams enter the appropriate pathway.
4. **Clean, wash and dry.** Contamination is removed and material is prepared for safe and consistent processing.
5. **Prepare the material.** The sorted plastic is reduced or conditioned as required for sheet-making or injection moulding.
6. **Process by polymer pathway.** LDPE is converted into HRP sheets; HDPE, PP and PS are processed through compact injection moulding.
7. **Manufacture and finish products.** Sheets are cut and stitched, while moulded items are trimmed and finished into saleable fashion, lifestyle, utility and gifting products.
8. **Check quality and package.** Finished products undergo quality review before storage, packaging and dispatch.
9. **Sell and learn from the market.** Direct sales, exhibitions, customised orders, institutional procurement and corporate gifting create feedback for product and enterprise development.

MATERIAL BOUNDARY	The model does not process mixed plastic as a single feedstock. Separation by polymer and processing suitability is central to product quality.

Facility and production controls

Fig: Presenting recycled products at forum

1. **Shared operating base:** the Chinar YUVA Centre combines training, production and enterprise incubation in Baramulla.
2. **Dedicated work areas:** the facility includes material storage, processing, training and finished-product storage spaces.
3. **Technology assets:** plastic-processing machinery, moulds and supporting equipment enable sheet production, injection moulding and product finishing.
4. **Quality discipline:** participants are trained in material identification, machine operation, finishing, quality control, inventory and packaging.
5. **Market orientation:** product development, branding, exhibitions and institutional outreach are treated as part of the production model, not as separate end-stage activities.

Skills-to-enterprise progression

Participants move from orientation and material identification to segregation, cleaning, machine operation, supervised manufacturing, finishing and quality control. Training also covers branding, inventory management, entrepreneurship and market engagement. This sequence is intended to move beneficiaries beyond one-time skilling towards participation in locally anchored production and enterprise operations.

Monitoring and adaptation

Conserve India reports using beneficiary records, attendance sheets, donor reports, production registers, waste-processing records and documentation of machinery, product development and market engagement. Reviews with participants, Swachhagrahis, the Indian Army, municipal stakeholders and technical partners are used to adjust mobilisation, waste sourcing, training and production practices.

Reported results and evidence status

Result area	Reported result	Evidence boundary
Plastic upcycled	>4,600 kg of LDPE, HDPE, PP and PS	Cumulative total.
Direct engagement	65 beneficiaries	Includes 20 Swachhagrahis;
Awareness reach	1,500+ community members and stakeholders	Activity-level and unique-participant methodology not supplied
Production systems	Two enterprises: PoshBag and Hunar	Product list provided;
Sales and livelihoods	Sales channels and enterprise opportunities established	Revenue, wages, and income change not quantified
Climate outcome	About 12 tCO2e avoided	Indicative estimate based on project emission factors; not directly measured or independently verified

Financial and revenue model

CSR support from HDFC Bank Parivartan and SBI Foundation financed infrastructure, machinery, moulds, equipment, technical training, product development and enterprise support. The submitted establishment cost is approximately ₹70-80 lakh. A similar replication is estimated at ₹60-75 lakh, depending on local infrastructure, technology and production capacity.

1. **Revenue channels:** direct product sales, exhibitions and fairs, customised orders, institutional procurement and corporate gifting.
2. **Recurring costs:** waste collection and preparation, electricity, artisan remuneration, maintenance, consumables, packaging, quality control, marketing and delivery.
3. **Sustainability proposition:** product revenue is expected to progressively support operating expenses, incomes, maintenance and reinvestment; the current level of cost recovery is not reported.
4. **Not part of the model:** no carbon-credit revenue, tipping fees or user charges are reported.

What supports replication

1. **Reliable feedstock:** segregated and sufficiently clean LDPE, HDPE, PP and PS streams linked to community and municipal collection systems.
2. **A stable operating institution:** a trusted production and training facility with space, utilities, logistics and continuity.
3. **Appropriate technology and skills:** polymer-specific machinery, moulds, trained operators, quality systems and maintenance support.
4. **Enterprise leadership and markets:** locally managed groups, product development, working capital, institutional buyers and recurring demand.

Contact person	Email	Website
Shubham Prakash	shubham@conserveindia.org	https://conserveindia.org/

Dapodi Material Recovery Facility: A Women-Led Model

Centre for Youth Development and Activities | Dapodi, Pune | Commissioned 4 November 2024

CORE SERVICE **550 households, wet + dry**	EXPANDED DRY-WASTE REACH **More than 3,000 households**	DRY WASTE **30-35 tonnes/month**
WET WASTE **About 350 kg/day**	WOMEN ENGAGED **8 SHG members**	RECYCLABLES REVENUE **₹1.5-1.75 lakh/month***

**Estimated from 30-35 tonnes sold monthly at an average realisation of about ₹5,000 per tonne.*

Case in brief

The Dapodi Material Recovery Facility (MRF) was established to replace open dumping and mixed-waste disposal in the Anandwan and Katewasti settlements with source segregation, daily collection, local processing and women-led livelihoods. The core service covers approximately 550 households with wet and dry waste collection; dry-waste collection has subsequently expanded to more than 3,000 households.

Women from local Self-Help Groups collect waste by push cart, operate the segregation and composting systems and participate in recyclable sales. Dry material is separated into specific output streams and compacted for local recyclers; wet waste is processed through vermicomposting, NADEP beds and a mechanical composter. The model combines municipal infrastructure, NGO-led mobilisation, CSR support and market linkages within a single community facility.

The service gap before the intervention

1. **Mixed waste and open dumping:** households disposed wet and dry waste in open spaces and drains, undermining recycling and composting.
2. **Irregular last-mile collection:** dense informal settlements lacked a dependable, locally adapted collection system.
3. **No local recovery facility:** recyclable plastics, paper and metals were scavenged or sold as low-value mixed scrap, while organic waste went unprocessed.
4. **Livelihood exclusion:** women and informal workers had limited access to recognised waste-management roles, stable income and worker-safety systems.

Coverage model

Catchment	Households	Service	Reported throughput
Core Anandwan-Katewasti	About 550	Regular wet and dry collection	About 350 kg wet waste/day; dry waste included in facility intake
Expanded dry-waste network	>3,000	Dry-waste collection	Up to about 2 tonnes on collection days; 30-35 tonnes/month

Implementation partnership

1. **PCMC:** land, electricity, water, SHG honoraria and municipal enablement.
2. **CYDA:** community mobilisation, household awareness, SHG formation and training, and day-to-day operational support.
3. **Aker Solutions:** financial and technical support to the Zero Waste Management Project.
4. **TrashTech Pvt Ltd:** digital monitoring, recyclable pricing, buyer linkages and revenue realisation.
5. **Women's SHGs:** collection, segregation, composting and participation in dry-waste sales, with the Vaishnavi Mahila Bachat Gat prominently involved.

Collection-to-recovery operating sequence

1. **Mobilise households.** CYDA and local women conduct door-to-door awareness on separating wet and dry waste and using simple household bins.
2. **Collect segregated waste.** SHG members use push carts for the core 550-household daily collection system; the wider network supplies additional dry waste.
3. **Record service and intake.** On-ground records and the TrashTech dashboard track coverage, collection volumes, efficiency and environmental estimates.
4. **Inspect and micro-segregate.** Material is manually sorted on a dedicated bed so clean organic matter and recoverable dry streams enter separate processes.
5. **Sort dry output streams.** The submission lists plastics, paper, copper, general scrap, snack/wrapper packaging, white paper, and sanitary/diaper waste; the sanitary stream is not sold as a recyclable.
6. **Compact recoverable dry waste.** Suitable plastics, paper, metals and scrap are compressed for storage, transport and sale to local recyclers.
7. **Process clean organic waste.** Wet waste is routed through vermicomposting, NADEP beds and a mechanical composter to produce compost.
8. **Handle sanitary waste separately.** Sanitary and diaper waste is directed to a dedicated incinerator rather than recycling or composting lines.
9. **Move outputs into use.** Dry recyclables are sold; compost is currently used locally, with potential for future sale to nurseries, urban farms or municipal green spaces.

Input-output and destination map

Input stream	Processing	Output	Current destination / boundary
Recoverable dry waste	Manual sorting + dry-waste compressor	Separated and compacted recyclables	Sold to local recyclers through market linkages
Clean wet / organic waste	Vermicomposting, NADEP and mechanical composter	Compost	Used locally; sale is proposed but not yet reported
Sanitary and diaper waste	Separate sanitary incinerator	Combustion residue and emissions	Consent, emission controls, operating records and ash disposal were not supplied
CIRCULARITY BOUNDARY	The demonstrated circular outputs are sale of segregated dry recyclables and local use of compost. Sanitary-waste incineration is a separate disposal function and should not be counted as material recovery.		

INDIA SANITATION COALITION
BUILD • USE • MAINTAIN • TREAT

Facility, safety and operating controls

Fig: Dapodi Plant

1. Infrastructure: PCMC land with a segregation bed, dry-waste compressor, mechanical composter, vermicomposting and NADEP beds, and a sanitary incinerator.
2. Worker protection: gloves, boots, masks, reflective vests and safety orientation are reported for SHG operators.
3. Appropriate technology: the model relies on manually operable, locally maintainable equipment rather than capital-intensive automation.
4. Quality control: micro-segregation is used to keep organic feedstock cleaner and improve the value of recovered dry material.

Monitoring and course correction

TrashTech's digital platform reportedly tracks household coverage, dry- and wet-waste volumes, collection efficiency and environmental estimates, alongside daily facility records. SHG attendance and income are also tracked. CYDA, PCMC and TrashTech jointly review operating indicators.

Reported results and evidence status

Result area	Reported result	Evidence boundary
Core collection	550 households receive wet and dry service	Frequency is described as daily;
Dry-waste expansion	>3,000 households	275 establishments, 45-50 schools and >20,000 people are also claimed in the form but not reconciled in the detailed case narrative
Dry throughput	30-35 tonnes/month; about 2 tonnes on collection days	Monthly figure is internally consistent.
Wet throughput	About 350 kg/day	Cumulative measured compost yield not mentioned
Landfill diversion	About 490-550 tonnes/year	Calculated from reported dry and wet throughput
Women's livelihoods	8 women engaged with honorarium income	-
Climate outcome	900-1,050 tCO_2e/year from recycling + about 32 tCO_2e/year from composting	Factor-based estimate

Revenue and operating-cost position

Dry recyclables are reported to realise an average of approximately ₹5,000 per tonne. At 30-35 tonnes per month, estimated revenue is ₹1.5-1.75 lakh against monthly OPEX of about ₹3.2 lakh. Recyclables therefore cover approximately 47-55% of operating costs, leaving a monthly gap of about ₹1.45-1.70 lakh. This gap is currently bridged through the PCMC-CYDA-TrashTech partnership.

1. **Current revenue:** sale of segregated plastics, paper, copper and general scrap to local recyclers.
2. **Cost base:** SHG honoraria, equipment maintenance, consumables and logistics.
3. **Unmonetised output:** compost is used locally; no compost sales revenue is reported.
4. **Capital requirement:** the submission does not provide the facility's capital cost or an estimated replication cost.

Sustainability and replication conditions

1. **Municipal enablement:** land, utilities, honorarium support and formal integration of SHG-run MRFs into the city system.
2. **Community operations:** a trained women's group with safety systems, dependable collection routines and clear operating responsibility.
3. **Market performance:** transparent buyer linkages, better per-tonne realisation, compost monetisation and sufficient throughput to spread fixed costs.
4. **Technical compliance:** maintenance plans, compost-quality monitoring and documented sanitary-incinerator approvals, emission controls and residue disposal.

Compendium relevance and publication priorities

The Dapodi MRF is a strong example of a public-private-community model that combines source segregation, women-led operations, material recovery, local organic-waste treatment and measurable revenue performance in an informal-settlement context.

Contact person	Email	Website
Mr Pravin Jadhav	pravin.jadhav@cydaindia.org	https://cydaindia.org/

Plastic-Free Chhindwara: Enforcing the Single-Use Plastic -SUP Ban

Fusion Waste Management and Consultancy Pvt. Ltd. | Chhindwara, Madhya Pradesh | 2022-23

CITY COVERAGE	POPULATION REACH	REUSE INFRASTRUCTURE
48 wards reported	**276,840 people reported**	**20 Thaila/Bartan Banks**
SCHOOLS / INSTITUTIONS	MARKETS / COMMERCIAL	REUSE TRANSACTIONS
50+ reported	**50+ reported**	**Not reported**

Case in brief

Plastic-Free Chhindwara combined access to reusable alternatives, behaviour-change communication and municipal enforcement to reduce single-use plastic (SUP). Chhindwara Municipal Corporation (CMC), with technical support from Fusion Waste Management and Consultancy, established 20 Thaila/Bartan Banks that make reusable cloth bags and utensils available for shopping, community functions, social gatherings and public events. Door-to-door outreach, rallies, street plays and stakeholder consultations sought to reduce demand, while inspections, warnings, seizures and fines addressed prohibited supply and use. The intervention is best understood as a prevention-and-reuse model rather than a plastic-processing project: its circular value depends on products completing repeated issue-use-return cycles.

Problem and circularity opportunity

CMC identified persistent use of disposable plastic by consumers, vendors, retailers and other market actors, alongside limited access to convenient reusable alternatives. Enforcement alone would not remove the practical reasons for continued consumption. The intervention therefore paired regulation with a visible reuse service: citizens could obtain cloth bags or utensils from community-facing banks, while IEC explained the environmental effects of SUP and promoted responsible consumption. This shifts the focus upstream in the waste hierarchy - preventing disposable items from entering the municipal waste stream - rather than relying only on downstream collection and recycling.

Three-part implementation model

Component	Function in the SUP-reduction model
1. Alternatives and reuse	Twenty Thaila/Bartan Banks provide access to reusable cloth bags and utensils at strategic city locations.
2. IEC and participation	Door-to-door campaigns, rallies, street plays, audiovisual material, pamphlets, displays, meetings and discussions engage households, schools, markets, workers and municipal actors.
3. Enforcement	CMC and the Regional Office of the State Pollution Control Board inspect establishments and markets, identify violations, seize prohibited items, issue warnings and impose applicable fines.

Delivery roles

CMC is the municipal implementation and enforcement authority. Fusion Waste Management and Consultancy provided technical support. The Regional Office of the State Pollution Control Board supported enforcement. NGOs, SHGs, Mohalla Committees, elected representatives, NSS volunteers, students, schools, vendors, traders, manufacturers, recyclers and citizens were mobilised for awareness and participation. The submission does not identify which entities operated individual banks, owned the reusable inventory, cleaned utensils, managed deposits or fees, or maintained transaction records.

Thaila/Bartan Bank and enforcement operating sequence

Stage	Operating activity / control	Circular output or evidence
1. Policy and product mapping	Identify prohibited SUP items, applicable enforcement provisions and the reusable alternatives required by local users.	Defined scope for IEC, banks and inspections.
2. Stakeholder consultation	Consult residents, consumers, vendors, sellers, manufacturers, recyclers and community organisations on current practices and willingness to shift.	Demand and implementation inputs.
3. Hotspot and site selection	Place banks near markets, high-footfall locations, wards, institutions or event venues. Twenty strategic locations are reported, but not listed.	Accessible reuse points.
4. Inventory mobilisation	Procure or mobilise cloth bags and reusable utensils; define ownership, item codes, opening stock and replenishment rules.	Reusable assets ready for circulation; quantities not supplied.
5. Bank operation	Make items available to citizens for shopping, gatherings and events. Record user, item, quantity, issue date and any deposit or fee.	Issued reusable products; access terms not reported.
6. Use cycle	Users replace disposable carry bags or tableware with the issued alternatives during the intended activity.	Avoided use of SUP per completed service cycle.
7. Return and reconciliation	Receive items, record returns and overdue/lost/damaged stock, and reconcile physical inventory with the issue register.	Measured return rate and reusable stock balance; process not described.
8. Inspection and cleaning	Check bags and utensils for damage or contamination; wash, disinfect and dry food-contact utensils using a documented hygiene protocol.	Safe stock for reissue; protocol not supplied.
9. Reissue or retirement	Return serviceable items to circulation; repair where feasible and record the authorised endpoint for items that can no longer be used.	Multiple reuse cycles and documented end-of-life routing.
10. IEC mobilisation	Use door-to-door contact, rallies, street plays, audiovisual material, pamphlets, displays, meetings and group discussions.	Awareness of the ban and available alternatives.
11. Market engagement	Sensitise vendors, retailers, traders and manufacturers; explain prohibited products, alternatives and compliance expectations.	Demand- and supply-side behaviour change.
12. Inspection planning	Prepare establishment and market routes, trained teams, checklists and an enforcement schedule with CMC and the Pollution Control Board.	Consistent, risk-based enforcement.
13. Compliance inspection	Inspect sale, storage, distribution and use; document establishment, item, quantity, date and evidence of any violation.	Traceable compliance record.

Stage	Operating activity / control	Circular output or evidence
14. Corrective action	Issue warnings, seize prohibited stock and impose applicable fines or penalties under authorised procedures.	Deterrence and recorded action; counts and values not reported.
15. Seized-stock routing	Securely store, weigh and route seized plastic through an authorised recovery or disposal channel with chain-of-custody records.	Documented endpoint; not described in the submission.
16. Performance review	Review bank transactions, return rates, SUP avoided, hotspot compliance, seizures, penalties, complaints and costs; adjust locations and outreach.	Evidence-led course correction and expansion.

Minimum records and safeguards

Control area	Minimum evidence required
Bank ledger	Site, opening stock, issues, returns, deposits/fees, losses, damage, cleaning, reissues, purchases and closing stock by product type.
Hygiene and safety	Cleaning standard for utensils, potable-water requirement, drying/storage controls, damaged-item rejection, staff PPE and user guidance.
Enforcement register	Inspections, establishments, prohibited items, seized quantity/weight, warning or penalty, fine amount, storage and final endpoint.
Impact measurement	Baseline SUP use, completed reuse cycles, estimated disposable items/weight avoided, cost per cycle and documented calculation assumptions.

Reported results

Indicator	Submission
Municipal reach	48 wards and 276,840 people reported
Reuse infrastructure	20 Thaila/Bartan Banks
Institutional reach	50+ schools/institutions; 50+ markets/commercial; industries 0/NA
Awareness and training	Multiple IEC channels and capacity building reported
SUP prevention	Reduced dependence and increased adoption claimed
Enforcement	Inspections, warnings, seizures and fines reported
Material circularity	Tonnage, waste-to-wealth and closed-loop outcomes selected
Livelihood and revenue	Improved worker income and recovered-material revenue selected
Climate result	Quantified GHG reduction selected

Financial and operating model

The form identifies government financing or a government scheme as the support source and describes the intervention as an activity-based model, but the financial/revenue response is 'NA'. The case should therefore be presented as a municipally supported public-service and behaviour-change intervention, not as a demonstrated revenue-generating circular enterprise. A credible sustainability assessment requires the cost of reusable inventory, bank setup,

Fig: Thaila Bank

cleaning, staff, IEC, enforcement, losses and replenishment; the source and annual value of municipal funding; any deposits, rental/user fees or fines; and the party responsible for each recurring cost. Fine income should be treated as an enforcement instrument rather than the core business model.

Sustainability and replication

The model can be replicated by an urban local body when enforcement is paired with convenient alternatives and accountable community partners. Long-term operation depends on assigning each bank an operator, securing recurring funds, maintaining hygienic and adequate inventory, recording issue-return cycles, integrating IEC into routine ward and school programmes, and sustaining fair enforcement. Expansion to additional wards or hotspots should follow evidence of demand, high return and reissue rates, lower SUP consumption, manageable cost per use and reduced violations. The questionnaire identifies limited replicability as its second-ranked challenge.

