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NITI AAYOG – UNDP HANDBOOK ON

SUSTAINABLE URBAN PLASTIC WASTE MANAGEMENT

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Acknowledgements

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Message, Vice Chairperson, NITI Aayog

The clarion call of the Honourable Prime Minister to address the issue of single-use plastics on the 73rd Independence Day triggered massive attention towards plastic waste management in the country. It is encouraging to observe that India's overall solid waste treatment capacity saw a steep rise from 18 percent in 2014 to 70 percent in 2021. Over the past six years, the Central Government, State Governments, urban local bodies, and most importantly, the citizens of the country have shown remarkable coordination and dedication for Swachhta like never seen before. The Swachh Bharat Mission received acclaim from around the globe for its impressive measurable results achieved within a short period. However, while Swachhta is a continuous journey, we as a nation need to move towards stricter implementation of the Reduce-Reuse-Recycle concept.

While urbanisation enables greater economic development in the country, the stress on urban local bodies to deliver efficient urban services, including efficient urban waste management, remains one of the significant challenges. It is towards meeting these challenges that NITI Aayog has joined hands with the United Nations Development Programme (UNDP) to lay down ideas in the form of a comprehensive handbook: '**NITI Aayog-UNDP Handbook on Sustainable Urban Plastic Waste Management'** can be adopted by urban local bodies to good effect.

To that end, this handbook aims to enable the capacity building of officials in urban local bodies and other relevant stakeholders at the city level on plastic waste management. The learnings documented here are based on multiple models, which reflect socially and financially inclusive approaches towards plastic waste management in India.

The handbook also discusses national and international case studies across different components of plastic waste management. The represented models have focused on the sustainability and scalability of approaches in all Indian cities based on specific estimated parameters. I am hopeful that the handbook will act as an essential knowledge resource for stakeholders in the waste management sector.

I am also sure that this handbook will go a long way in achieving the broad objectives set out in the Swachh Bharat Mission. I compliment the UNDP team and the Managing Urbanization vertical at NITI Aayog led by Special Secretary, Dr K. Rajeswara Rao for conceptualizing and publishing this handbook. His team comprising Deputy Advisor, Dr Biswanath Bishoi, and Young Professional, Mr Dhiraj Santdasani also deserve due recognition for their efforts.

Dr Rajiv Kumar
Vice Chairperson
NITI Aayog

सत्यमेव जयते
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Foreword, CEO, NITI Aayog

With the launch of the Swachh Bharat Mission (Urban) 2.0, India has taken a significant step to further reinforce the Swachhta momentum achieved in the first phase of the mission. With greater emphasis on source segregation, waste processing facilities, and phasing out of single-use plastics, SBM 2.0 is set to fast-track country's smooth transition to a circular economy. While India generates about 3.4 million tonnes of plastic waste annually, urban local bodies across the country have been facing tremendous pressure to manage this waste efficiently. In addition, India's rapid pace of urbanization has also contributed to the stress on urban services. However, even in such a challenging environment, the dedication shown by the State Governments, urban local bodies, private sector companies, organizations, and citizens, for implementing Swachh Bharat Mission in the true spirit and making it a Jan Andolan is supremely remarkable.

The world is becoming more aware and more inclined towards effective patterns of resource usage. Efficient plastic waste management provides a vast landscape to enable superior resource efficiency in the manufacturing sector. Recycling or upcycling plastic waste offers a paradigm shift from conventional techniques or incineration and landfilling by altering end-of-life products, scraps and other types of plastic waste into valuable raw materials after the necessary value additions.

While many cities have implemented noteworthy models of plastic waste management, it is essential that a robust knowledge repository is created to capture these best practices so that urban local bodies across the country can learn, observe, adapt and replicate models as relevant. It is with this vision that this handbook has been developed jointly by NITI Aayog and UNDP. The book provides a comprehensive overview of managing plastic waste by representing and discussing components of the entire plastic waste value chain. I believe that this handbook will certainly support all relevant stakeholders in informing themselves about pertinent initiatives and the efficient ways to deal with plastic waste.

I compliment the efforts of UNDP in development of this vital knowledge resource and for working alongside numerous cities and other partners, helping them streamline plastic waste management systems. My special appreciation goes to the Managing Urbanization vertical of NITI Aayog led by Special Secretary, Dr K. Rajeswara Rao, for spearheading this important task, and his team involving Deputy Advisor Dr Biswanath Bishoi, and Young Professional, Mr Dhiraj Santdasani.