Contact Person	Email	Website
Amit Mishra	amitmishra@fwmc.in	http://www.fwmc.in/

Smart Sort

Green Worms Waste Management Pvt Ltd | Palakkad and Thrissur, Kerala | Continuing since 2024

TRAINING **40+ sessions reported**	INSTITUTIONS **36 LSGs covered**	WORKFORCE **1,200+ HKS members trained**
SORTING KNOWLEDGE **20+ material categories**	THRITHALA RECOVERY **5–6 tonnes/month**	THRITHALA SALES **₹50,000 - ₹60,000/month**

Case in brief

Smart Sort is a practical capacity-building programme that helps Kerala's Haritha Karma Sena (HKS) workers convert collected dry waste into higher-value recyclable fractions. Green Worms trains workers at Material Collection Facilities (MCFs) to identify more than 20 material categories; distinguish plastic polymers and other recoverables; prevent contamination; handle, store and aggregate materials safely; and connect sorted fractions to authorised recycling markets. Local Self Government Institutions (LSGs) mobilise the workforce and provide the operating platform, while HKS members apply the learning through collection and manual sorting. Thrithala Grama Panchayat provides the submission's clearest site example, with a reported 5–6 tonnes of recyclables segregated per month and ₹50,000–₹60,000 generated through material sales.

Why advanced sorting was needed

Kerala's decentralised waste system had created a collection network through HKS, but many participating LSGs still sorted dry waste into only a few broad categories. Mixed or contaminated fractions lost market value, recoverable material was missed, and workers had limited knowledge of polymers, storage standards and recycler requirements. The result was lower recovery and weaker income potential despite regular household and commercial collection. Smart Sort addresses this last-mile knowledge and market gap without replacing the existing public collection system.

Intervention proposition

- **Worker-centred technical training:** real materials and live demonstrations build identification and safe-handling skills that can be used immediately at the MCF.
- **Value-based segregation:** workers learn that PET, HDPE, LDPE, PP, multilayer packaging and other materials have different quality requirements and prices.

- **Existing-infrastructure model:** the programme uses HKS collection systems, MCF space and LSG oversight, limiting the need for new capital assets.
- **Market-linked recovery:** Green Worms connects prepared fractions with authorised recyclers so that improved sorting can translate into sales.
- **Continuous reinforcement:** field visits, refresher inputs and mentoring support the shift from one-time training to routine practice.

Specific case: Thrithala Grama Panchayat

Dimension	Submitted evidence
Reported operating result	HKS members segregate approximately 5–6 tonnes of recyclable materials each month.
Reported financial result	Monthly recyclable sales of ₹50,000-₹60,000; this is a Panchayat-level sales figure, not documented individual take-home income.
Change described	A Panchayat with limited systematic segregation adopted more scientific category-wise sorting after Smart Sort training.

Delivery partnership

Actor	Role in the model
Green Worms	Training design and delivery, technical mentoring, monitoring and recycler or market linkages.
LSGs	Identify need, coordinate implementation, mobilise HKS members and support MCF operations.
HKS members	Collect, inspect, identify, sort, store and prepare recyclable fractions for sale.
Households and businesses	Improve source segregation and hand over cleaner dry waste.
Recycling companies	Purchase compliant material fractions and return them to production value chains.

From training need to recycler dispatch

Stage	Activity / technical content	Output and circular function
1. LSG selection	Green Worms and the local body identify MCFs or HKS teams requiring technical support in segregation and material recovery.	Target site and participant cohort.
2. Baseline discussion	Existing collection, sorting practices, common contamination, storage constraints and market gaps are reviewed with workers and officials.	Training priorities adapted to local conditions.
3. Structured orientation	Classroom inputs explain circularity, worker safety, contamination control, recycler requirements and the link between quality and material value.	Shared technical and economic understanding.
4. Material identification	Participants handle real samples and learn more than 20 categories, including PET, HDPE, LDPE, PP, multilayer plastics, paper, cartons, metals and textiles.	Ability to distinguish saleable fractions.
5. Interactive practice	Games, storytelling, quizzes, demonstrations and question-and-answer sessions simplify polymer and quality concepts across literacy levels.	Improved participation and retention.
6. Household collection	HKS members collect dry recyclable waste from households and commercial establishments and reinforce source-segregation messages.	Dry-waste feedstock delivered to the MCF.

Stage	Activity / technical content	Output and circular function
7. Reception and inspection	Incoming material is checked for moisture, food residue, non-recyclables and hazardous contamination before detailed sorting.	Contamination identified and safer workflow established.
8. Category-wise sorting	Workers manually separate material by polymer, product type, quality and recycling value rather than retaining only broad mixed categories.	Cleaner, more marketable recyclable fractions.
9. Cleaning and preparation	Fractions are cleaned where necessary and prepared to meet buyer quality requirements.	Reduced contamination and improved sale potential.
10. Safe storage	Sorted materials are stored separately to preserve quality and accumulate dispatchable quantities.	Protected category-wise inventory.
11. Market linkage	Green Worms' network supports dispatch and sale to authorised recycling companies.	Waste-to-wealth transaction and material return to production.
12. Follow-up and correction	Field visits, procurement data, worker feedback, review meetings and refresher training address recurring identification or operating gaps.	Practice sustained and training refined.

Material-quality framework

Material group	Sorting and quality requirement
Plastics	Separate PET, HDPE, LDPE, PP and multilayer packaging; distinguish polymer and product forms; keep fractions dry and free of food residue.
Fibre-based material	Separate paper, cardboard and cartons by grade and contamination; protect from moisture during storage.
Metals and other recyclables	Keep metals, textiles and other recoverables distinct according to buyer acceptance and local market value.
Rejects / unsafe material	Remove non-recyclables and hazardous contaminants from saleable fractions; endpoint and reject quantities are not described in the submission.

TECHNICAL BOUNDARY	Smart Sort is not a new processing plant or digital sorting technology. Its technical intervention is worker capability: more precise manual identification, contamination control, safe storage and market-aligned aggregation within existing MCFs. Final reprocessing occurs downstream at authorised recycling facilities.

Monitoring and course correction

The submission identifies training sessions, participants, recyclable procurement, segregation quality, income improvements and participant feedback as core indicators. Green Worms uses field visits, refresher training and periodic reviews to reinforce practice.

Reported results and evidence status

Result area	Submitted result
Programme sessions	More than 40 training sessions
Institutional coverage	36 LSGs
HKS participants	More than 1,200 members
Indirect reach	3,000+ people
Thrithala recovery	Approximately 5–6 tonnes/month
Thrithala sales	₹50,000-₹60,000/month
Kadavallur and Vallappuzha	Improved segregation and income reported
Climate outcome	Reduced landfill disposal, burning and virgin-material demand claimed

Financial and livelihood model

The immediate economic mechanism is higher-value recyclable sales: detailed segregation can increase the quantity recovered, improve quality and allow more fractions to be sold at better prices. HKS members operate within existing LSG collection and MCF systems, while Green Worms provides training and market links. The questionnaire identifies the programme as self-funded and reports zero per-household deployment cost, but it also acknowledges expenditure on trainers, materials, travel, monitoring and technical support. It does not explain Green Worms' revenue or fee arrangement, who bears training costs, how sale proceeds are allocated, or whether ₹50,000–₹60,000 is gross revenue, net surplus or worker income. These distinctions are essential for demonstrating livelihood enhancement.

Sustainability and replication

Smart Sort scales by improving an existing workforce and facility network rather than building new infrastructure. A replication package would identify an LSG and MCF, assess existing waste categories and buyers, train HKS members with real materials, establish category-wise storage and authorised recycler linkages, and follow performance through procurement and income records. Its low capital requirement is an advantage, but sustained results depend on source segregation, storage space, market demand, local-body oversight, refresher training and transparent distribution of material-sale income.

Contact Person	Email	Website
Shameer PT	shameer@greenworms.org	https://www.greenworms.org/

Circular economy Model in Rural Area

Institute of Development Management | Hardoi, Uttar Pradesh | Seven villages | Since 2021

VILLAGE INFRASTRUCTURE 7 RRCs operational	**WASTE MANAGED** 530 tonnes reported	**ORGANIC INPUTS** 514 tonnes processed by composting
DRY RECOVERY 16 tonnes for recycling	**SERVICE REACH** 1,813 households; >30,000 people	**CLIMATE RESULT** 226 tCO_2e estimated avoided

Case in brief

The Swachh Gram Pariyojna established a decentralized solid-waste service chain across seven villages in Hardoi district. Households segregate wet and dry waste; sanitation workers collect it door to door and transport it to village Resource Recovery Centres (RRCs). Wet waste and cow dung are processed through aerobic composting, while dry material is sorted, stored and sent to authorised recyclers. The model combines physical infrastructure with Gram Panchayat oversight, Village Level Swachhata Committees (VLSCs), trained sanitation workers and sustained community engagement. Recovered outputs are returned to productive use through compost for agriculture and recyclable sales; circularity is further demonstrated through recycled-plastic benches and tyre-based waste-to-art installations.

Why the intervention was needed

Before implementation, waste was openly dumped on streets, vacant land and in drains, creating Garbage Vulnerable Points and risks of blocked drainage, pollution and vector-borne disease. Existing RRCs were in poor condition and largely non-functional, with little segregation, composting or scientific processing. Limited household awareness, irregular collection and weak community participation prevented the villages from converting waste into useful material.

Service model

- Household level: source segregation of wet and dry waste and participation in door-to-door collection.
- Village operations: sanitation workers collect waste and operate the RRCs using SOPs and basic equipment.
- Processing: aerobic composting of wet waste and cow dung; sorting, storage and recycling of dry waste.
- Circular use: agricultural application or potential sale of compost, sale of recyclables and visible reuse installations.

- Institutional anchor: VLSCs and Gram Panchayats support planning, monitoring, O&M and community mobilization.

Institutional responsibilities

HCL Foundation provided financial and strategic support. IDM led project planning, implementation, technical guidance, capacity building and monitoring. Gram Pradhans, Panchayat Sachivs and VLSCs supported local planning, mobilization and oversight. Sanitation workers handled collection, segregation and RRC operations, while women's groups, schools, youth volunteers and residents reinforced source segregation and cleanliness practices. The intervention complements Swachh Bharat Mission (Gramin).

Operation and processing sequence

Stage	Technology / activity	Function and output
Source segregation	Households separate wet and dry waste	Reduces mixing and prepares each material stream for the appropriate recovery route.
Primary collection	Door-to-door collection by sanitation workers	Moves household waste into the formal village service chain.
Conveyance	Transport from households to the village RRC	The questionnaire classifies processing as off-site because treatment occurs away from the point of generation.
Reception and sorting	Secondary segregation at the RRC	Separates organics from dry recyclable fractions and removes unsuitable material.
Organic processing	Aerobic composting of wet waste and cow dung	Stabilises organic material and creates a soil-resource pathway for agriculture.
Dry-material recovery	Sorting by recyclable category	Recovers saleable materials from the dry-waste stream.
Storage	Temporary storage within the RRC	Consolidates dry material until sufficient quantity is available for dispatch.
Market linkage	Transport and sale to authorised recyclers	Returns recovered dry material to recycling and generates limited operating revenue.
Recovered-output use	Compost directed to agriculture; dry recyclables sold	Returns recovered material to productive use and supports a limited revenue stream.
Circular demonstrations	Ten recycled-plastic benches and tyre-based waste-to-art installations	Makes resource recovery and reuse visible within the villages.

RRC OPERATING PLATFORM	Five existing Resource Recovery Centres were renovated and all seven were made operational. The model reused village infrastructure to limit capital cost and relied on trained sanitation workers, basic equipment, clear SOPs, capacity building and continuous field monitoring.

Reported input-output flow

Material stream	Reported quantity	Recovery route
Household wet waste	39,000 kg	Processed through composting
Cow dung	475,000 kg	Processed through composting
Dry recyclable waste	16,000 kg	Recovered and sent for recycling
Total scientifically managed	530,000 kg	Sum of the three reported streams

Waste removed from public spaces

Cleanup pathway	Reported quantity
Garbage Vulnerable Points	226,580 kg removed
Village drains	14,429 kg removed
Regular street sweeping	101,860 kg collected
REUSE AND CIRCULARITY	**Organic inputs are composted for agricultural use; dry recyclables are sold into formal recycling; ten recycled-plastic benches were installed at village RRCs; and discarded tyres were converted into waste-to-art installations. The questionnaire does not quantify finished compost, actual agricultural use or compost revenue.**

Outcomes, sustainability and replication

Result area	Reported achievement
Coverage	Seven villages; 1,813 households; >30,000 people reported as reached
Resident benefit	>20,000 residents reported as directly benefiting from improved services and cleaner surroundings
Infrastructure	Five RRCs upgraded and all seven village RRCs operational
Material recovery	530 tonnes scientifically managed through composting and recycling
Estimated climate result	Approximately 226 tCO_2e avoided using conservative emission factors
Circular revenue	Approximately INR 20,000 generated from recyclable-material sales

Behaviour change as an operating input

The technical system was reinforced through 60 VLSC meetings, 32 flash-mob campaigns, 11 capacity-building programmes, school sessions, cleanliness drives, rallies and village events. More than 15,000 community members were engaged. These activities were used to improve segregation, discourage dumping and burning, and build the participation required for regular collection and RRC operations.

Financial and O&M model

CSR funding supported the intervention. The main operating costs are collection, sanitation-worker salaries, RRC operation and maintenance, transport of recyclables, IEC, equipment maintenance and monitoring. Reuse of existing RRC infrastructure reduced capital requirements. Recyclable sales have generated about INR 20,000; compost sales are identified as a potential additional stream. VLSCs, Gram Panchayats and trained sanitation workers are expected to sustain daily operations, with Panchayat support and recovered-material revenue contributing to O&M.

REPLICATION LOGIC	The model can be transferred where Gram Panchayats can provide or rehabilitate an RRC, organise segregated collection, assign sanitation workers, create composting and dry-storage space, link recyclables to authorised buyers and maintain community oversight through a VLSC.

Challenges addressed

- Household resistance: sustained IEC, school engagement, rallies, flash mobs and Panchayat-led communication supported behaviour change.
- Non-functional infrastructure: five RRCs were repaired and all seven were brought into operation.
- Collection and worker adoption: training, SOPs, basic equipment and field monitoring supported regular service delivery.

Contact Person	Email	Website
Tauseef Raza	idm.operations@globalschool.edu.in	https://idm.org.in/

Dumad Circular Waste Management Model: A Village-Level Circular Economy Solution for Climate Action

Kachare Se Azadi Foundation | Dumad, Savli, Vadodara, Gujarat | Continuing since April 2021

HOUSEHOLDS 1,360+ covered	POPULATION 5,000+ residents reached	ORGANICS 84 tonnes/year processed
DRY RECYCLABLES 4 tonnes/year recovered	LIVELIHOODS 6 jobs + 5 workers integrated	CLIMATE CLAIM 57.5 tCO_2/year reduction

Case in brief

Kachare Se Azadi Foundation (KSAF), with Dabke Eco Solutions LLP and Gram Panchayat Dumad, operates a village-scale system that keeps four household waste streams separate and assigns each a defined route. Wet waste is treated locally in Rocket Composters and composting pits to produce compost and compost tea; dry waste is sorted, prepared and sold through a village Material Recovery Facility (MRF); sanitary, domestic hazardous and non-recyclable reject waste is sent through authorised collection and disposal systems. The intervention combines household behaviour change, decentralised organic processing, centralised dry-waste recovery, market linkages and local livelihoods in one peri-urban service model.

Why Dumad needed an integrated system

Dumad is a fast-growing peri-urban village with more than 5,000 residents in approximately 1,360 households. Before the intervention, mixed disposal constrained collection and recycling and increased reliance on dumping and landfill. Organic waste from households, vegetable markets and community spaces decomposed in the open, creating odour, vectors and methane. Plastics, paper, glass, metals, multilayer packaging and textiles were lost in mixed waste or recovered informally under unsafe conditions. Source-segregation awareness was limited, and waste workers had little access to stable work, safety measures or formal recognition.

What makes the model distinct

- **Dual processing architecture:** organic waste is treated close to source while recyclable dry waste is consolidated at a village MRF.
- **Two organic outputs:** Rocket Composters and pits produce solid compost and nutrient-rich compost tea for soil applications.

- **Market-linked recovery:** sorted recyclables are cleaned, stored or baled according to buyer requirements and sent to authorised recycling industries.
- **Social integration:** six direct jobs are reported, alongside the integration of five informal workers into MRF sorting operations.

Implementation footprint and roles

Stakeholder	Reported role
KSAF + Dabke Eco Solutions LLP	System design, implementation, technology, capacity building, monitoring and market or replication support.
Gram Panchayat Dumad	Local institutional support, implementation oversight and monitoring.
Households, schools and community	Source segregation, participation in IEC, feedback and local ownership.
Waste and sanitation workers	Separate collection, transport, composting, MRF sorting, weighing, baling, storage and records.
CSR and market partners	Early-stage infrastructure or awareness support and downstream recycling linkages.

FIRST-YEAR COST	The case study estimates ₹2,000–₹2,500 per household in year one, covering awareness, the collection system, infrastructure and processing facilities.

Collection, processing and circular return sequence

Stage	Activity / technology	Output and circular function
1. Behaviour change	Door-to-door visits, village meetings, school sessions, demonstrations and cleanliness drives explain four-way segregation.	Household participation and cleaner inputs.
2. Source segregation	Households separate wet, dry, sanitary and domestic hazardous waste before collection.	Two identifiable streams; reduced cross-contamination.
3. Separate collection	Trained sanitation workers use designated door-to-door collection vehicles and keep streams separate.	Segregated loads retained through transport.
4. Reception and recording	Daily records and waste-quantity assessments track collection and movement to the relevant processing route.	Operational data for monitoring and audits.
5. Organic treatment	Wet waste is processed locally in Rocket Composters and composting pits within the village.	Biodegradable input stabilised without long-distance hauling.
6. Organic outputs	Processing yields organic compost and nutrient-rich compost tea; production quantity and conversion yield are not reported.	Solid and liquid soil inputs.
7. Local use or sale	Compost and compost tea are reported as used or marketed for farms, nurseries, gardens, landscaping and plantations.	Nutrients returned to soil; revenue stream described but not quantified.
8. Dry-waste sorting	At the MRF, trained workers sort paper, cardboard, plastics, metals, glass, textiles, multilayer packaging and other recyclables.	Category-wise material fractions.
9. Preparation	Depending on buyer requirements, recyclables are cleaned, weighed, stored and baled.	Lower contamination and dispatch-ready inventory.
10. Recycler dispatch	Prepared fractions are sold and transported to authorised recycling industries.	Materials re-enter manufacturing value chains.
11. Controlled disposal	Sanitary waste, domestic hazardous waste and non-recyclable rejects are kept separate and channelled to authorised systems.	Risk-managed endpoint for non-circular fractions.

TECHNICAL PLATFORM	The organic route combines village-based Rocket Composters with composting pits. The MRF provides sorting platforms, category-wise storage, weighing systems, baling facilities and transport linkages. Operations require trained personnel, separate collection, routine maintenance, utilities, PPE, records, buyer coordination and authorised outlets for residual streams.

Circular pathways and system boundary

Input	Village process	Output	Next destination
Wet / biodegradable	Rocket Composter + composting pits	Compost + compost tea	Gardening, landscaping and agriculture
Dry / recyclable	MRF sorting, cleaning, weighing, storage and optional baling	Separated recyclable fractions	Authorised recycling industries
Sanitary / hazardous / rejects	Separate collection and channelisation	Controlled residual stream	Authorised disposal; route not detailed

Monitoring and operating controls

Daily records reportedly cover collection, source segregation, transport, MRF operations, compost and compost-tea production, and recyclable recovery. Segregation audits and quantity assessments are used to identify gaps. KPIs include participating households, wet and dry waste collected, recovered materials, organic outputs, landfill diversion, estimated GHG reductions, jobs and awareness events. KSAF, Panchayat representatives, workers and partners review progress through periodic meetings.

Reported performance and evidence status

Result area	Submitted result	Interpretation
Coverage	1,360+ households; 5,000+ residents	Reported current reach
Organic processing	Approximately 84 tonnes/year	Reported input processed; not compost output
Dry recovery	Approximately 4 tonnes/year	Reported MRF recovery; no material breakdown
Direct employment	6 jobs across collection, composting, transport and processing	Reported;
Informal integration	5 workers engaged in sorting and MRF operations	Reported;
Organic products	Compost and compost tea produced, used and marketed	
Climate outcome	52.5 tCO_2/year from organics + 5 tCO_2/year from plastics	Self-reported estimate;
Behaviour and cleanliness	Segregation widely accepted; dumping, littering and burning reduced	Qualitative claim;
Replication	Manjusar, Baska, Kunpad and Asoj named	Replication claimed; dates, scale and results absent

Revenue and operating model

The highlighted business model combines sales of sorted recyclables, compost tea and compost with service contracts, consultancy, technical support, training, exposure visits and other decentralised waste-management assignments. CSR support helped fund early infrastructure and community awareness. Reported operating costs include personnel, collection and transport, IEC, utilities, monitoring, processing, and maintenance of Rocket Composters, MRF equipment and facilities. Diversification is presented as the route to self-sustainability, but the case studies has not shared actual revenue, price, sales volume, cost-recovery ratio, household user fee, profit or worker-income data. Financial viability therefore remains an operating proposition rather than a quantified result.

Partnerships, sustainability and replication

Partners named are KSAF, Dabke Eco Solutions LLP, Gram Panchayat Dumad, community members, schools, academic institutions, recycling industries and CSR organisations including Apollo Tyre, Polycab, L&T Services, BT Water Treatment, Axtel, Schurter Electronics, Nisol and Seal For Life. Sustainability depends on continued four-way segregation, Panchayat oversight, trained operators, equipment maintenance, reliable authorised buyers and viable sales or service income. Replication uses modular collection, local organic processing and a village MRF adapted to settlement size and local markets. Dumad is described as a Centre of Excellence hosting exposure visits; the number of visits and visitors is not reported.

Challenges addressed

- **Household adoption:** mixed-disposal habits and irregular segregation were addressed through repeated IEC, demonstrations, schools and community feedback.
- **Operational discipline:** worker training, monitoring and defined routes were used to maintain segregation through collection, transport, composting and MRF operations.
- **Early financial stability:** CSR support and diversified revenue streams were used while recyclable and compost-tea markets developed.

Contact Person	Email	Website
Kachare Se Azadi Foundation Dr. Suneet Dabke	ksafoundation21@gmail.com	https://conceptbiotech.org/

From Waste to Wealth: Transforming Organic Waste into Community Assets at Silverdale Apartment, Bengaluru

PBK Waste Solutions Private Limited / Daily Dump | Bengaluru, Karnataka | Product-led community composting model

BUSINESS MODEL **Sale of composters and support products**	**CORE OFFERING** **Gaia bulk composters**	**DESIGN CAPACITY** **18 kg/day per Gaia pair**
PROCESS **Passive aerobic hot-pile composting**	**TARGET CUSTOMERS** **Apartments and institutions**	**PORTFOLIO REACH** **96,000+ homes; 800+ institutions**

Case in brief

PBK Waste Solutions Private Limited, operating through the Daily Dump brand, is a technology solution provider that designs and sells decentralised composting products. Its community proposition is built around Gaia—modular bulk organic-waste converters purchased by apartments, offices, resorts and institutions to process segregated kitchen and garden waste on their own premises. Product sales are supported by demonstrations, site-appropriate product selection, installation, hands-on training for housekeeping staff, segregation materials, operating consumables and troubleshooting. Silverdale Apartment in Bengaluru is presented as one deployment of this product-and-service model: the RWA owns the infrastructure and trained staff operate it, while Daily Dump supplies the technology and implementation support. The intervention at Silverdale directly serves approximately 228 households, representing around 900–1,000 residents, and enables 100% source segregation and on-site processing of the community's biodegradable waste.

The problem at Silverdale

Before the intervention, kitchen waste was mixed with other municipal waste and transported outside the apartment for disposal. This increased dependence on external collection, used transport capacity and removed organic nutrients from the local cycle. At the disposal endpoint, biodegradable waste could contribute to landfill accumulation, leachate and methane. The intervention was designed to prevent that loss by combining reliable household segregation, on-site treatment and community management.

What makes the model distinct

- **At-source circularity:** organic waste is processed where it is generated, avoiding an additional wet-waste transport and disposal step.
- **Passive aerobic design:** internal 'breathing towers' support airflow without electricity; no routine mixing, stirring or shifting is specified.
- **Modular capacity:** additional Gaia or Aaga units can be added as daily organic-waste generation increases.

- **Operator accessibility:** housekeeping staff can run the process after hands-on training; ergonomic access supports compost harvesting.
- **Behaviour embedded in infrastructure:** resident engagement, segregation rules and staff routines are treated as part of the solution, not as optional outreach.

Community composting platform: Gaia and Aaga

Product	Published capacity	Design / operating format	Published harvest cycle
Gaia 800	1 unit handles 18 kg/day	1 composter + base; breathing towers; no mixing	First harvest ~3 weeks; then every 2 weeks
Aaga 550	1 pair handles 18 kg/day	Use in pairs/series; breathing tower; no mixing	First harvest ~4 weeks; then every 2 weeks

PRODUCT DESIGN	**Both are UV-stabilised, roto-moulded plastic, outdoor aerobic hot-pile composters. Internal air channels support passive aeration; daily waste is layered with Remix Powder; electricity, stirring and shifting are not required. Units can be added in series as waste generation grows. However for the intervention at Silverlade, only Gaiga was deployed**

What the customer receives

TSP component	Role in the solution
Technology	Gaia composter selected and sized to the site's daily wet-waste generation.
Implementation	Product demonstration, installation support and a workflow for segregation, collection, loading and harvesting.
Capacity building	Awareness sessions for residents and hands-on operating training for housekeeping staff.
Supporting products	Remix Powder, household or common bins, collection implements, communication material and other accessories.
After-sales support	Troubleshooting guidance, helpline support, product warranty and replacement parts for manufacturing defects.

Roles at the Silverdale deployment

Daily Dump supplies the product, implementation guidance and training. The RWA procures the system, communicates with residents and oversees performance. Residents segregate kitchen waste. Housekeeping staff collect or receive the organic stream, remove contamination, load the composter, add Remix Powder, monitor conditions and harvest compost. Gardeners or other users return mature compost to soil. The submission does not report Silverdale's household count, product quantity, actual daily input or compost use.

Monitoring and course correction

The submission describes daily staff oversight of segregation, loading, moisture, bulking-medium addition and composting progress; RWA review of system performance; and periodic Daily Dump site visits or remote troubleshooting. Residents and staff receive repeated demonstrations when contamination or process problems recur. A publishable monitoring sheet should capture households participating, kilograms received each day, contaminants removed, amendment used, unit loaded, harvest date, wet and dry compost weight, end use, downtime, complaints and corrective action.

From product selection to compost return

Stage	TSP / customer activity	Commercial or circular output
1. Lead and site assessment	The apartment or institution identifies a wet-waste problem; daily generation, available outdoor space, staff and compost-use options are assessed.	Basis for choosing and sizing the product.
2. Product configuration	Daily Dump recommends Gaia units at a published design basis of 18 kg/day per system; additional units can be added in series.	Customer-specific equipment configuration and quotation.
3. Purchase and installation	The customer buys the composting equipment and required accessories; units are placed outdoors in a well-ventilated location.	Customer-owned decentralised processing infrastructure.
4. Segregation system	Residents separate wet, dry, toxic and reject waste; bins, communication material and collection routines reinforce the system.	Clean organic feedstock and separate downstream streams.
5. Resident and staff training	Demonstrations build community acceptance; housekeeping staff receive hands-on training in collection, loading, moisture control, hygiene and harvesting.	Local operating capability and defined accountability.
6. Daily collection and inspection	Cooked food, peels, leftovers, tea leaves, coffee grounds, eggshells and garden organics are collected; visible non-compostables are removed.	Prepared organic-waste batch.
7. Loading and layering	Waste is added daily and covered with adequate Remix Powder, a dry composting medium that helps manage moisture and odour.	Balanced feedstock inside the composter.
8. Passive aerobic decomposition	Breathing towers regulate airflow. Published directions do not require electricity, routine mixing, stirring or shifting.	Low-energy aerobic hot-pile processing.
9. Monitoring and support	Operators check moisture, odour, insects, hygiene, loading and progress; Daily Dump provides troubleshooting when operating problems persist.	Course correction and reduced nuisance risk.
10. Harvesting	Gaia's first harvest is indicated after about three weeks and Aaga's after about four weeks; both can then be harvested approximately fortnightly.	Compost output; actual Silverdale yield is unreported.
11. Return to soil	Mature compost is used in gardens, landscaping or farms. Daily Dump also states that it can pick up compost in Bengaluru and pay a small amount per kilogram.	Nutrients returned to soil and the biological loop closed.

Product-led business model and evidence status

Commercial element	How the TSP model works
Primary revenue	Direct sale of Gaia, Aaga and other composting products to households, RWAs, offices, resorts and institutions.
Recurring products	Remix Powder, compost microbes, cocopeat, bins, tools and other composting or collection accessories.
Implementation support	Demonstrations, product selection, installation, segregation design and resident or staff training; the website notes some accessories and services may cost extra.
After-sales relationship	Troubleshooting, helpline support, warranty fulfilment, replacement parts and potential repeat purchase as the customer adds modular capacity.
Customer value	On-site processing, no electricity requirement, reduced dependence on wet-waste transport, compost for soil and possible value from clean dry recyclables.

Reported performance: case versus company portfolio

Result area	Reported information
Silverdale deployment	Gaia-based on-site aerobic composting is described as continuing
Silverdale diversion	Organic waste processed on site and off-site transport reduced
Silverdale compost	Compost returned to soil
Gaia rated output basis	18 kg/day; equivalent to 6,570 kg/year at full daily use
Organisation-wide reach	96,000+ households and 800+ institutions across India
Organisation-wide climate	22,379+ tCO2e saved since 2006
Organisation-wide soil return	431+ tonnes of compost returned to soil since 2012

Sustainability and replication

The model scales through repeatable product sales rather than ownership of a central processing plant. A customer funds the equipment, allocates space and staff, and retains the compost and avoided-disposal benefit; Daily Dump earns through the equipment-and-support relationship. Replication requires a waste audit, a community champion, reliable segregation, an accountable operator, space with ventilation, a product configuration matched to actual kilograms per day, a supply of amendment and a defined compost outlet. Modular expansion and no electricity lower adoption barriers, while contamination, staff turnover, weak monitoring and absence of a compost-use plan remain key risks.

Contact person	Email	Website
Abdul Rasheed Khan	operations@dailydump.org	https://www.dailydump.org/

Sustainable Enterprise & Livelihood creation with Bio-enzymes natural cleaners

PraanaPoorna Collective Private Ltd | Karnataka and Haryana | Continuing since 2021

CITRUS WASTE **450 kg/month; about 5 t/year**	MICRO-UNITS **6 established; 4 reported active**	PEOPLE TRAINED **250 women across 10 SHGs**
ANNUAL OUTPUT **4 t sold + 1 t self-use**	PACKAGING REUSE **1,000 containers tracked**	CLIMATE ESTIMATE **710.7 kg CO2e avoided, FY 2022-23**

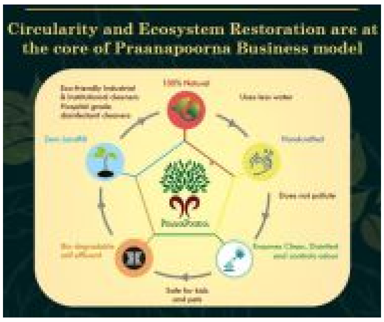
Case in brief

PraanaPoorna's Make & Market model converts locally available citrus peels and discarded fruit into bio-enzyme inputs for natural household cleaners, while training community groups to operate low-capital production units. The model links three circular pathways: organic by-products are used as production inputs; discarded containers from dry-waste centres are sanitised and reused; and the resulting cleaners are sold or used locally as alternatives to selected petrochemical-based products. Production is handcrafted at room temperature without heat or heavy machinery, allowing small units to be located close to raw-material sources and consumers. The enterprise model is intended to support women SHGs and other marginalised groups through technical training, branding, costing, quality control and market access.

Problem and circularity opportunity

Fruit markets and juice centres generate citrus residues that can enter mixed-waste streams, while conventional cleaners commonly depend on synthetic surfactants, acids and virgin plastic packaging. Community groups may have access to local raw materials but lack tested formulations, production systems, quality controls and reliable markets. PraanaPoorna addresses this gap through a distributed production model that uses citrus waste and plant-based inputs to make natural cleaners, reuses packaging, and builds micro-enterprise skills. Claims concerning reduced frothing, water saving and biodegradability are part of the product proposition; however, water-quality or water-saving results have not been quantified in the submitted evidence.

What makes the model distinct



- Waste-to-product link: citrus peels and discarded fruit become bio-enzyme inputs rather than being treated only as waste for disposal.
- Distributed production: small community units are designed to source, make, package and sell close to local markets.
- Low-equipment process: room-temperature fermentation and hand production avoid heat-intensive processing and heavy machinery.
- Packaging loop: discarded containers from dry-waste centres are disinfected, reconditioned and returned to use.

- Livelihood platform: training combines production skills with costing, label design, branding, compliance and route-to-market support.

Implementation footprint and partnerships

The initiative has recorded activity in Bengaluru, Orohalli, Hoskote and Kolar in Karnataka, and Jhajjar in Haryana. Partners include Saahas for an Orohalli rural SHG unit; Development Alternatives for an NRLM-linked cluster in Jhajjar; Amogh NGO for differently-abled participants; Diya Foundation and Grace Reform Trust for mothers of children with special needs; and Gift of TIME Foundation with Vacuum Tech for supply of natural cleaners to 50 government schools in Kolar. A 2021 transgender initiative supported through Gift of TIME Foundation ended in 2022. These partnerships have funded training, unit setup, product promotion, institutional supply or buy-back arrangements in different combinations.

Monitoring and technical safeguards

PraanaPoorna reports six months of handholding under an MoU with the group and sponsor. Monitoring includes weekly video calls, monthly site sampling and batch review, actual-cost calculations, MRP and label support, and laboratory testing approximately every six months. Samples are reported to have been submitted to NABL-accredited laboratories for antimicrobial efficacy and toxicity checks. The underlying laboratory reports, tested product variants, standards and validity periods were not included with the three submitted documents.

Operation and production sequence

Stage	Technology / activity	Circular output
1. Partner and cohort selection	Identify an NGO, SHG or community group; agree the training, production and market-linkage arrangement.	A local operator group and site plan for the micro-unit.
2. Feedstock sourcing	Source citrus peels or discarded fruit from fruit markets and juice centres; obtain jaggery and other locally used plant-based ingredients.	Organic by-products enter a productive value chain.
3. Preparation and fermentation	Place prepared citrus material, water and jaggery in fermentation vessels. Room-temperature aerobic fermentation in cool, dark spaces.	Raw fermented bio-enzyme base.
4. Natural bio-extraction	Use the fermentation process to obtain enzyme-rich extracts; product formulations also use soapnut and selected tree-derived ingredients as applicable.	Plant-based functional inputs containing flavonoids and saponins.
5. Blending	Process the local bio-enzyme and blend it with natural concentrate. The supplementary model specifies 95% local bio-enzyme and 5% concentrate for finished cleaners.	Standardised cleaner formulation for the intended use.
6. Container recovery	Collect discarded plastic containers from dry-waste centres, inspect them, disinfect them with prepared bio-enzyme and recondition them for reuse.	Recovered packaging suitable for refilling, subject to quality checks.
7. Filling and labelling	Fill in small batches; apply unit costing, MRP, product labels and local branding developed during training.	Finished floor, toilet and other natural-cleaning products.
8. Batch and laboratory checks	Review samples during monthly site visits, conduct weekly video follow-ups and send samples for laboratory testing about once every six months.	Batch approval and corrective action; external testing where undertaken.
9. Sale, self-use and market linkage	Supply local consumers or institutions, use products within the cohort, and route surplus through sponsor or commercial channels where an active arrangement exists.	Revenue, household savings or institutional use; channel varies by unit.

UNIT CONFIGURATION	**A standard community unit is reported to require about 100 sq. ft. and INR 100,000 in setup cost, with stated capacity up to 1,500 litres per month. The questionnaire separately describes this capacity as 1.5 tonnes per month. Typical inputs include fermentation vessels, mixing and filling tools, testing kits, safety gear, packaging space and simple inventory records. No heat or heavy machinery is required.**

Six-month Make & Market training pathway

Training phase	Content and enterprise purpose
Phase 1: capacity building (months 1-6)	Citrus-waste fermentation; bio-enzyme processing and blending; container sanitisation; small-batch packing; costing, MRP, label design, branding, inventory and hyper-local sales; regular handholding through site visits and calls.
Phase 2: enterprise and scaling	Standardise quality-control procedures; establish a licensed site and pursue relevant certifications; expand product processing and packing; and prepare capable units for contract manufacturing or wider market distribution.

Two routes for community production

Route	Operating model
Raw bio-enzyme supply	Community groups ferment and process raw bio-enzyme from local organic residues; the lower-complexity route is intended to create an early cash-flow pathway.
Local finished-product unit	The unit blends, bottles, brands and sells finished cleaner locally. Direct sales may be combined with surplus buy-back only where quality and a confirmed purchaser support it.

Circular outputs and reuse pathways

- **Organic by-product recovery:** citrus residues are converted into bio-enzyme inputs.
- **Packaging reuse:** discarded containers are inspected, disinfected and refilled, reducing demand for new packaging.
- **Local product use:** cleaners are sold, supplied to institutions or self-consumed. No treated-wastewater recovery or reuse is documented.

Reported results and circular value

Result area	Reported achievement
Organic material upcycled	About 450 kg/month of citrus peels or discarded fruit; supplementary note rounds this to 5 tonnes/year.
Units	Six production units established; four reported active at the time of the supplementary response.
Training	250 women across 10 SHGs trained. Four active units are reported to produce for self-consumption; the number of people currently producing is not stated.
Product output	About 4 tonnes/year of bio-enzyme or natural cleaners sold, plus 1 tonne/year for self-consumption.
Packaging reuse	1,000 reused or recycled bottles/containers reported; the tracking period is not specified.
Livelihood result	INR 100,000 per year reported, but the submission does not define whether this is aggregate revenue, group income, unit income or participant income.
Institutional reach	Natural cleaners supplied to 50 government schools in Kolar under a CSR-supported partnership.
Product portfolio	Floor and toilet cleaners are central to the livelihood model; the submission also identifies detergent, kitchen degreaser, disinfectant and other natural product applications.

Environmental impact evidence

Greenr's Environmental Impact Scorecard for FY 2022-23 estimates 710.7 kg CO_2e of emissions avoided through replacement of selected petrochemicals and avoidance of virgin HDPE packaging. The calculation uses company-reported sales, assumed conventional product formulations and third-party emission factors. It assumes consumers would otherwise have purchased an equal volume of conventional cleaner, with a separate replacement ratio for laundry detergent and shampoo. The scorecard is therefore an attribution estimate, not a direct measurement of emissions at the community units.