Amitabh Kant
CEO
NITI Aayog

सत्यमेव जयते
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Foreword, Special Secretary, NITI Aayog

In the past few years, India has achieved remarkable progress in its waste management sector under the Swachh Bharat Mission (U). The fact that the country's waste processing capacity has increased four times since 2014 shows the scale and size of the mission and its meticulous implementation on the ground. The next phase of Swachh Bharat Mission has further strengthened the clean India movement with an explicit focus on waste source segregation, waste treatment, and phasing out of single-use plastics.

While Swachhta is a way of life and not an initiative bounded by time, we need to further build upon the momentum achieved in these years and shift towards a more resource-efficient and circular economy in new urban India. In this regard, efficient management of plastic waste has emerged as one of the key challenges in the waste management sector, which needs dedicated focus from all sections of society. India generates about 3.4 million tonnes of plastic waste per year, and about 70 percent of plastic packaging products are converted into plastic waste within a short period.

Multiple cities and organisations across the country have implemented innovative, sustainable, and resource-efficient models of plastic waste management. To achieve leapfrogging success in the sector nationally, it is important that other urban local bodies study these business models and replicate them as relevant and as applicable to their cities. This handbook is a knowledge repository containing 18 case studies across four themes and has been developed to support stakeholders of the plastic waste management sector in enhancing information and awareness.

The book covers several aspects of sustainable urban plastic waste management and will help urban local bodies to develop efficient waste management plans for their cities based on their requirements and guidelines. In process of developing this document, about 20 stakeholder consultations with different urban local bodies, plastic waste recyclers, private players, NGOs/CSOs, academia, and on-ground discussions with more than 14 Indian cities and 4 Southeast Asian cities (virtually) were conducted by UNDP. State Pollution Control Boards being the key stakeholders, may refer to this handbook for relevant initiatives and may also translate the book in regional languages for more effective use of all stakeholders as needed.

Last but not the least, I would like to compliment the efforts made by UNDP India team in the development of this publication and their support to various cities in the area of plastic waste management. I also express my deep sense of gratitude to the team of Managing Urbanisation vertical, especially Dr Biswanath Bishoi, Deputy Advisor, and Mr Sanjay Gupta, Economic Officer. Mr Dhiraj Santdasani, Young Professional deserves special appreciation for managing the publication and for his persistent efforts in finalization of this document.

Dr K. Rajeswara Rao IAS
Special Secretary
NITI Aayog

Foreword, Resident Representative, UNDP India

I am happy to present a new handbook **'NITI Aayog-UNDP Handbook on Sustainable Urban Plastic Waste Management,'** jointly developed by UNDP and NITI Aayog.

Two of the biggest environmental crises in the world today are climate change and plastic pollution. According to a report by the Center for International Environmental Law organization, globally the plastic production and disposal resulted in 850 million tons of greenhouse gas emissions in 2019. The same may be responsible for up to 2.8 billion tons by 2050.

Sustainable plastic waste management can move plastic from 'waste' to a 'renewable resource' and promote a circular plastics economy.

We have made a conscious effort to gather best practices and examples from cities which face similar infrastructure and plastic waste challenges. The handbook covers best practices of plastic waste management from India, including from countries in Southeast Asia, like Indonesia and Vietnam.

This publication aims to provide practical and replicable solutions to the urban local bodies across India to manage plastic waste in cities. The solutions are aligned with the principles of Swachh Bharat (Clean India) Mission. I hope that the urban local bodies will find this handbook a useful tool to help India achieve its vision of Swachh Bharat.

My special appreciation to NITI Aayog and UNDP India Plastic Waste Management team for producing this handbook. My sincere thanks to our corporate partners for their support of the Plastic Waste Management Programme.

Shoko Noda
Resident Representative
UNDP India

Abbreviations

AI	Artificial Intelligence
ADB	Asian Development Bank
BCC	Behaviour Change Communication
BMC	Bhubaneswar Municipal Corporation
BMT	Billion Metric Tonnes
BPL	Below Poverty Line
BWGs	Bulk Waste Generators
CE	Circular Economy
CIPET	Central Institute of Petrochemicals Engineering & Technology
CKCL	Clean Kerala Company Limited
COVID-19	Coronavirus
CPCB	Central Pollution Control Board
CRRI	Central Road Research Institute
CSE	Centre for Science and Environment
CSOs	Civil Society Organizations
CSR	Corporate Social Responsibility
DIC	District Industries Centre
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
FMCG	Fast Moving Consumer Goods
FRP	Fibre Reinforced Plastic
GST	Goods and Services Tax
HDPE	High-Density Polyethylene
IEC	Information, Education and Communication
ILO	International Labour Organization
IIM	Indian Institute of Management
IIT	Indian Institute of Technology
IMC	Indore Municipal Corporation
KITA	Kitakyushu International Techno-cooperative Association
KYC	Know Your Customer