INTERPRETATION	**The avoided-emissions figure should not be read as a net carbon result. The same scorecard separately reports Scope 1, Scope 2 and selected Scope 3 emissions for PraanaPoorna's FY 2022-23 operations. Water savings, reduced chemical discharge and changes in frothing of water bodies were not quantified.**

Financial and livelihood model

CSR or sponsor funding supports beneficiary mobilisation, training, basic equipment, working capital, compliance and monitoring. At unit level, value is expected from direct sales, raw bio-enzyme supply, self-consumption and, where feasible, contract manufacturing or sponsor-linked procurement. The questionnaire records revenue from upcycled-product sales and reports a setup cost of INR 100,000 per unit. Market access remains decisive: PraanaPoorna notes that an earlier commitment to buy back output was stopped because of quality variation, while the supplementary proposal retains buy-back as an option for surplus stock under a future or partner-specific arrangement. The reported INR 100,000 annual livelihood figure needs a defined beneficiary and cost basis before it can be presented as income enhancement.

Sustainability and replication pathway

Replication requires a reliable citrus-waste catchment, a local community partner, a small production space, fermentation and packing equipment, six months of technical handholding, batch controls, applicable licences and a confirmed local market. PraanaPoorna states that a micro-unit can be established in about three months and that distributed production can raise capacity rapidly; these are model projections rather than independently demonstrated scale results. The strongest replication logic is hyper-local: keep raw-material sourcing, production, container reuse and sales close together, then expand only after product consistency and demand are established.

Implementation challenges addressed

- **Product consistency:** quality variation affected an earlier buy-back arrangement; regular sampling, batch approval and laboratory testing are the stated controls.
- **Market access:** direct marketing is difficult for SHGs, making sponsor procurement, local institutional demand and commercial partnerships important.
- **Enterprise readiness:** licensing, cost control, packaging and sustained mentoring are required before a trained group becomes a stable production business.

Contact person	Email	Website
Smitha Kamath	smitha@praanapoorna.com	https://praanapoorna.com/

FROM WASTE TO RESOURCE:
Decentralised composting for a circular economy via Jabor Mukto Jorhat initiative

Saahas | Jorhat, Assam | Launched July 2023

ORGANISATION **NGO/CBO; solid-waste work since before 2015**	MODEL **Urban, on-site segregation, collection and composting**	PROGRAMME REACH **2 wards in Phase I; 6 wards in Phase II**
REPORTED OUTREACH **15,000 households; 26,620 individuals**	ORGANIC PROCESSING **168 MT biodegradable waste processed**	TOTAL DIVERSION **2,092.5 MT municipal waste reported diverted**

Case in brief

Saahas launched Jabor Mukto Jorhat to reduce mixed waste reaching the Garmur dumpsite. The model combines doorstep engagement, source segregation, segregated collection and a portfolio of small composting systems adapted to neighbourhoods, apartment complexes, schools, temples and public institutions. Wet waste is treated near its source and the resulting compost is used mainly for gardening and landscaping at participating sites; dry and domestic hazardous waste are kept separate for municipal collection. The intervention therefore links behaviour change with local processing infrastructure and progressively assigned operation and maintenance responsibilities.

The urban waste challenge

Urban Jorhat approximately generates nearly 50 tonnes of municipal solid waste each day. Limited source segregation, gaps in collection infrastructure and a growing number of apartment complexes meant that much of the waste was transported in mixed form to Garmur. The dumpsite can be described the dumpsite as overburdened and can be associated with the prevailing system with pollution, public-health risks and concern about possible contamination of the nearby Bhogdoi River. Indiscriminate disposal at public locations created additional garbage-vulnerable points. With organic material reported to form 40-50% of the waste stream, the programme prioritised local wet-waste treatment alongside improvements in household practice.

Programme evolution and scope

Phase I (2023-24) engaged 2,500 waste generators across two wards through awareness campaigns, segregation drives and behaviour-change activities. Phase II (2024-25) expanded to six wards, strengthened door-to-door engagement and SHG-led collection, and added decentralised processing infrastructure.

Fig: Installation of a **cylindrical mesh lane composter** in a residential neighbourhood under the Jabor Mukto Jorhat initiative.

Circular or zero-waste models are two primary themes of the programme, and has recorded footprints at household, school, market, public-space, and community centres. It reports 20-29 schools or institutions, 50 or more market or commercial establishments and 1-9 industries or worksites reached, but does not detail the form of engagement.

Fig: Students participating in a live demonstration of **pipe composting** as part of school-based waste management awareness

About Saahas

Saahas is an NGO/community-based organisation with solid-waste work dating from before 2015. Its wider portfolio includes direct implementation, technology piloting, circular value-chain facilitation, research and evaluation, and policy advocacy. For Jabor Mukto Jorhat, Saahas led mapping, mobilisation, training, deployment and technical handholding with JMB and participating institutions.

How the model works

The intervention uses a common implementation sequence but varies the processing system by waste volume, available space and the institution responsible for daily operation.

- Map waste and select sites using baseline surveys, ward-level information, space availability and stakeholder willingness.
- Agree roles and secure approvals from JMB, RWAs, schools, temple committees or the Deputy Commissioner's Office, depending on the site.
- Build segregation practice through door-to-door IEC, community sessions, demonstrations and green-bin/blue-bin guidance.
- Keep dry and domestic hazardous waste separate for municipal collection; treat segregated wet waste on site with sawdust or dry leaves as the carbon source.
- Provide start-up handholding, weekly turning where required, surprise checks and refresher support before transferring routine responsibility to local operators.

Context-specific composting configurations

System	Indicative context and capacity	Operating arrangement
Mesh lane composter	Clusters of 75-100 households; about 16 sq. ft.; roughly 40 kg/day per unit	SHG or ULB sanitation workers collect segregated wet waste; locally available dry leaves provide carbon.
Apartment tank composter	Residential bulk generators; about 45 sq. ft.; 55-60 kg/day per unit	Housekeeping teams collect wet waste; sawdust is added and the material is turned weekly. Compost is used on site.
School pipe composter	Canteen or mid-day meal waste; about 1 sq. ft.; roughly 7 kg/day per unit	Students, teachers and support staff are trained through the Low Waste School Initiative.
Temple 'Divine' composter	Biodegradable ritual offerings; up to 10 kg/day per unit	Temple committees monitor segregation and routine operation to prevent non-biodegradable contamination.
Leaf composter	Schools, public spaces and government premises; 1-2 kg/day per unit	Processes leaf litter and supplies carbon-rich 'browns' for other composting systems.

Capacity note: All capacities and footprints are indicative figures reported by Saahas and have not been independently tested for this draft.

Behaviour change, partnerships and monitoring

Behaviour change precedes infrastructure. Residents, apartment associations, housekeeping staff, SHGs, students, teachers, waste workers and municipal officials participated in household visits, group meetings, demonstrations and refresher sessions. The submission reports capacity building for 29 waste workers on collection, segregation, occupational safety and standard operating procedures, alongside participation by around 200 volunteers and interns. Engagement platforms included the Saahasi Bondhu network, One Hour Impact campaign and Lead the Loop school programme.

JMB provided permissions, institutional coordination and field support; RWAs financed and managed apartment systems; SHGs supported awareness, collection and routine operation; schools, temples and public offices hosted and monitored units. Saahas and JMB officials conducted joint surprise visits using a checklist covering segregation, quantity processed, composting cycles and odour. Operational problems triggered corrective guidance, refresher training or municipal follow-up. Periodic reviews also examined compost use and potential expansion.

Reported results and emerging value

The project is estimated to have diverted 2,092.5 MT of segregated municipal solid waste from landfill through door-to-door collection, source segregation, and subsequent recovery and treatment pathways, based on household-level collection data and the assumed composition of different waste streams. This included approximately 1,255.5 MT of wet/biodegradable waste, of which 168 MT was processed through decentralized composting, while the remaining biodegradable waste was utilized as animal feed through gaushalas and piggeries, wherever feasible. Approximately 627.75 MT of dry waste was channelled through the Dry Waste Collection Centre (DWCC) and local recovery pathways, with recyclable material recovered for recycling and the non-recyclable fraction directed towards RDF/co-processing in cement kilns. A further 209.25 MT of domestic hazardous waste was separately collected and directed to a JMB-authorized incineration facility for safe disposal. It also records transformation of 48 garbage-vulnerable points, plantation of more than 210 trees and reduction of 52 kg of single-use plastic waste.

Reported outreach includes more than 15,000 households, 26,620 sensitised individuals, nearly 2,000 students and about 200 volunteers and interns. The submission describes improved adoption of source segregation across households and institutions, but does not provide a baseline/endline segregation rate. Twenty-nine waste workers were trained; no quantified change in their income or formal employment status is reported.

Financing and operation and maintenance

- CSR funding supported implementation and three of the 14 reported mesh lane composters; the CSR funder and total grant value are not named in the questionnaire.
- JMB reportedly funded 11 mesh lane composters at a combined cost of about INR 1 lakh. Apartment systems, financed by participating RWAs, cost about INR 30,000-60,000 depending on design and waste volume.

- Indicative installation costs are about INR 3,000 for a pipe composter and INR 10,000 for a Divine Composter. Costs for leaf units and recurring maintenance are not provided.
- RWAs report collective contributions of INR 4,000 per month towards waste collection workers. User fees also support collection and maintenance, while SHGs, housekeeping staff, schools and temple committees assume routine operating roles.
- Compost is mainly used on site. Surplus may be distributed or sold, but the submission does not document compost-sale revenue, quantified fertiliser savings or avoided municipal transport and disposal costs.

Challenges and course correction

The questionnaire ranks community resistance as the most significant challenge, followed by informal-sector integration and operational constraints. Field-level issues included finding suitable space, addressing odour and aesthetic concerns, maintaining segregation through the collection chain, preventing non-biodegradable contamination at temples and sustaining collection when user fees were low. Repeated engagement, practical training, joint monitoring and escalation to JMB officials were used to resolve problems and maintain local accountability.

Pathway to scale

The submission reports expansion of apartment composting from one to five complexes and community lane composting from three to eleven locations. The stated next step is to establish at least two composters in each of Jorhat's 19 wards; additional temples, schools and government residential quarters have expressed interest. Replication will depend on confirming site-level waste volumes, capex and O&M responsibilities, segregation quality and local operator capacity.

Transferable lessons

- Choose technology only after mapping waste, space and operator readiness.
- Build segregation behaviour before commissioning infrastructure.
- Share capital costs and assign O&M ownership at the point of use.
- Use joint municipal-community monitoring to identify and correct failures early.

Contact person	Email	Website
Aarti Sachdeva	aarti.sachdeva@saahas.org	https://saahas.org/

Worker-Friendly Dry Waste Collection Centre (DWCC)

Technology Informatics Design Endeavour (TIDE) | Chintamani, Karnataka | Initiated in 2025

DRY-WASTE CONTEXT About 7 TPD of 30 TPD municipal waste	BASELINE THROUGHPUT About 0.3 TPD at the old DWCC	DESIGN CAPACITY Up to 2 TPD after retrofit
WORKFORCE 5 women SHG operators	RECOVERY PROJECTION Up to 730 tonnes/year	CLIMATE PROJECTION About 308 tCO_2e/year avoided

Case in brief

TIDE and the Chintamani City Municipal Council (CMC) have retrofitted the town's existing Dry Waste Collection Centre into a semi-mechanised, heat-resilient and worker-friendly material recovery hub and benefiting around 28,571 people from the intervention. The intervention combines resource recovery with occupational welfare: dry waste is digitally weighed, conveyor-sorted, baled, stored and dispatched to authorised recyclers, while climate-responsive roofing, ventilation and dedicated WASH and rest facilities protect operators from heat stress. Five women from the Shri Muthu Mariamma Self-Help Group, formerly informal waste pickers with more than two decades of experience, operate the facility and are being integrated into the municipal system. The model shows how an underperforming municipal asset can be upgraded without constructing a new facility.

Why the retrofit was needed

Chintamani, with a reported population of nearly 92,000, generates about 30 tonnes of municipal solid waste each day, including approximately 7 TPD of dry recyclable waste. The town's only DWCC, established in 2015, processed only about 0.3 TPD because of inadequate space, obsolete equipment, limited manpower and poor working conditions. Recyclables were consequently lost to landfill or recovered inefficiently through informal channels. Workers faced high indoor temperatures, weak ventilation and inadequate rest, storage, sanitation and safety facilities, constraining both well-being and productivity.

What makes the model distinct

- Adaptive reuse: expands and upgrades an existing municipal asset instead of building a new centre.
- Worker-first climate resilience: heat-reduction, ventilation, WASH, rest and safety features are treated as operating infrastructure.
- Semi-mechanised recovery: conveyor sorting, baling and mechanical handling reduce manual effort and improve material quality.
- Digital traceability: an IoT-enabled scale records incoming and outgoing material for inventory and performance monitoring.
- Inclusive municipal operation: a women-led SHG operates the facility within a CMC-linked revenue and wage structure.

Heat-resilient and worker-welfare retrofit

Design component	Purpose and features
Thermal protection	Radiant-barrier roof insulation, heat-reflective or cool-roof coating and white roofing sheets reduce radiant heat gain.
Air movement	Turbo ventilators, industrial fans and improved natural ventilation reduce heat build-up in the sorting and storage areas.
WASH and welfare	Dedicated rest area, drinking-water dispenser, handwashing station, seating or lounge space, lockers and a gender-neutral toilet.
Safety and oversight	PPE, first-aid provisions, CCTV surveillance and safer mechanical handling support daily operations.

Fig: Heat resilient features inside the DWCC

Fig: Operations ongoing by the SHG members

Partnership and operating responsibilities

The demonstration forms part of an Integrated Water Management Programme funded by Germany's Federal Ministry for Economic Cooperation and Development (BMZ) through BORDA. TIDE led baseline assessment, business-model design, equipment procurement, retrofit integration, capacity building, monitoring and recycler linkages. The CMC provided the existing DWCC, undertook expansion civil works, supplies dry waste and is expected to maintain the asset. SHG members undertake sorting, weighing, baling, documentation, storage and safe material handling. Authorised recyclers and aggregators provide the downstream market for recovered fractions.

Collection, recovery and dispatch sequence

Stage	Technology / activity	Output and circular function
1. Municipal collection	CMC collection systems receive segregated dry waste from households, commercial establishments and public spaces.	Dry recyclable stream routed to the municipal DWCC.
2. Transport and reception	Collection vehicles deliver dry waste to the upgraded centre for controlled unloading.	Material enters a defined recovery facility rather than moving directly to disposal.
3. Inbound weighing	An IoT-enabled weighing scale records the quantity received; facility logbooks maintain supporting records.	Digital inflow data for accountability, inventory and planning.
4. Conveyor feeding	Waste is placed on a conveyor for a more organised and ergonomic sorting workflow.	Steady material movement and reduced repetitive manual handling.
5. Category sorting	SHG operators separate paper, plastics, metals, glass and multilayer packaging; contaminants or non-recoverable fractions are removed.	Cleaner, category-wise recyclable fractions with stronger market value.

Stage	Technology / activity	Output and circular function
6. Baling	High-volume materials such as PET bottles are compacted using a hydraulic baler.	Dense bales that require less storage and transport volume.
7. Internal handling	A pallet truck and semi-electric stacker move baled and sorted material more safely within the facility.	Reduced manual lifting and organised movement to storage.
8. Designated storage	Recovered fractions are stored separately until sufficient quantities are accumulated for sale and dispatch.	Protected inventory with less mixing and contamination.
9. Outbound weighing	Materials leaving the DWCC are weighed and recorded against the corresponding category and buyer.	Traceable dispatch quantities and transaction records.
10. Recycler dispatch	Sorted or baled materials are sold and transported to authorised aggregators or recyclers.	Recovered material re-enters recycling value chains; sale proceeds support the municipal operating model.

FACILITY PLATFORM	The upgraded DWCC is designed to process up to 2 TPD and acts as a pre-sorting centre for the municipality's future Material Recovery Facility. Its core equipment comprises a conveyor belt, hydraulic baler, IoT-enabled weighing scale, pallet truck and semi-electric stacker, supported by category-wise storage, electrical supply, PPE, CCTV and routine machinery maintenance.

Worker roles and formal-integration pathway

Five women members of the Shri Muthu Mariamma SHG are responsible for segregation, conveyor sorting, weighing, baling, record-keeping, storage and material handling. The questionnaire describes them as former informal waste pickers who are in the process of being formally integrated through the CMC; it does not establish that formalisation has already been completed. Revenue from recyclable sales is deposited with the municipality, which pays wages or honoraria to the SHG members. Training covers safe handling, machine operation, occupational health and safety, PPE and documentation.

Monitoring and operational controls

Control area	Monitoring mechanism
Material data	Daily IoT-scale and logbook records for inflow, recovered fractions, outbound dispatch and authorised buyers.
Performance	Dry waste processed, recovery rate, equipment utilisation, worker productivity and consistency of waste supply.
Worker environment	Indoor temperature monitoring to assess the effectiveness of the heat-resilient retrofit.
Course correction	Regular TIDE and CMC site visits plus meetings with SHG operators, municipal officials and recyclers.

Circularity boundary

The DWCC does not manufacture a new product or process wet waste. Its circular function is to preserve the value of dry recyclable materials through accurate weighing, category sorting, densification, protected storage and verified dispatch. Final recycling occurs downstream through authorised aggregators or recyclers.

Performance status and projected value

Result area	Reported value
Municipal waste context	About 30 TPD total waste, including around 7 TPD dry recyclables.
Old DWCC throughput	About 0.3 TPD before the intervention.
Upgraded capacity	Up to 2 TPD after expansion and equipment installation.
Annual material recovery	Approximately 730 tonnes of dry waste.
Climate outcome	Approximately 308 tCO_2e avoided annually.
Workforce	Five women SHG members operating the facility.
Material-sale revenue	Estimated at '50k-60k'.
Capital cost	Reported as INR 42,00,000/-

Financial and municipal ownership model

The primary operating revenue is the sale of sorted paper, plastics, metals and glass to authorised buyers. Baling and organised storage are expected to improve material quality, transport efficiency and sale value. The project proposes viability-gap funding for the first six months after commissioning to cover wages, electricity, equipment maintenance and recurring costs while throughput and buyer relationships stabilise. Sale proceeds are deposited in the CMC account. The CMC pays SHG wages or honoraria and also proposes reserving accumulated recyclable-sale revenue for post-handover O&M. The precise allocation mechanism, revenue period and sufficiency against actual operating costs are not yet provided.

Sustainability and replication pathway

Long-term operation depends on CMC ownership, regular supply of segregated dry waste, trained SHG operators, machinery maintenance, accurate transaction records and dependable authorised buyers. Replication in another small or medium ULB would begin with a waste-flow and facility assessment; retrofit an existing DWCC for thermal comfort and safe workflow; install right-sized sorting, weighing, baling and handling equipment; train an operator group; establish recycler agreements; and provide transitional finance until throughput and revenue stabilise. Limited additional land is an advantage, but electricity, storage, source segregation and municipal O&M support remain essential.

CLIMATE VALUE	The model combines mitigation and adaptation. Recovery and recycling can avoid landfill disposal and virgin-material production, while cool-roof, insulation and ventilation measures reduce worker exposure to extreme heat. The reported 730-tonne and 308-tCO_2e figures remain projections until actual operating records and the GHG calculation method are supplied.

Implementation challenges addressed

- **Retrofit delays:** tendering, re-tendering and monsoon disruption extended civil works; coordination with CMC was required.
- **Operating viability:** recyclable revenue alone may not cover early O&M, leading to a six-month VGF proposal and continued municipal support.
- **Feedstock quality:** inconsistent source segregation reduces the quantity and value of recovered material; IEC, worker training and collection improvements are the response.

Contact person	Email	Website
E Sasi Priya	sasi.priya@tide-india.org	https://tide-india.org/

Green Wari Maharashtra: Transforming a Sacred Journey into an Environmental Movement

TrashTech Pvt Ltd | Dehu–Pandharpur and Alandi–Pandharpur routes, Maharashtra | 7–24 July 2026

CAMPAIGN **18 days on two routes**	VOLUNTEERS **497 youth mobilised**	PLASTIC COLLECTED **7,139 kg reported**
COLLECTION TARGET **10,000 kg; 71% achieved**	ON-ROUTE REACH **1 million+ reported**	DIRECT SPEND **Approx. ₹1.50 lakh**

Case in brief

Green Wari Maharashtra 2026 was an 18-day, route-based plastic-recovery and behaviour-change campaign conducted during Maharashtra's Wari pilgrimage. TrashTech Pvt Ltd and the Green Youth Movement deployed youth teams along the Sant Tukaram Maharaj Palkhi route from Dehu and the Sant Dnyaneshwar Maharaj Palkhi route from Alandi, both terminating at Pandharpur. Volunteers collected bottles, food packaging and wrappers at roadsides, halts, camps and congregation areas; reinforced responsible disposal; and transferred recovered material through temporary hubs towards Material Recovery Facilities (MRFs) and recycling channels. The campaign reports 7,139 kg of plastic collected, 497 volunteers mobilised and more than one million people reached. It is the first field milestone of a proposed three-year movement.

Why the Wari required a mobile waste model

Lakhs of pilgrims move through towns and villages over several weeks, while host communities provide water and food at temporary service points. This produces a sharp, shifting load of single-use bottles, disposable cups, food packs and wrappers. Fixed municipal systems can be overwhelmed at high-footfall halts; unmanaged plastic accumulates along roads, temporary camps and fields and may enter drains and water bodies. The operational challenge is therefore temporal and geographic: collection capacity must move with the procession, concentrate at waste hotspots and connect each day's recovery to existing downstream infrastructure.

Intervention proposition

- **Mobile collection:** route-wise teams walked with the processions and focused collection at major halts, camps and congregation areas.
- **Volunteer-led behaviour change:** one-to-one conversations, street plays, placards and demonstrations linked cleanliness with devotion and collective responsibility.
- **Daily recovery chain:** plastic was moved to nearby hubs or MRFs for segregation, measurement, documentation, storage and onward recycling.
- **Shared delivery:** public agencies, Palkhi committees, colleges, civil-society organisations and corporate partners contributed permissions, people, safety inputs and logistics.
- **Recognition and continuity:** Green Champions and post-campaign volunteer reflection reinforced youth leadership and learning for subsequent years.

Specific implementation geography

Route / element	Coverage	Field setting
Sant Tukaram Maharaj Palkhi	Dehu to Pandharpur	Moving road corridor, pilgrimage halts, temporary camps and major gathering points.
Sant Dnyaneshwar Maharaj Palkhi	Alandi to Pandharpur	Moving road corridor, pilgrimage halts, temporary camps and major gathering points.
Operating window	7-24 July 2026	Eighteen changing daily locations over more than 200 km.

Delivery partnership

Actor group	Role reported in the campaign
TrashTech + Green Youth Movement	Campaign leadership, volunteer deployment, collection, coordination, monitoring and public communication.
Public authorities	PMC, PCMC and Zilla Parishad Pune supported coordination, logistics and links to existing waste systems.
Palkhi Sohala Committees	Integrated the environmental message and facilitated access to the moving pilgrimage system.
Institutions and civil society	Colleges and community organisations mobilised volunteers, outreach and route support.
Technical / corporate partners	AIILSG, Bisleri–Bottles for Change, Umicore, Terre des Hommes and others contributed safety, recovery or programme support.

From route planning to recycler hand-off

Stage	Activity / control	Output
1. Route and hotspot mapping	The two Palkhi routes, daily halts, congregation points, temporary camps and high-waste areas are mapped before deployment.	Coverage plan for a moving event.
2. Permissions and coordination	Organisers coordinate with Palkhi committees, municipal bodies, district administration, Traffic Police and local partners.	Authorised access and local support.
3. Volunteer registration	Youth are recruited through colleges, civil-society groups and partner networks; the campaign mobilised 497 volunteers.	Route-ready volunteer pool.
4. Orientation and safety	Volunteers receive guidance on waste handling, segregation, communication, personal safety and field responsibilities.	Common handling and conduct protocol.
5. Route-wise allocation	Teams, facilitators, collection supplies, transport, food and accommodation are assigned across changing locations.	Daily field deployment.
6. Awareness at source	Conversations, street plays, placards, banners and demonstrations encourage Warkaris and hosts to use responsible disposal points.	Cleaner handover and public participation.
7. Hotspot collection	Teams collect bottles, food packaging and wrappers from roadsides, halts, camps and congregation areas while walking with the procession.	Plastic removed from the public realm.
8. Transfer to hub / MRF	Collected material is consolidated and transported to temporary recovery hubs or nearby MRFs.	Daily feedstock aggregation.
9. Inspection and segregation	Plastic is separated from non-recyclables and sorted into recoverable fractions; detailed fraction standards were not submitted.	Cleaner recyclable streams.
10. Weighing and recording	Daily quantities and location performance are recorded through a digital application, supported by photographs and videos.	Operational data and course correction.
11. Temporary storage	Sorted material is held until an economic or logistically viable dispatch can be arranged.	Protected inventory for transport.

Stage	Activity / control	Output
12. Recycler hand-off	Recoverable plastic is reported as channelled to material-recovery and recycling systems.	Downstream recycling pathway initiated.
13. Daily monitoring	Teams review volunteers, route coverage, hygiene, safety, logistics, waste quantities and communications.	Problems corrected during the 18-day run.
14. Review and recognition	Volunteer evaluation captures lessons; Green Champions are recognised for leadership and sustained participation.	Learning retained for future Wari cycles.

Material flow and quality controls

Flow point	Submitted or required control
Input	Primarily drinking-water bottles, food packaging and wrappers collected from public-event spaces.
Preparation	Consolidation, removal of obvious non-recyclables, category-wise segregation, weighing, documentation and temporary storage.
Circular output	Recoverable plastic dispatched into recycling channels; no recycler-wise quantity, invoice, end product or recycled-output mass was submitted.
Rejects / safeguards	Contaminated or non-recyclable residues require a defined disposal endpoint; reject quantities, PPE protocol and incident data were not supplied.

TECHNICAL BOUNDARY	Green Wari did not itself manufacture recycled products or operate a new treatment plant. Its technical innovation was a mobile collection, segregation, data-tracking and logistics layer that connected a moving religious gathering to existing MRF and recycling infrastructure. The documented outcome is plastic collected; recycling completion still requires downstream receipts and end-market traceability.

Monitoring and course correction

Daily monitoring covered volunteer attendance, route coverage, waste collection, transport, hygiene, safety and media documentation. The digital application reportedly captured daily waste quantities, while photographs, videos and testimonials recorded field action.


संध्या

Reported results and evidence status

Result area	Submitted result
Campaign duration and coverage	18 days across two principal routes
Youth mobilisation	497 volunteers against a target of 360
Plastic collection	7,139 kg against a 10,000 kg target
On-route public reach	More than 1 million people
Digital reach	More than 10 million people
Material circularity	Plastic segregated and sent to recovery / recycling
Behaviour change	Positive engagement and cleaner-practice messaging reported
Livelihood and climate	Environmental benefits described

Financial and resource model

The campaign reports approximately ₹1.50 lakh in direct expenditure and nearly ₹70,000 from recovered-plastic sales—equivalent to about 47% of direct spend before considering in-kind support. At the reported 7,139 kg collected, direct expenditure was approximately ₹21 per kilogram and plastic revenue approximately ₹9.8 per kilogram; these are editorial calculations from questionnaire totals, not audited unit economics. Municipal bodies supplied caps and T-shirts, AIILSG provided safety materials, and partners supported transport and logistics. Because much of the stream was low-value or contaminated, recyclables alone could not cover operating costs. The proposed model therefore blends material sales with government, CSR, institutional and volunteer contributions.

What makes the case replicable

The model adds a temporary, mobile operating layer to existing municipal and recycling infrastructure, avoiding the capital cost of a new processing facility. Replication at another festival requires event and route mapping; organiser and government permissions; trained teams and field supervisors; PPE and collection supplies; daily food, transport and accommodation; temporary consolidation points; access to MRFs and authorised recyclers; a digital weighing and dispatch ledger; behaviour-change materials; and a defined financing plan. The 2026 campaign is a completed field demonstration within a continuing three-year movement, not yet evidence of multi-event replication.

Contact person	Email	Website
Mathew Mattam	matthewmattam@gmail.com	https://www.trashtechindia.com/

Reinventing Waste Management : Building Circular Cities through Technology

WeVOIS Labs Private Limited | Multi-state India | Scaling since 2021

ORGANISATION Private-sector company; solid-waste work began in 2015-19	**SERVICE MODEL** Long-term B2G contracts with digital monitoring and recovery partners	**REPORTED FOOTPRINT** 36+ cities across seven states
REPORTED COVERAGE >46 lakh citizens; >10 lakh households and commercial establishments	**WORKFORCE** >2,000 sanitation workers reportedly onboarded	**PRICING BASIS** Per-household model; varying by geography, service scope, operating requirements and infrastructure

Case in brief

WeVOIS uses an AI- and IoT-enabled operating system to connect municipal waste collection with downstream resource recovery. GPS-enabled Vehicle Tracking Systems and AI-assisted route planning support collection operations, while RFID-enabled monitoring helps verify service delivery and asset use. Dedicated mobile applications for workers and officers digitise attendance, task allocation, route activity and field reporting; a citizen application supports complaints, feedback and service communication. Central dashboards provide project teams and Urban Local Bodies with real-time visibility over collection, transport, segregation, processing and recovery.

The municipal systems challenge

Before the intervention, the submission identifies four linked gaps: inconsistent door-to-door collection; low source segregation; limited visibility over vehicles, workers and service delivery; and fragmented links between collected waste and processing or recycling. Manual records made route control, attendance, service verification and corrective action difficult. Mixed waste also reduced the recovery value of dry materials and increased the likelihood that organic and recyclable waste would reach dumpsites. WeVOIS designed the intervention to create a digitally monitored chain from collection to recovery.

Programme scope and deployment

WeVOIS reports operations in 36 or more cities across Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, Goa, Tamil Nadu and Uttarakhand. It names Ajmer, Jaipur, Sikar, Bundi, Pali, Jodhpur, Hisar, Mapusa, Chennai, Vidisha, Itarsi, Begumganj and Etmadpur as examples, but does not provide the complete city list or district-state mapping. The initiative covers urban, peri-urban, rural, informal-settlement, industrial, coastal and hilly or tribal contexts; the detailed narrative, however, centres on municipal and predominantly urban operations. The submission classifies the work as part of government schemes and states alignment with Swachh Bharat Mission (Urban). Deployment is reported across households, schools, markets, industrial sites, public spaces, community centres and rural panchayats, including 50 or more establishments in each of the school/institution, market/commercial and industry/worksite categories.

About WeVOIS

WeVOIS identifies as a private-sector company and a DPIIT-recognised startup. Its stated wider portfolio includes direct implementation, technology development, circular value-chain facilitation, research and evaluation, policy advocacy and recycled-product manufacturing. It has ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 and SA 8000:2014 certifications, along with relevant CPCB clearances.

How the model works

The model combines digital control of collection with physical segregation, processing and market linkages. It is adapted to each city's waste volume, contract scope, infrastructure and downstream markets.

- Configure the service area, collection frequency, routes, assets, staff and processing linkages with the ULB.
- Promote source segregation through door-to-door IEC, school outreach, community engagement and digital communication.
- Run collection routes using GPS-enabled vehicles and VTS; use AI-assisted route optimisation to improve route planning and fleet deployment.
- Use RFID, worker applications and officer dashboards for service verification, attendance, task allocation, field reporting and performance review.
- Sort dry waste at MRFs and channel recovered paper, plastic, metal, glass and textiles to authorised recyclers or manufacturing partners; route organics to composting or bio-CNG facilities.

Fig: Presorting of textile waste

Fig: Recycled Fiber

IoT-enabled Technology and resource-recovery architecture

Technology / asset	Use in the collection-to-circularity chain	Evidence for verification
GPS, VTS and AI	Track vehicles, check route compliance and support route optimisation for door-to-door collection.	Routes covered, missed trips, distance, fuel and time savings.
RFID	Verify collection activity, asset use and service delivery at identified points.	Tag coverage, scan protocol, exceptions and audit method.
Worker and officer mobile applications	Record attendance, allocate tasks, track field activity and report operational issues.	User adoption, data fields, uptime and action taken on alerts.
Citizen mobile application and central dashboards	Enable service communication, complaints and feedback, while consolidating operational KPIs for real-time review by WeVOIS and ULB teams.	Resolution time, dashboard definitions, reporting frequency and access controls.
MRFs and processing links	Sort and bale dry recyclables; route organics to composting/bio-CNG and textiles to recycling partners.	Stream-wise input, output, rejects, capacity, buyers, sale value and traceability.

Behaviour change and workforce inclusion

Dedicated IEC teams engage households, commercial establishments, institutions and communities through repeated contact rather than one-time messaging. The submission reports source-segregation rates above 70% in several operating areas, but does not identify the cities, baseline, measurement period or verification method. It also reports that more than 2,000 sanitation workers were onboarded into formal systems and received wages, PPE, digital-literacy training, work tools and social-security benefits. However, improved livelihood claims cannot yet be quantified as the number trained, employment arrangements, retention, gender profile and change in income are not disaggregated.

Partnerships, monitoring and accountability

ULBs provide mandates, oversight and long-term service contracts. Households and establishments segregate waste; sanitation workers operate digitally monitored collection; MRF teams sort recoverable material; and recyclers or manufacturing partners receive outputs. Technology partners support the digital systems. Monitoring reportedly covers route compliance, service delivery, segregation, waste processed, recovery, attendance and grievance resolution through dashboards, field audits and stakeholder reviews.

Reported reach and performance

Indicator	Reported value
Geographic reach	36+ cities across seven states
Population / premises	>46 lakh citizens; >10 lakh households and commercial establishments
Collection	97% collection accuracy
Source segregation	>70% in several operational areas
Landfill diversion / resource conversion	70-80% of collected waste
Sanitation workforce that were brought in formal system	>2,000 workers reportedly onboarded into formal systems

Evidence boundary: *Values are self-reported and are not disaggregated by city, waste stream or reporting year. However, video testimonials from ULB representatives support their work.*

Financial and operating model

- Municipal service contracts, generally structured for three to seven years, are described as the principal revenue source. Pricing follows a per-household model, but the applicable rate is determined separately for each contract based on geography, scope of services, collection and processing requirements, technology deployment, operational conditions and infrastructure involved. WeVOIS therefore does not apply a single standard per-household tariff across projects. Additional revenues are reported from B2B waste services, technology licensing or SaaS, annual maintenance contracts, processing services, recyclables, compost, textile fibres and bio-CNG partnerships.
- The questionnaire also selects government financing, institutional grants, self-funding and user fees or material revenue. It does not identify funders, contract values, the share of each revenue stream, or whether the per-household charge is paid by the ULB or directly by users.
- Major costs include workforce, collection and transport, processing-facility operations, technology, maintenance, fuel and logistics, IEC and training. Actual O&M costs, payment performance, margins and resource-sale income are not provided.

Challenges and course correction

The detailed response identifies three recurring constraints: resistance to source segregation, limited digital familiarity among frontline workers, and difficulty monitoring dispersed field operations. WeVOIS reports responding through sustained IEC, school and community engagement, local-language interfaces, simplified applications, training and handholding, incentive-based participation, GPS and RFID tracking, and central dashboards. The separate ranking table is not internally clear, so this draft relies on the narrative description rather than assigning a formal rank to the challenges.

Pathway to scale

The reported expansion across seven states suggests that the service architecture can be adapted to different city sizes. Replication nevertheless requires more than the digital platform: a viable contract and payment mechanism, collection assets, processing land and capacity, trained workers, stable recyclers and offtakers, local-language engagement, and agreed data definitions are all necessary. Before wider adoption, city-level unit economics and outcomes should be compared across contract types and waste streams.

Transferable lessons

- Connect digital oversight to physical processing capacity and verified downstream offtake.
- Treat source segregation and worker adoption as continuous operating functions.
- Define KPIs, reporting periods and denominators consistently across every city.
- Disaggregate material flows and financial returns before claiming a closed circular loop.

Contact Person	Email	Website
Sarita Meena	sarita.wevois@gmail.com	https://www.wevois.com

Advancing Circular Solid Waste Management through Community Ownership in Kapurthala

ITC Limited | Kapurthala, Punjab | Initiated in 208; results reported to FY 2025-26

GEOGRAPHIC REACH **50 wards + 125 villages**	**HOUSEHOLDS** **42,458 in FY 2025-26** **22,284 Urban HH and 20,174 Rural HH**	**WASTE COLLECTED** **9,018 MT in FY 2025-26**
REPORTED DIVERSION **88% from landfill**	**RECOVERY NETWORK** **38 MRFs + decentralised composting**	**RECYCLABLE SALES** **₹72.46 lakh in FY 2025-26**

Case in brief

ITC's Community-Led Decentralised Solid Waste Management (CLDSWM) programme was developed to move Kapurthala from mixed-waste collection and disposal towards source segregation, local processing and market-linked recovery. It began as a four-ward pilot covering 2,285 households in FY 2018-19, expanded across all 50 wards of Kapurthala city and was subsequently adapted for 125 villages.

The model combines two-bin segregation, Swachh Veer-led door-to-door collection, home and community composting, NADEP pits, a network of 38 Material Recovery Facilities (MRFs), recyclable-market linkages and local governance through 188 Mohalla Committees (104 urban and 84 rural). ITC provides catalytic programme support, while municipal and rural institutions, FINISH Society, communities and recycling partners operate the local system.

The baseline service and recovery gap

1. **Low segregation:** the 2018 assessment reported only about 12% source segregation, limiting composting and recyclable recovery.
2. **Partial collection:** about 57% of households had door-to-door access, and collection was reportedly once every two to three days in covered areas.
3. **Disposal-led system:** mixed waste moved largely towards dumpsites; organised composting and recorded recyclable recovery were absent at programme inception.
4. **Fragmented responsibility:** municipal systems, private collectors and informal actors operated without a unified segregation-to-recovery chain.
5. **Environmental context:** better waste control was also relevant to protecting local assets such as the Kali Bein and Kanjli Wetland, although no water-quality outcome is claimed.

Scale-up trajectory and reported change

Indicator	FY 2018-19	FY 2025-26
Households covered	2,285	42,458
Annual waste collected	91 MT	9,018 MT
Home-composting households	76	2,341
Organised composting	0 MT	1,153 MT
Recyclables recovered	0 MT	3,109 MT

Implementation partnership

1. **ITC:** model design, catalytic finance, IEC resources, capacity building, monitoring systems and partnership orchestration.
2. **Municipal Corporation and Gram Panchayats:** collection systems, local infrastructure, institutional integration and operational support.
3. **FINISH Society:** field implementation, mobilisation, behaviour change and capacity building. The Swachhata Mitra App is currently used by FINISH Society's supervisors and animators, with a planned transition towards government ownership.
4. **ISC, DDWS Punjab and the Lighthouse Initiative:** technical support, convergence, learning and adaptation for rural scale-up. Phase I of ISC's Lighthouse Initiative covered two Gram Panchayats that were subsequently declared model Gram Panchayats, while Phase II expanded to the entire Dhilwan block.

Segregation-to-recovery operating sequence

1. **Mobilise and organise.** Mohalla Committees, Gram Panchayats, SHGs, schools and Swachh Veers conduct repeated household engagement and resolve service issues.
2. **Segregate at source.** The programme promotes two-bin and three-bin segregation and is progressively moving towards a four-bin system.
3. **Collect from the doorstep.** Swachh Veers operate local collection routes; handcarts and small carts serve narrow lanes that larger municipal vehicles cannot reach.
4. **Treat organics close to source.** Biodegradable waste goes to 2,341 home-composting households, 26 cluster composting units or 152 NADEP pits: 40 urban and 112 rural.
5. **Use recovered nutrients.** Reported compost destinations include agriculture, kitchen gardens, community green spaces and temple or gurdwara premises.
6. **Aggregate dry waste.** Recoverable dry material is taken to 38 MRFs - two urban and 36 rural - for sorting, storage and aggregation. These MRFs are existing or strengthened government facilities operated through the local government system.
7. **Channel materials to markets.** Paper, cardboard, plastics, metals and glass are sold through authorised recyclers and scrap-market linkages; low-value plastics and MLP are routed for recovery or co-processing. This is done through a network of 22 recyclers.

8. **Monitor and correct.** The Swachhata Mitra App reportedly tracks coverage, collection, user charges, infrastructure functionality and recovery indicators for programme review.

Material pathway and current destination

Input stream	Treatment / recovery	Reported output	Destination or evidence boundary
Household organics	Home, cluster or NADEP composting	745 MT composting in FY 2025-26	Compost use is reported;
Temple floral waste	Segregation and local composting	Compost across 27 religious sites	Used within premises and local green spaces
Dry recyclables	MRF sorting and aggregation	1,609 MT recovered	Sold to recycler and scrap-market linkages
Plastic and MLP	Recycling, recovery or co-processing	444 MT plastic, including about 40 MT MLP	Appears to be part of dry recovery, not an additional tonnage
Residual / sanitary	Separate downstream handling	12% of total collection reportedly landfilled	Sanitary-waste protocol

Community governance and behaviour change

The programme has established 188 Mohalla Committees—104 in urban areas and 84 in rural areas—as community-level platforms for participation and oversight. Comprising residents, women's groups and SHGs, youth, local influencers and other community representatives, these committees support source segregation, collection monitoring, user-charge mobilisation, grievance resolution and coordination with municipal and panchayat systems. Each committee reportedly covers approximately 200–250 households, which aligns with the programme coverage of 42,458 households.

Behaviour change is reinforced through sustained door-to-door engagement, the Swachh Ghar campaign, kitchen stickers, community meetings, school-based activities and campaigns such as "My Waste, My Responsibility." Together, these measures encourage households to adopt source segregation and strengthen community ownership of local waste-management services.

Monitoring and accountability

Community oversight is combined with field records, the Swachhata Mitra App, periodic reviews by ITC, municipal representatives and implementation partners, and strategic review through a Project Management Committee.

Reported results and evidence status

Result area	Reported result
Geographic scale	All 50 city wards and 125 villages
Household reach	42,458 households: 22,284 urban households across all 50 wards and 20,174 rural households across 125 villages
Waste management	9,018 MT of waste collected and managed in FY 2025–26
Landfill diversion	88%; only 12% reportedly landfilled

Result area	Reported result
Resource recovery	1,153 MT composted and 3,109 MT of recyclables recovered
Plastic Recovery	647 MT of plastic, including approximately 40 MT of MLP
Community ownership	188 Mohalla Committees
Worker well-being	124 Swachh Veers, including eight women; reported average monthly income of ₹25,000; all covered through medical check-ups and 67 supported to obtain Ayushman Bharat cards

Financial and operating model

The programme follows a blended financing model combining household user charges, recyclable sales, government-supported infrastructure and ITC's programme-management support. Approximately 21,470 urban and 19,340 rural households reportedly contribute user charges of ₹50–100 per month, depending on location and service arrangements. Recyclable-material sales generated approximately ₹72.46 lakh in FY 2025–26.

Government convergence through SBM-Urban, SBM-Grameen, MGNREGA, Gram Panchayat Development Plans and the 15th Finance Commission supports infrastructure creation and system strengthening.

Sustainability and replication conditions

Long-term sustainability is supported by community oversight through Mohalla Committees, integration of collection and processing within municipal and Gram Panchayat systems, government-funded composting and MRF infrastructure, and market linkages with 22 recyclers—15 urban and seven rural. The planned transition of the digital monitoring platform to government ownership is also intended to strengthen institutional continuity.

Under Phase I of ISC's Lighthouse Initiative, the model was implemented in two Gram Panchayats that were subsequently recognised as model Gram Panchayats. Building on these learnings, Phase II expanded the intervention across the entire Dhilwan block. The wider ITC programme is reported to operate across 35 districts and 14 states and to have supported 19 waste-management PPPs; however, these are ITC-wide scale figures and not Kapurthala-specific outcomes.

Contact Person	Email	Website
Priyanka Guha	priyanka.guha@itc.in	https://itcportal.com/home.html

Case Studies
Water/Liquid waste

BOSON White Water – India's First Enabler of Circular Wastewater Management

BOSON White Water | Bengaluru cluster, with reported extensions to other cities | Active scale-up in 2026

INSTALLATIONS **36 sites reported**	**FLEET THROUGHPUT** **Approx. 1.55 MLD reported**	**RESIDENTIAL SOURCES** **28 apartments reported**
OFFTAKE NETWORK **45+ water buyers reported**	**PIPED-CLUSTER PRICE** **Approx. ₹0.25/litre**	**OPERATING MODEL** **Zero client CapEx / pay per use**

Case in brief

BOSON White Water addresses a recurring urban mismatch: apartment and commercial STPs produce secondary-treated effluent that is often underused or discharged, while nearby industries, data centres, laundries, IT parks, malls and construction sites purchase tanker or borewell water. BOSON installs, operates and maintains a proprietary 11-stage tertiary-treatment retrofit at the source STP, monitors production and quality remotely, and directs the reclaimed water either to the host property's own non-potable uses or to nearby buyers through piped clusters and GPS-tracked tankers. The submission presents a portfolio case of 36 installations and approximately 1.55 MLD of reported daily processing, rather than performance data from one named site. Its central innovation is therefore the combination of treatment, digital assurance, local offtake and water-as-a-service economics.

The water-market problem

Bengaluru imports energy-intensive Cauvery water and faces groundwater stress. Although larger properties are required to operate STPs and reuse treated water, inconsistent secondary-treatment performance, limited on-site demand and the absence of a reliable distribution market leave surplus effluent unused. At the same time, industrial and commercial users in the same micro-markets require dependable non-potable water. Apartments continue to bear STP costs without a return, buyers pay for tanker or groundwater supply, and under-treated water may reach drains. BOSON's model links these disconnected sources and users after tertiary quality upgrading.

Three linked components

- **Tertiary quality upgrade:** retrofit an 11-stage polishing system downstream of a functioning source STP; no stage-wise process description was submitted.

- **Digital operating assurance:** track flow, selected quality indicators, uptime and data staleness through a centrally managed IoT architecture.
- **Local redistribution:** use reclaimed water within the host property or connect surplus production to nearby non-potable buyers by pipe or tracked tanker.
- **Commercial alignment:** BOSON finances and operates equipment, while clients pay for water or service; residential hosts may receive space rent.
- **Regulatory anchor:** source STP and reuse obligations create the feedstock base, while metering and quality records support compliance and buyer confidence.

Two commercial deployment pathways

Pathway	Source site	Water pathway	Revenue logic
Captive-use property	IT park, mall, institution, hotel or other commercial site with an existing STP	BOSON installs and operates tertiary treatment; recovered water is used for cooling, laundry or other approved non-potable demand	Fixed charge linked to water produced
Residential surplus hub	Apartment with a functional STP and excess treated effluent	BOSON funds the retrofit, uses rented space, aggregates surplus and supplies nearby buyers	Buyer payment for delivered water; host receives rent
Utility-board pathway	BWSSB/HMWSSB-operated STP	Proposed or emerging recovery-and-supply arrangement for nearby commercial and industrial users	Commercial terms not supplied

Stakeholder value chain

Actor	Role and value
Apartment / property	Provides secondary effluent, space, access and utilities; gains compliance support, disposal relief, captive water or rent.
BOSON	Finances or installs the retrofit, operates and maintains it, monitors performance, manages logistics and bills for water/service.
Industrial / commercial buyer	Receives reclaimed water for approved non-potable processes at a reported price below prevailing tanker supply.
Utility board	Provides regulatory and institutional interface; specific roles and agreements vary and are not documented in the submission.

From secondary effluent to a verified water sale

Stage	Activity / technical control	Output
1. Micro-market mapping	Identify source STPs with surplus effluent and nearby industrial, construction, laundry, data-centre or commercial demand.	Potential local water cluster.
2. Source-site assessment	Review STP functionality, secondary-effluent flow and quality, surplus after captive use, space, power, access and discharge problem.	Eligible feedstock and retrofit basis.
3. Buyer qualification	Confirm quantity, daily profile, end use, required quality, delivery mode, storage and willingness to enter a supply arrangement.	Defined offtake requirement.
4. Commercial structuring	Select captive-use service, residential-surplus sale or utility pathway; agree pricing, space, utilities, O&M and water ownership.	Bankable source-to-buyer contract.
5. Retrofit design	Configure BOSON's proprietary 11-stage tertiary system to the source flow and quality profile.	Site-specific polishing train.

Stage	Activity / technical control	Output
6. Installation and commissioning	Install treatment, meters, sensors, controls and connection to storage or dispatch without replacing the upstream STP.	Operational tertiary-treatment asset.
7. Secondary-effluent feed	Receive already-treated STP water; BOSON does not replace the source property's sewage collection or secondary treatment.	Influent to advanced polishing.
8. Eleven-stage polishing	Upgrade effluent through the proprietary treatment sequence; individual unit processes and residual streams are not disclosed in the submission.	Reclaimed-water output.
9. Quality verification	Monitor selected parameters and compare product water with the claimed BIS 10500:2012 benchmark and buyer-use requirements.	Release / hold decision.
10. IoT data transmission	Sensors transmit flow, quality and uptime data through the reported WireGuard/MQTT architecture.	Secure near-real-time site data.
11. Central analytics	Cumulative meter readings are aggregated in InfluxDB and displayed in Grafana; stale-data and zero-flow alerts flag intervention needs.	Fleet dashboard and fault visibility.
12. Captive-use routing	Where the host property has demand, reclaimed water is supplied to cooling, laundry or other approved non-potable applications.	On-site freshwater substitution.
13. Surplus dispatch	Excess water is loaded into GPS-tracked tankers or sent through a local piped cluster to pre-identified buyers.	Off-site productive reuse.
14. Delivery and billing	Delivered quantity is recorded and charged under the applicable water or service agreement; source-side rent is paid where contracted.	Circular-water transaction.
15. O&M and remediation	BOSON operates the plant, responds to alerts, troubleshoots underperforming sites and maintains treatment and monitoring equipment.	Quality, uptime and supply continuity.

Digital assurance architecture

Layer	Function and evidence boundary
Site layer	Flow, quality and uptime sensors plus cumulative meters; exact sensor list, calibration schedule and redundancy not supplied.
Connectivity	WireGuard and MQTT reported for secure transmission and messaging across decentralised sites.
Data and visualisation	InfluxDB time-series aggregation and Grafana dashboards support day-level production review and site segmentation.
Exception management	Staleness and zero-flow alerts identify non-performing sites within hours; response-time and uptime records are absent.
Distribution tracking	GPS-enabled tanker fleet records movement; linkage between source batch, quality release, volume and buyer receipt is not described.

TECHNICAL BOUNDARY	The submission does not identify the eleven individual treatment stages, chemical and energy inputs, recovery ratio, reject-water volume, sludge/residual pathway or accredited test results. The system should therefore be described as a proprietary tertiary retrofit. Meeting a drinking-water specification is a quality claim; the documented end uses in this cluster are industrial and other non-potable applications, not direct human consumption.

Quality and chain-of-custody controls

A defensible water sale requires source identification, inlet and outlet sampling, calibrated production meters, defined release parameters, storage hygiene, tanker or pipe sanitation, batch/dispatch traceability, buyer receipt and permitted end use. The questionnaire describes remote assurance and GPS tracking but does not provide the parameter list, test frequency, laboratory reports, calibration records, tanker cleaning protocol, contracts or buyer-wise delivery ledger.

Reported results and evidence status

Result area	Submitted result
Installation fleet	36 sites
Residential network	28 Bengaluru apartments
Water buyers	45+
Fleet production	Approx. 1.55 MLD
Water quality	Reported to meet BIS 10500:2012
Piped-cluster price	Approx. ₹0.25/litre
Operational visibility	Alerts identify stale or zero-flow sites within hours
Climate benefit	Groundwater, tanker and long-distance freshwater substitution

Financial and revenue model

The operating model is water-as-a-service rather than equipment sale. BOSON bears or arranges tertiary-system capital, operates and maintains the asset, and earns through a fixed charge linked to production at captive-use commercial sites or through sale of delivered water from residential surplus hubs. In the latter, BOSON also pays the host RWA rent for occupied space and manages tanker or piped delivery. The submission cites approximately ₹0.25 per litre for the piped-cluster model. Reported awards/grants of ₹20 lakh, ₹50 lakh and ₹40 lakh should be separated from recurring operating revenue and from capital deployed at the 36 sites.

Sustainability and scale

The model can scale where four conditions coincide: **a compliant and functioning source STP, consistent surplus effluent, nearby non-potable demand and viable delivery economics.** Standard OPEX proposals, central monitoring and a troubleshooting manual reduce the cost of managing distributed assets. Piped micro-clusters can improve logistics where sources and buyers are dense; tankers extend reach but introduce transport cost and emissions.

Contact Person	Email	Website
Gowthaman Desingh	gowtham@transwaters.com	https://bosonwhitewater.com/

A Himalayan Model for Faecal Sludge Management: Technology, Governance and Regional Service Delivery in Rudrapur, Uttarakhand

National Institute of Urban Affairs | Rudrapur, Uttarakhand | Commissioned 1 October 2023

TREATMENT CAPACITY **125 KLD FSTP**	REPORTED SERVICE AREA **>4.1 lakh population**	REPORTED INTAKE **6,945 desludging trips**
CALCULATED INTAKE **27.78 million litres at 4 kL/trip**	FORMAL FLEET **16 licensed cesspool vehicles**	CAPITAL INVESTMENT **INR 6.38 crore under AMRUT 2.0**

Case in brief

The Rudrapur intervention is a regional faecal sludge management system, not only a treatment asset. Licensed and GPS-tracked cesspool vehicles connect on-site sanitation systems to a 125 KLD FSTP. At the plant, screening and sedimentation separate the waste streams; the liquid fraction is treated through an Anaerobic Baffled Reactor (ABR), Planted Gravel Filter (PGF) and chlorination, while the solid fraction is dewatered through a screw press and rotary dryer. Treated effluent is reused for horticulture within the premises and a 50 kW solar installation offsets part of the plant's electricity demand. NIUA supported the DPR, FSM roadmap, technical design, capacity building and statewide replication strategy.

Why a regional FSM model was needed

Rudrapur and other towns in Uttarakhand rely heavily on septic tanks and other on-site sanitation systems. The submission cites a 2021 Shit Flow Diagram indicating that only 6% of human waste followed safe pathways and 94% was managed unsafely before the intervention. Informal emptying without assured transport and treatment created particular risks in the Terai region's high-groundwater conditions. Conventional underground sewers were also described as technically and financially difficult. Individual smaller municipalities lacked the land, expertise and resources for standalone treatment plants, motivating a shared hub-and-spoke facility.

Regional scope

The programme description links Rudrapur with Kichha, Sitarganj, Gadarpur, Nagla, Dineshpur, Nanakmatta and Gularbhoj, creating a shared treatment hub for municipal septage from the surrounding cluster. Industrial-zone septage and effluent are directed separately to a Common Effluent Treatment Plant. The questionnaire alternately describes the service area as seven ULBs and lists Rudrapur plus seven neighbouring centres; Industrial-zone septage and effluent are directed separately to a Common Effluent Treatment Plant.

Institutional architecture

- **NIUA:** technical advisory, DPR and FSM roadmap, capacity building and replication support.

- **Uttarakhand Peyjal Nigam:** engineering, construction and current oversight of contracted plant operations.
- **Rudrapur Municipal Corporation:** bylaws, licensing, user charges, GPS oversight and service regulation.
- **Astha Enviro Pvt. Ltd.:** plant operation; Uttarakhand Jal Sansthan is identified for future long-term stewardship.
- **Uttarakhand State Pollution Control Board:** environmental compliance, monitoring and coordination.

Service-chain principle: *the plant, regulated collection fleet, digital trip tracking, municipal bylaws and regional institutional arrangements operate as one system.*

Operation and processing sequence

Stage	Technology / control	Function and output
1. Service request	Licensed private desludging operator	Households and establishments request emptying under the municipal user-fee system.
2. Collection	GPS-enabled cesspool vehicle	Septage is collected and transported to the authorised regional facility; trips are digitally traceable.
3. Reception	Screening	Plastics and other non-biodegradable material are removed before treatment.
4. Separation	Sedimentation and liquid-solid separation	Settled solids are diverted to dewatering; the liquid fraction enters biological treatment.
5. Solid line	Screw press and rotary dryer	Dewatered and dried solids are transferred to a designated storage yard; co-composting with municipal organic waste is being considered.
6. Liquid line	Anaerobic Baffled Reactor (ABR)	Anaerobic treatment reduces the organic load in the separated liquid stream.
7. Polishing	Planted Gravel Filter (PGF) and chlorination	Nature-based filtration and disinfection produce treated effluent for compliant discharge or reuse.
8. Water reuse	On-site horticulture	Treated effluent is used for landscape irrigation within the FSTP premises.
9. Energy	50 kW ground-mounted solar system	Solar generation offsets part of the electricity required for plant operation.

Regulation, digital monitoring and accountability

Rudrapur Municipal Corporation's septage-management bylaws formalise vehicle licensing, user charges and delivery to the FSTP. GPS tracking links the collection fleet to authorised disposal. Operational reports are submitted by the plant operator to the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) Project Management Consultant, Municipal Commissioner and Urban Development Directorate; key indicators are uploaded to the state's Ganga Tarang portal.

Reported reach and outcomes

Indicator	Reported value / boundary
Trips received	6,945 since commissioning
Calculated intake	Approximately 27.78 million litres, using the questionnaire's standard 4 kL per trip
Beneficiary reach	>20,000 households and establishments
Formal service chain	16 licensed vehicles, 16 drivers and 16 helpers; four personnel operate the plant
REUSE AND RESOURCE RECOVERY	**The operating reuse loop is treated-effluent irrigation for horticulture within the FSTP and washing of Solar panels. The solid line reduces moisture through a screw press and rotary dryer. Dried solids are reported as stored for final disposal, while the questionnaire also refers to compost use and consideration of co-composting with municipal organic waste but lack of any concrete policy in this regard, it is currently disposed off or given to nursery owners to use it as manure in non-food crops only.**

Demonstration, peer learning and statewide replication

Replication pathway	Evidence from the submission
Peer-learning visit	Approximately 30 officials and practitioners from Nagaland visited Rudrapur in November 2024 to study the pilot and its regional service-chain model.
State investment pipeline	The pilot informed preparation of FSSM DPRs valued at approximately INR 225 crore across Uttarakhand.
Regional planning method	The state roadmap identifies STPs capable of co-treatment faecal sludge and clusters smaller municipalities around suitable infrastructure within an approximately 25 km haulage radius.
Reported statewide reach	More than 50% of Uttarakhand's ULBs are reported as linked to scientific treatment; remaining ULBs are being integrated through new facilities under SBM-U 2.0.

Why the pilot is replicable: it combines a regional treatment hub, licensed road-based collection, digital tracking, municipal regulation, assigned institutional roles and a planning method for linking smaller towns to existing or new treatment capacity.

Financial and operating model

Component	Reported amount / arrangement
Capital expenditure	INR 6.38 crore under AMRUT 2.0
Initial O&M support	Approximately INR 10 lakh per year for five years
User charge	INR 1,500 per desludging trip: INR 150 to the ULB and INR 1,350 retained by the operator
2026 licence fee	INR 3,221; stated to increase 10% annually
2026 renewal fee	INR 2,417; stated to increase 10% annually
FINANCING GAP	**NIUA states that user charges and licensing revenues do not yet cover full plant O&M. A structured or scheduled-desludging fee is under formulation, while the post-five-year funding arrangement remains an important sustainability decision.**

Institutional sustainability and public engagement

Licensing brings private cesspool operators, drivers and helpers into a regulated chain. Uttarakhand Peyjal Nigam currently oversees the contracted operator, Astha Enviro Pvt. Ltd.; Uttarakhand Jal Sansthan is identified for future stewardship. Dr. R. S. Tolia Uttarakhand Academy of Administration - ATI Nainital and IIT Roorkee supported capacity building. The Malasur campaign used murals and vehicle branding to connect regular septic-tank emptying with groundwater and public-health protection.

CLIMATE LINK	**Safe containment-to-treatment pathways protect groundwater in the high-water-table Terai region. The PGF provides a nature-based polishing step, treated water replaces freshwater for on-site horticulture, and the 50 kW solar installation reduces dependence on grid electricity.**

Contact Person	Email	Website
Dr. Mahreen Matto	mahreen@niua.org	https://niua.in/

Bioclean Septic: Restoring Flow and Reducing Sludge at a Community Toilet

Organica Biotech Private Limited | Ramabai Nagar, BMC (N) Ward, Mumbai | Trial

SITE 12-seater community toilet	BASELINE CONDITION 6.8 ft sludge; outlet blocked	TRIAL PERIOD Reported six-week trial
FLOW OUTCOME Outlet reopened within first week	SLUDGE OUTCOME 6.8 ft to 4.8 ft (about 29%)	WATER REUSE Not part of the trial

Case in brief

At the 12-seater Community Toilet at Ramabai Nagar, hardened sludge had accumulated to approximately seven feet in the septic tank. The outlet was completely blocked and sewage was no longer flowing. Organica Biotech used Bioclean Septic in an in-situ bioremediation trial intended to restart biological breakdown within the existing tank, without adding civil works, electricity or mechanical treatment equipment.

During the reported six-week trial, sewage began flowing through the previously blocked outlet within the first week. Visible liquefaction of hardened sludge was observed after about 33 days, and measured sludge depth reduced from 6.8 feet to 4.8 feet. Laboratory results from samples collected before and after treatment also showed lower COD, BOD and phosphate concentrations. The treated water was not reused because reuse was not the objective of this pilot but it will surely ease the process for reuse.

The site-level sanitation problem

1. **Severe sludge accumulation:** the tank contained about seven feet of hardened organic sludge; the recorded baseline depth was 6.8 feet.
2. **Loss of hydraulic flow:** the outlet was fully blocked by accumulated sludge, preventing sewage from moving through the system.
3. **Community-service risk:** failure of the septic system serving a 12-seater toilet created an immediate sanitation and maintenance concern.
4. **Required response:** the trial focused on restoring flow and biologically reducing or liquefying accumulated sludge inside the existing tank.

Intervention and treatment boundary

Bioclean Septic is a commercially sold microbial additive for preventive maintenance of household and institutional septic tanks. Organica Biotech supplies a powdered consortium of beneficial microorganisms that users mix with water, pour through a toilet and flush into the connected tank. In this case it was applied as an in-situ treatment to a heavily loaded, blocked tank. The product supported the tank's biological process; it did not replace the septic tank, create a new treatment plant or establish a separate treated-water recovery system. The product is intended to support the tank's existing biological process by accelerating decomposition of biodegradable solids, reducing sludge accumulation and controlling odour—without new civil works, electricity or mechanical equipment. The intervention does not itself collect faecal sludge, operate treatment infrastructure, produce a reusable biosolid or enable treated-water reuse.

How the Ramabai Nagar trial was documented

1. **Establish the baseline.** The blocked outlet, absence of sewage flow and sludge depth of 6.8 feet were recorded; a sewage sample was collected.
2. **Apply the biological treatment.** Bioclean Septic was used in the existing tank during the in-situ trial..
3. **Observe operational change.** Flow through the blocked outlet resumed within the first week, followed by visible sludge liquefaction after approximately 33 days.
4. **Measure the outcome.** Final sludge depth was recorded at 4.8 feet, and the after-treatment sewage sample was collected for testing.

Measured results from the Ramabai Nagar trial

The before-and-after comparison is based on sewage samples dated 25 February 2019 and 17 April 2019. Organica describes the intervention as a six-week trial. Results below are reported from the supplementary information supplied for the case study.

Parameter	Before treatment	After treatment	Change
COD (ppm)	4,536	987	78.24% lower
BOD (ppm)	1,520	308	79.73% lower
Phosphates (ppm)	0.30	0.08	73.33% lower
Fecal coliform (unit not supplied)	>2,400	1,100	Declined; exact % cannot be calculated

What the laboratory results show

The COD and BOD results indicate that the organic pollution load was substantially lower in the after-treatment sample than in the baseline sample. Phosphate concentration also declined. Fecal coliform fell from a reported value above 2,400 to 1,100, but the baseline was open-ended and the unit was not supplied; therefore, an exact percentage reduction should not be stated.

INTERPRETATION LIMIT	The results demonstrate improvement between the two sampling dates. They do not, by themselves, establish compliance with a discharge or reuse standard, and they should not be presented as proof that the effluent was safe for reuse.

Fig: Befoe and after images

Observed operational outcomes

1. Sludge depth: reduced from 6.8 feet to 4.8 feet—a decline of 2 feet, or approximately 29%.
2. Outlet blockage: the outlet was completely blocked at baseline; sewage began flowing through it within the first week.
3. Liquefaction: visible liquefaction of the hardened sludge was observed after about 33 days.
4. Trial completion: the organisation reported the six-week intervention as successfully completed.

Product mechanism and system boundary

1. Application to the existing system. The microbial formulation is introduced into the septic system without constructing a new treatment unit.
2. Biological decomposition. Beneficial microorganisms are intended to accelerate the breakdown and liquefaction of biodegradable solids inside the tank.
3. Continued onsite treatment. Settling, retention and biological processes remain dependent on the septic tank's design, loading and condition.
4. Existing effluent route. Liquid continues through the site's outlet or onsite disposal arrangement; this trial did not add a controlled reuse pathway.

Technical safeguards

Performance can vary with tank size and design, number of users, hydraulic loading, retention time, temperature, cleaning chemicals and prior maintenance. A microbial additive cannot repair cracked tanks, broken baffles, failed soak systems or other structural defects. Inspection and authorised desludging remain necessary where residual or non-biodegradable material must be removed.

Commercial model and potential for scale

Organica's model is product-led rather than infrastructure-led. Revenue is generated through sales of Bioclean Septic to households, institutions and sanitation-market intermediaries. Because application uses existing toilets, plumbing and septic tanks, expansion does not depend on new land, electricity or specialised treatment equipment.

Commercial element	Submitted model
Product format	250 g microbial treatment powder; other strengths or bundles may be offered.
Reported customer price	About ₹349 for a 250 g pack.
Revenue source	Repeat product sales rather than grant-funded operation.
Sales and influence channels	Direct website, e-commerce, retailers, distributors, plumbers, sanitation professionals and institutional buyers.
Scale proposition	A lightweight product that can be applied within existing onsite sanitation systems without a civil retrofit.

What this specific case demonstrates

1. Use within existing infrastructure: the intervention was applied to a functioning community sanitation asset without constructing a separate treatment plant.
2. Operational recovery: a fully blocked outlet resumed flow within the first week, addressing the immediate service problem.
3. Measured sludge reduction: sludge depth fell by approximately 29% during the reported trial period.
4. Before-and-after water-quality evidence: COD, BOD and phosphate values were substantially lower in the after-treatment sample.
5. Replicable delivery concept: the broader product can be distributed through conventional retail, digital and institutional channels.

Compendium relevance

The case is most appropriately positioned under decentralised onsite wastewater management and biological support to septic-tank performance. **Its circularity contribution is indirect: it seeks to keep existing sanitation infrastructure functional and reduce accumulated biodegradable solids.**

Contact person	Email	Website
Nikhil Ajarekar	nikhil.ajarekar@organicabiotech.com	https://organicabiotech.com/

From Waste to Wicket: How Chepauk Stadium Achieved 95% Water Circularity Without a Single Drop of Chemicals

Raksha Green | Chepauk Cricket Stadium, Chennai, Tamil Nadu | 2024–March 2026

EXISTING STP 100 KLD design capacity	**TREATED-WATER REUSE** 95% reported	**POLLUTANT REDUCTION** 96-99% reported
HYDROGEN SULPHIDE 99% reduction reported	**ANNUAL SAVINGS** Approx. ₹43 lakh reported	**COST REDUCTION** 54% reported

Case in brief

Raksha Green retrofitted the Tamil Nadu Cricket Association's existing 100 KLD sewage treatment plant at Chepauk Cricket Stadium by replacing the site's chemical-treatment programme with a proprietary microbial biosolution dosed into the existing aeration tank. The submitted case reports 95% reuse of treated water for pitch irrigation, gardens, flushing and other non-potable needs; 96–99% reduction in selected pollutant parameters; elimination of persistent odour; and conversion of generated sludge into biomass for use in stadium landscaping. The intervention required no new civil works or additional treatment footprint and was delivered as a direct commercial service from 2024 to March 2026.

The problem at Chepauk

The stadium's chemical-dependent STP was reported to have inconsistent pollutant control, persistent hydrogen-sulphide odour and recurring sludge accumulation and disposal. Despite operating a treatment plant, the facility did not reuse treated water and continued to draw freshwater for the cricket pitch, landscaping and secondary facility uses. In water-stressed Chennai, this created avoidable demand on freshwater sources as well as chemical, sludge-management, compliance and worker-safety burdens. The influent reportedly combined sewage from stadium facilities and the surrounding neighbourhood, although the contributing network and daily flow profile were not submitted.

Fig: Easy Product Application

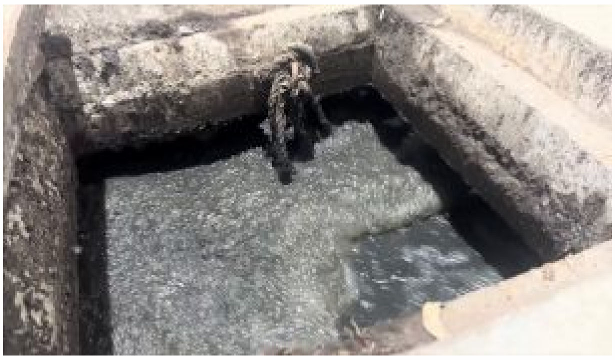


Fig: Before Treatment

Intervention proposition

- **Biological retrofit:** a site-formulated microbial consortium was introduced into the existing aeration tank, retaining the installed STP assets.
- **No new civil works:** the intervention used the existing collection, aeration and associated equipment, with no reported added land or energy demand.
- **Reuse-led treatment:** treated water was directed to pitch irrigation, gardens, flushing and other non-potable applications rather than discharge.
- **Sludge pathway:** Raksha Green reports in-situ conversion to usable biomass and on-site garden application, allowing the holding tank to be decommissioned.
- **Operator capability:** TNCA's water and sanitation team received a site-specific SOP covering dosing, monitoring, reporting and escalation.
- **Commercial service:** TNCA paid for the deployment directly; no grant, CSR or government financing was used for this case.

Site-specific deployment

Dimension	Submitted case detail
Facility and setting	Large, high-footfall public sports stadium in dense urban Chennai; approximately 50,000 spectators during major matches.
Treatment asset	Existing 100 KLD on-site STP; 100 KLD is stated capacity, not a submitted record of average daily inflow.
Wastewater source	Combined domestic sewage from stadium facilities and reportedly the surrounding neighbourhood.
Reuse destinations	Cricket pitch, stadium gardens, flushing and other secondary non-potable uses.
Implementation period	2024 to March 2026; the questionnaire does not state whether service continued after March 2026.

Delivery roles

Actor	Role in the Chepauk case
Raksha Green	Site inspection, formulation and dosing plan, SOP, operator training, biosolution supply, remote monitoring and technical support.
Tamil Nadu Cricket Association	Commercial client and facility owner; provided access, assigned O&M staff and managed daily operation and reporting.
On-site O&M team	Applied dosing, monitored defined parameters, maintained records and escalated deviations under the site SOP.

From an underperforming STP to on-site reuse

Stage	Activity / technical control	Output
1. Engineering inspection	Raksha Green inspected the operating STP, condition of installed assets and reported performance problems before engagement.	Site diagnosis and retrofit boundary.
2. Baseline characterisation	Influent and effluent conditions informed a site-specific biological formulation; sampling values and dates were not supplied.	Treatment need and starting condition.
3. Infrastructure correction	The existing collection, aeration tank, pumps and associated equipment were retained; any prerequisite repairs are not described.	Functioning host STP for biological dosing.

Stage	Activity / technical control	Output
4. Biosolution formulation	A consortium of naturally occurring microorganisms was selected for the wastewater characteristics reported at Chepauk.	Site-specific biological input.
5. SOP and dosing plan	A written procedure defined replenishment schedule, operational checks, reporting format and escalation points.	Controlled daily routine.
6. Operator training	TNCA's water and sanitation staff were trained on safe handling, dosing, monitoring and response actions.	Site team prepared for independent operation.
7. Aeration-tank dosing	The biosolution was added directly to the existing aeration tank without a shutdown or new civil structure.	Microbial population introduced.
8. Biological oxidation	Raksha Green reports microbial breakdown of organic pollutants and odour-causing compounds within the existing process.	Reduced pollutant load and odour.
9. Existing STP separation	Treated liquor continued through the plant's installed downstream stages; clarification and disinfection details were not submitted.	Effluent available for quality assessment.
10. Routine testing	BOD, COD, TSS, total nitrogen, faecal coliform and hydrogen sulphide were reportedly tracked against PCB requirements.	Compliance and reuse decision data.
11. Daily reporting	The site team reported results to Raksha Green for remote review, deviation detection and course correction.	Ongoing technical backstopping.
12. Treated-water reuse	Compliant effluent was directed to pitch irrigation, gardens, flushing and other non-potable uses.	Freshwater substitution within the stadium.
13. Biomass management	Generated solids were reportedly metabolised into biomass and used in gardens; handling and application steps are not documented.	Claimed on-site solids loop.
14. Performance review	Water quality, reuse, sludge accumulation, odour and operating costs were reviewed over the service period.	Evidence for continuation and replication.

Input-output and control framework

Flow point	Submitted position and evidence gap
Influent	Domestic sewage from stadium uses and reportedly nearby connections; actual daily flow, peak-event loads and influent concentrations absent.
Biological input	Proprietary microbial biosolution replenished on a regular schedule; dose, frequency, storage and shelf-life not submitted.
Liquid output	Treated water reported as reused on site; reuse volume, storage, distribution, disinfection and cross-connection controls not described.
Solid output	Biomass reported as used for gardens; mass balance, removal frequency, dewatering, pathogen/heavy-metal testing and application rate absent.

TECHNICAL BOUNDARY	**This is a biological process retrofit, not a stand-alone STP. Performance still depends on a functional collection network, hydraulic balance, aeration, solids separation, disinfection where required, reuse storage and distribution, preventive maintenance and compliant residuals management.**

Product validation versus site performance

Eurofins is cited as confirming that the biosolution is pathogen-free, non-toxic and food-grade safe, while Clevergene NGS is cited as characterising the microbial consortium. These are product-level claims. Verification of Chepauk's treatment outcome requires separate accredited inlet/outlet laboratory reports, flow and reuse meters, PCB compliance records, freshwater bills, sludge logs and financial calculations for the stated monitoring period.

Reported results and evidence status

Result area	Submitted result
Plant scale	100 KLD STP
Water reuse	95% of treated water reused
Pollutant removal	96-99% across BOD, COD, TSS, total N and faecal coliform
Odour / H_2S	99% H_2S reduction and odour complaints eliminated
Sludge / biomass	Sludge eliminated; holding tank decommissioned; biomass used in gardens
Freshwater use	No freshwater used for stated secondary purposes
Financial outcome	Approx. ₹43 lakh annual savings; 54% cost reduction
Compliance	Full PCB compliance maintained

Commercial and O&M model

TNCA engaged Raksha Green through a direct fee-for-service contract. Pricing is stated to begin at ₹0.10 per litre treated per day for a 100 KLD plant, with lower unit rates at larger scale. The recurring fee covers biosolution replenishment, monitoring support and technical backstopping; TNCA operates the existing plant through its trained site team. No capital investment, by-product sale, water tariff, carbon credit or grant was reported.

Sustainability and replication

The model's main scaling advantage is retrofit compatibility: a functioning STP can potentially adopt the biological dosing programme without new land or civil works. Replication requires site inspection; influent characterisation; a viable aeration and separation train; a dose and monitoring protocol; trained operators; routine laboratory testing; secure non-potable reuse infrastructure; compliant solids management; and a commercial comparison with current chemical, freshwater and sludge costs. The submission reports deployments across other sectors, but does not provide a site list, capacities or independently verified results; those portfolio claims should remain separate from the Chepauk case.

Contact person	Email	Website
Sriranjini Chandramoulee	sriranjini@rakshagreen.com	https://rakshagreen.com/

Recycled Wastewater: A Sustainable Solution for Water-Scarce Regions

S M Sehgal Foundation | Pinangwan, Nuh district, Haryana | Initiated in 2024

DESIGN CAPACITY **50,000 litres per day**	STORAGE **28 lakh litres in restored pond**	REPORTED COVERAGE **Approx. 708 households**
IRRIGATION DEMONSTRATED **17.5 acres in Rabi 2025-26**	CAPITAL COST **Approx. INR 31 lakh**	LOCAL INSTITUTION **12-member Village Development Committee**

Case in brief

S M Sehgal Foundation established a decentralised wastewater treatment and reuse system in Pinangwan, Nuh where saline groundwater and unreliable rainfall constrain irrigation. Domestic wastewater that previously accumulated in the village pond is diverted from the sewage drain and passed through a gravity-based wastewater treatment system and returned to the restored pond for agricultural reuse. The model combines passive biological treatment, online and laboratory water-quality monitoring, community-managed operation and farmer uptake. Its circularity proposition is direct: it converts a local pollution load into an irrigation resource while reducing dependence on unsuitable groundwater and the vagaries of monsoon rainfall.

Context and problem

Pinangwan is a rural, water-stressed settlement in Nuh district of Haryana. High groundwater salinity limits its use for irrigation, and without surface water irrigation sources, farming has depended heavily on rainfall. At the same time, household regularly flowed through village drains into a pond, creating stagnant conditions, odour, mosquito breeding and exposure risks. Some farmers reportedly used untreated wastewater, with concerns about sludge accumulation in agricultural fields, odour, and occasionally facing skin irritation and waterborne disease. The intervention sought to address sanitation and create an alternative source of irrigation by treating the continuously available wastewater close to its source and reusing it productively.

Intervention scope and governance

The detailed case concerns Pinangwan village in Nuh district. The Gram Panchayat supported consultation, site selection and implementation and reportedly provided panchayat land near the pond. A 12-member Village Development Committee (VDC), comprising beneficiary farmers, ward representatives and community members, oversees routine management, irrigation coordination and issue resolution. S M Sehgal Foundation designed and implemented this pilot project of village wastewater recycling and reuse of treated water in agriculture, along with beneficiary training, monitoring and documentation for this rural development and climate-resilience intervention.

What the model integrates

1. Treatment: decentralised, nature-based removal of solids, organic load and pathogens.
2. Reuse: treated water stored in the village pond and supplied for crop irrigation.
3. Monitoring: online inlet/outlet indicators plus periodic accredited-laboratory testing.
4. Management: VDC and Gram Panchayat oversight, beneficiary training and locally collected O&M charges.

Technical model: passive treatment and agricultural reuse

1. Screening chamber removes plastics, leaves, cloth and other floating debris.
2. Settler/septic tank settles suspended solids and supports partial anaerobic decomposition.
3. Anaerobic baffled reactor increases contact with anaerobic microorganisms to reduce organic pollutants.
4. Anaerobic filter uses cinder media and microbial biofilms for further solids and organic-load removal.
5. Horizontal planted gravel filter uses gravel to grow biofilm and wetland vegetation roots to infuse oxygen, support aerobic microbes to degrade organics and remove nutrients.
6. Polishing pond provides additional settling of finer solids, UV rays from sunlight exposure help kill pathogens and reduce bacteria. Extended retention ensures disinfection before treated water is used for irrigation.

Operating design: The treatment train is reported to use gravity, natural microorganisms and vegetation without routine pumping or chemical dosing.

Reported treatment performance

Parameter	Reported removal efficiency
Chemical Oxygen Demand (COD)	86.9% removal
Biological Oxygen Demand (BOD)	85.6% removal
Total Suspended Solids (TSS)	92.9% removal
Turbidity	91.9% removal
Oil and grease	96.3% removal
Coliform bacteria / E. coli	98.1% / 96.8% removal

Online and laboratory monitoring

An IoT system reportedly monitors inlet and outlet water quality parameters including pH, electrical conductivity, TSS, BOD, COD and oxidation-reduction potential, helps in monitoring inlet/outlet water quality and timely action in case there is any issue with the treatment, while an ultrasonic flow meter continuously records treated volume. Data are available through a cloud dashboard, and the system had reportedly operated for more than ten months at submission. Periodic NABL-accredited laboratory testing covers physical, organic and microbial assessment of 21 parameters and confirms that the treated water is suitable for reuse in agriculture.

Agricultural reuse and reported outcomes

The restored pond reportedly stores about 28 lakh litres of treated water. During the Rabi 2025-26 season, wheat and mustard across 17.5 acres received treated-water irrigation. Farmers using treated water reported that their crop yield has increased by 44% in wheat and 55% in mustard. Expansion to approximately 40 acres is planned, alongside promotion of drip and sprinkler irrigation.

Community adoption and safe reuse

Regular village meetings, demonstrations, exposure visits, wall paintings and training were used to promote treated water reuse and address concerns about water quality and crop safety. VDC members, farmers and sanitation workers were trained in system upkeep and safe reuse.

Reported scale, cost and evidence gaps

Indicator	Reported value / issue
System	50 KLD design capacity; restored pond storage of 28 lakh litres
Households	708 Households
People	502 people
Agricultural reach	17.5 acres irrigated in Rabi 2025-26. Plan to cover upto 40 acres using micro-irrigation practices
Capital cost	Approximately INR 31 lakh
Indicative household cost	INR 4,378/-

Financial and O&M model

1. Capital financing: Institutional or philanthropic grants by Sehgal Foundation for pilot. Replication possible through CSR projects and convergence with government programs/schemes.
2. Local O&M: the VDC/WMC is reportedly to collect membership and treated water reuse charges per acre from this season and deposit them into a community-operated bank account for maintenance with support from the Gram Panchayat.
3. Recurring costs: screen cleaning, vegetation upkeep, desludging, laboratory tests, sensors, repairs and irrigation distribution should be costed even though the core treatment train avoids routine energy and chemicals.

Challenges and safeguards

The submission ranks land or infrastructure constraints first, lack of O&M funding second and policy or regulatory gaps third. It also describes farmer hesitation, shortage of trained construction personnel and the need to integrate the system with existing drains while maintaining gravity flow. Reported responses included consultation, demonstrations, exposure visits, engineering assessment, construction supervision and VDC training. Replication also requires a non-flood-prone site, adequate land, safe sludge management, reliable monitoring and an agreed irrigation-allocation mechanism.

Sustainability and replication

The combination of passive treatment, local governance and agricultural demand offers replication potential in rural settlements, especially with saline groundwater, water-scarce areas and sufficient domestic wastewater availability. Adoption depends on actual inflow, land and elevation, effluent quality, seasonal irrigation demand, farmer acceptance, panchayat support and a local community-managed or funded O&M plan. The submission suggests the system's suitability for villages or hamlets having sufficient population. City- or village-level feasibility should therefore precede replication.

CLIMATE LINK	**Wastewater reuse can improve drought resilience and reduce pressure on exploitation of freshwater. A passive treatment train use no operational energy or chemicals than conventional systems**

Transferable lessons

1. Design treatment and reuse together; a compliant outlet needs a dependable user and delivery arrangement.
2. Combine online indicators with accredited laboratory verification and transparent operating thresholds.
3. Define community charges, responsibilities and sludge-management procedures before handover.
4. Report actual daily flow, water quality, farm uptake, yields and net financial benefit by season.

Contact person	Email	Website
Salahuddin Saiphy	s.saiphy@smsfoundation.org	https://www.smsfoundation.org/

Community-Managed, Inclusive Water and Sanitation Services for Kandavara Colony, Chikkaballapura

Technology Informatics Design Endeavour (TIDE) | Kandavara Colony, Chikkaballapura, Karnataka | 2021–ongoing

COLONY COVERAGE **91 households; 532 people**	PHYSICAL COVERAGE **7 internal lanes**	INSTALLED CAPACITY **30 KLD across two plants**
FY2024–25 TREATMENT **5.45 million litres reported**	REUSE-SUPPORTED GREENING **3,052 sq. ft reported**	PROJECT COST **Approx. ₹32 lakh**

Case in brief

Kandavara Colony is a 91-household Economically Weaker Section settlement developed under PMAY-Urban for sanitation workers, waste pickers and other marginalised households. TIDE, BORDA South Asia and Chikkaballapura City Municipal Council (CMC) implemented a two-phase decentralised wastewater system tailored to the colony's unequal infrastructure: three lanes without sewers received simplified sewerage and a 10 KLD DEWATS, while four lanes with an existing underground drainage network were connected to a 20 KLD, IoT-enabled Humus Bioreactor. Together, the systems provide 30 KLD of installed treatment capacity. Treated water is reported as reused for landscaping, a nearby Circularity Park, community-toilet cleaning and construction curing; the balance may be safely discharged. The case combines inclusive sanitation, nature-based treatment, municipal O&M and community caretaking.

Why a decentralised system was needed

When residents moved into the newly built colony, three of seven narrow internal lanes had no wastewater conveyance and four had underground drainage without treatment at the receiving end. Domestic greywater and blackwater stagnated or were discharged untreated, producing odour, vector-breeding conditions and public-health risks. Limited land and a small service population made a conventional centralised plant impractical. The challenge was also one of equity: 35 plots were occupied by sanitation-worker households, while the remaining 56 housed waste pickers and other marginalised residents with limited ability to finance recurring services.

Two phases, matched to existing infrastructure

Stage	Start	Coverage	Infrastructure	Status
Phase 1	January 2021	3 lanes / 35 households	New Simplified Sewerage System plus 10 KLD DEWATS	Operational
Phase 2	October 2024; plant operating January 2025	4 lanes / 56 households	Existing UGD plus 20 KLD IoT-enabled Humus Bioreactor	Operational
Combined	From January 2025	7 lanes / 91 households	Two decentralised plants; 30 KLD installed capacity	100% colony coverage reported

Fig: Simplified Sewer System

Fig: 20 KLD Humus BioReactor

Fig: 10 KLD DEWATS

Design principles

- **Infrastructure-fit:** build conveyance only where absent and use the existing UGD where it already functions.
- **Low-energy treatment:** passive, gravity-driven biological systems minimise dependence on mechanised aeration and complex machinery.
- **Productive reuse:** direct compliant effluent to non-potable applications within the colony and nearby public spaces.
- **Local operating capacity:** train residents as caretakers while shifting periodic desludging and repairs into CMC systems.
- **Phased inclusion:** sequence investment according to lane-level readiness while designing for eventual colony-wide service.

Public-private-community roles

Partner	Case-specific role
TIDE	Implementation leadership, construction oversight, community mobilisation and capacity building.
BORDA South Asia	Financing for both phases and technical inputs on decentralised treatment design.
Chikkaballapura CMC	Provided land; committed to institutional ownership, periodic desludging, repairs and municipal O&M integration.
Community caretakers	Daily observation, minor upkeep, issue reporting and liaison between residents and technical/municipal teams.
Hashtag Technology	Listed for technology/technical design; exact scope and contractual responsibility require clarification.

From household discharge to productive reuse

Stage	Activity / technical control	Output
1. Lane-level diagnosis	Map occupied plots, wastewater sources, gradients, blockages, land availability and whether each lane has functioning conveyance.	Phase-specific service design.
2. Community engagement	Door-to-door discussions and street meetings in Kannada explain health risks, construction impacts, caretaker roles and reuse applications.	Household participation and local feedback.
3. Municipal coordination	CMC provides land and aligns permissions, UGD interfaces, desludging, repairs and future institutional ownership.	Implementation and O&M pathway.
4. Capacity and site design	Domestic greywater and blackwater loads are allocated across 10 KLD and 20 KLD systems, with compact layouts for a land-constrained site.	30 KLD combined installed capacity.

Stage	Activity / technical control	Output
5. Phase 1 conveyance	A Simplified Sewerage System carries wastewater from 35 households across three previously unserved lanes.	Gravity-based collection to DEWATS.
6. Phase 1 treatment	The 10 KLD DEWATS provides passive decentralised biological treatment; internal treatment units are not described in the submission.	Treated Phase 1 effluent.
7. Phase 2 conveyance	The existing underground drainage network carries wastewater from 56 households across four lanes.	Avoided duplicate sewer construction.
8. Phase 2 treatment	A 20 KLD nature-based Humus Bioreactor treats the received flow through a passive, gravity-driven process.	Treated Phase 2 effluent.
9. Remote monitoring	IoT sensors on the Humus Bioreactor transmit operating information for remote oversight; sensor types and thresholds are not supplied.	Early warning and technical review.
10. Water-quality testing	Samples from both facilities are reportedly tested quarterly; parameters, laboratories, standards and results are not supplied.	Reuse or safe-discharge decision evidence.
11. Reuse distribution	Treated water is directed to plant landscaping, the Circularity Park, community-toilet cleaning and construction curing.	Freshwater substitution for non-potable uses.
12. Safe discharge	Treated effluent not reused is reported as safely discharged; outlet, receiving environment and consent conditions are not described.	No untreated open discharge claimed.
13. Routine upkeep	Local caretakers observe flow, odour and blockages and carry out day-to-day upkeep under a structured support arrangement.	Local response to minor operating issues.
14. Periodic O&M	CMC is expected to arrange desludging and infrastructure repair, with TIDE/BORDA support during transition.	Long-term asset functionality.

Flow, reuse and residuals controls

Control point	Submitted position
Influent	Household greywater and blackwater; actual daily/peak flow and influent-quality data are not submitted.
Liquid output	Treated effluent for non-potable reuse or safe discharge;
Reuse boundary	Roughly half of treated water is reused.
Sludge / residuals	Periodic desludging is planned through CMC.

TECHNICAL BOUNDARY	The submission names DEWATS and a Humus Bioreactor but does not describe their internal unit processes, hydraulic retention, treatment media, polishing or disinfection steps. It is therefore appropriate to present the system as passive, nature-based decentralised treatment without assigning unreported mechanisms or removal efficiencies.

Monitoring and course correction

The Phase 2 plant uses remote IoT monitoring, both facilities are reportedly sampled quarterly, and residents provide operating feedback. When blockages and peak-use odour were raised, TIDE and BORDA formalised O&M support, desludging schedules and caretaker training with CMC.

Reported results and evidence status

Result area	Submitted result	Evidence boundary
Coverage	91 households / 532 people / 7 lanes	Current FY2025–26 reach
Installed capacity	10 KLD DEWATS + 20 KLD Humus Bioreactor	-
FY2022–24 treatment	10 KLD/day; 3.65 ML/year	Figure equals nominal full-year capacity.
FY2024–25 treatment	5.45 million litres	Consistent with 10 KLD for 12 months plus 20 KLD for Jan-Mar; flow logs absent
Treated-water reuse	Roughly half reused for landscaping, cleaning and curing	annual volume absent
Greening	1,235 sq. ft increased to 3,052 sq. ft	Reuse-supported area reported
Environmental condition	Stagnation and odour eliminated; zero untreated open discharge	Qualitative
Water-quality monitoring	Quarterly testing reported	-

Financial and O&M model

BORDA South Asia financed capital implementation, while CMC provided land and is expected to absorb recurring O&M into municipal budgets. Residents do not pay a wastewater tariff; trained caretakers provide routine local upkeep, and CMC is responsible for periodic desludging and repairs. The reported combined project cost is approximately ₹32 lakh, or about ₹35,000 per household. Against 30 KLD of installed capacity, this is roughly ₹1.07 lakh per KLD—an editorial calculation that combines two phases and excludes any unreported land value or in-kind inputs. The model therefore demonstrates grant-funded capital with planned municipal O&M, not a revenue-generating water business.

Sustainability and replication

Replication depends on matching the solution to existing conveyance: install simplified sewers where networks are absent and add compact treatment where drains already reach a viable site. The low-energy, modular model is relevant to small, land-constrained settlements, but each replication requires verified wastewater flows and quality, land and gravity assessment, reuse demand, discharge permissions, sludge chain, trained operators, municipal budget ownership and locally serviceable components. Kandavara's continuing O&M transition should be documented before the model is treated as fully institutionalised.

Contact person	Email	Website
E Sasi Priya	sasi.priya@tide-india.org	https://tide-india.org/

Conclusion: From Projects to Verifiable Circular Systems

Taken together, the 22 case studies—16 on solid waste and six on used water—show that there is no single pathway to circularity. The cases span prevention and reuse, source segregation, material recovery, biological conversion, faecal-sludge management, decentralised treatment, STP improvement and treated-water reuse across varied geographies and institutional settings. Their diversity reinforces a central lesson: circularity must be designed around the resource stream, local context, institutional capacity and intended end use.

Across the portfolio, one message is consistent: technology alone does not create circularity. Functioning circular systems depend on reliable collection, quality inputs, skilled operators, worker safety, sustainable O&M, traceability, financing and dependable markets or offtakers. A technically sound facility without these supporting conditions may be an asset, but it is not yet a functioning circular system.

For solid waste, circularity should be assessed through a credible material balance: what enters the system, what is recovered, what is reused or sold, what is rejected and where each output ultimately goes. Collection or landfill diversion alone does not demonstrate circularity unless recovered materials re-enter productive value chains and residuals are safely managed.

For used water, treatment is an enabling step, but not the final outcome. Circularity requires measured treatment performance, fit-for-purpose quality, actual reuse, freshwater displacement and safe management of sludge and other residuals. Installed capacity should therefore be distinguished from operational capacity and actual utilisation.

The cases also highlight the need for stronger measurement, reporting and verification. Rated capacity, self-reported reach, organisation-wide achievements and projected climate benefits should not be treated as equivalent to verified site-level outcomes. Future replication would benefit from more consistent monitoring of actual throughput, uptime, mass or water balance, input and output quality, O&M costs, worker safety, revenue and offtake, and residual destinations.

The transition from projects to dependable systems will also depend on whether the complete service chain is financially and institutionally viable. Financing must extend beyond infrastructure to collection, sorting, storage, conveyance, testing, repairs, worker protection and residual management. Sustainable O&M financing, viable markets and long-term offtake are equally important, and blended finance may remain necessary where revenues from recovered materials or treated water cannot cover the full cost of service.

People must remain central to this transition. Waste pickers, sanitation workers, women's groups, local entrepreneurs and plant operators are integral to system performance. Their safety, livelihoods, skills and continued participation influence whether circular systems remain functional beyond the initial project period.

The cases demonstrate that workable solutions already exist, but they should not necessarily be replicated unchanged. The priority is to understand the conditions that make them effective and adapt those principles to local contexts. This requires clear institutional ownership, sustainable financing, reliable O&M, appropriate standards, functioning markets, worker inclusion and credible evidence of performance.

The transition required is therefore from asset delivery to verified service performance, from waste processing to resource recovery, and from wastewater treatment to safe and productive reuse. The long-term value of the models documented in this Compendium will depend on whether they can become locally appropriate, financially sustained and verifiably performing systems that reduce dependence on virgin materials and freshwater, prevent pollution, strengthen livelihoods and deliver measurable climate and public-health benefits.

This is the shift from successful projects to circular systems that can be trusted, adapted, replicated and scaled.

References

[1] Press Information Bureau, Government of India, “India’s Green Transformation: Twelve Years of Vishwaas, Nirman, and Jan Kalyaan,” Jun. 4, 2026.

[2] Ministry of Environment, Forest and Climate Change, Government of India, “New Solid Waste Management Rules Notified; To Come into Force from April 1, 2026,” Press Information Bureau, Jan. 28, 2026.

[3] Ministry of Environment, Forest and Climate Change, Government of India, “Circular Economy Framework and Extended Producer Responsibility,” Press Information Bureau, Mar. 23, 2026.

[4] Press Information Bureau, Government of India, “GOBARdhan: Fuelling Clean Energy and Rural Growth,” Aug. 6, 2026.

[5] Ministry of Textiles, Government of India, “Union Minister of Textiles Releases Report on Mapping of Textile Waste Value Chain in India,” Press Information Bureau, Mar. 10, 2026.

[6] N. Bassi, S. Gupta, and K. Chaturvedi, Reuse of Treated Wastewater in India: Market Potential and Recommendations for Strengthening Governance. New Delhi, India: Council on Energy, Environment and Water, 2023.

[7] Ministry of Housing and Urban Affairs, Government of India, AMRUT 2.0 Reforms Toolkit. New Delhi, India, n.d.

[8] Cabinet, Government of India, “Cabinet Approves the Continuation of Swachh Bharat Mission (Urban) (SBM-U) till 2025–26 for Sustainable Outcomes,” Press Information Bureau, Oct. 12, 2021.

[9] Ministry of Jal Shakti, Government of India, “Safe Reuse of Treated Water Gains Momentum; Policy Notified in Uttarakhand,” Press Information Bureau, Mar. 17, 2026.

[10] S. Gupta, K. Chaturvedi, A. Kashyap, and N. Bassi, Enabling Circular Economy in Used Water Management in India: A Municipal Index for Assessing Urban Local Bodies’ Performance. New Delhi, India: Council on Energy, Environment and Water, 2024.

[11] World Health Organization, Guidelines for the Safe Use of Wastewater, Excreta and Greywater, vol. 4, Excreta and Greywater Use in Agriculture. Geneva, Switzerland: World Health Organization, 2006.

[12] K. Velkushanova and L. Strande, “Faecal Sludge Properties and Considerations for Characterisation,” in Methods for Faecal Sludge Analysis. London, U.K.: IWA Publishing, 2021, pp. 15–54.

NOTES

NOTES

NOTES

India Sanitation Coalition (ISC), launched in June 2015, at Federation of Indian Chamber Commerce and Industry (FICCI), enables and supports safe and sustainable sanitation by bringing multiple organizations on a common platform through a range of catalytic actions. These include supporting the unlocking of WASH financing with focus on the private sector, forging partnerships with allied organizations for leading the discourse on sustainable sanitation; convening, curating and disseminating best practices in the sanitation advocacy — space and providing inputs into the policy aspects of sanitation through participation at allied forums.

https://www.indiasanitationcoalition.org/

CONTACT INFO

India Sanitation Coalition
FICCI Federation House Tansen Marg New Delhi-110001
Landline: 011-23487270
E-mail: indiasanitationcoalition@ficci.com

Social Link