LDPE	Low-Density Polyethylene
L&T	Larsen & Toubro
MoEFCC	Ministry of Environment, Forests and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
MLP	Multi-Layer Plastic
MRF	Material Recovery Facility
MT	Million Tonnes
NGOs	Non Governmental Organizations
PET	Polyethylene Terephthalate
PMC	Panaji Municipal Corporation/Pune Municipal Corporation
PP	Polypropylene
PROs	Product Responsibility Organizations
PS	Polystyrene
PVBS	Parisar Vikas Bhagini Sangh
PVC	Poly-Vinyl Chloride
PWM	Plastic Waste Management
RoC	Registrar of Companies
RUDA	Regional and Urban Development Agency
RWAs	Resident Welfare Associations
SHGs	Self Help Groups
SJSRY	Swarna Jayanti Shahri Rozgar Yojana
SMC	Sheet Moulding Compound/Surat Municipal Corporation
SMS	Stree Mukti Sangathana
SOP	Standard Operating Procedure
SPCB	State Pollution Control Board
SWM	Solid Waste Management
TCS	Tata Consultancy Services
TISS	Tata Institute of Social Sciences
TPD	Tonnes Per Day

ULBs	Urban Local Bodies
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization

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PLASTICS AND THEIR ROLE IN OUR LIVES

1

1.1 Plastics and their role in our lives

Plastic was first invented in 1907, and given that it was cheaper and more convenient than other materials, it soon found use in varied ways in our daily lives. Today, plastic is present in almost everything, from our money to electronic appliances, and it is used across multiple sectors, including packaging, building, construction, transportation, industrial machinery and health among others.

However, the lack of sustainable plastic waste management (PWM) poses a serious threat to our environment and natural ecosystem globally. Data indicates that while a large quantum of plastic waste is generated, low levels of it are sustainably managed and discarded worldwide. From 1950 to 2015, around 8.3 billion metric tonnes (BMTs) of plastic had been produced globally, and of this, 80 percent – 6.3 BMTs – was accounted as plastic waste. Of these 6.3 BMTs of waste, only 9 percent

was recycled, 12 percent incinerated and 79 percent dumped into landfills, oceans or waterbodies. There are two primary ways to manage plastic waste. The first is recycling or re-processing different categories of plastic waste into secondary material. The second is the incineration of plastic waste. However, incineration is expensive and causes pollution if not done using the right equipment.

1.1.1 Challenges concerning plastic waste

Plastic waste has numerous implications on the environment and health. The plastic waste dumped in landfills leaches into the ground and nearby water systems causing land and water pollution and ultimately reaches the food chain. The uncontrolled burning of the waste, including plastic, causes air pollution. In addition, the clogged plastic waste in sewerage systems further pollutes rivers and groundwater. The plastic in food and water can cause severe health issues such as genetic disorders, and endocrine system damage. According to the United States Environmental Protection Agency, all the plastic waste ever generated is still present on Earth today, this makes sustainable management of plastic waste important.

Single-use Plastic[1]

The Plastic Waste Management Rules, amended in 2021, define single-use plastic as plastic item intended to be used once for the same purpose before being disposed of or recycled. The United Nations defines single-use plastics, often referred to as disposable plastics, as being commonly used for plastic packaging, including items intended to be used only once before being thrown away or recycled. These include grocery bags, food packaging, bottles, straws, containers, cups and cutlery.[2] Single-use plastic is the most popular kind of plastic due to its easy access and high use. While it is cheap, strong and hygienic for transporting goods, it is the most difficult to recycle. Plastic carry bags are produced using less energy and water and generate less solid waste than paper bags as they take up less space in landfills.[3] These salient features of single-use plastics make it a preferred material in commercial use.

The adverse impacts of single-use plastic have created an alarming situation across the globe with a call for countries to make commitments against

The UN defines single-use plastics, often also referred as disposable plastics, are commonly used for plastic packaging and include items intended to be used only once before they are thrown away or recycled. These include, among other items, grocery bags, food packaging, bottles, straws, containers, cups and cutlery.

1 *https://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuingpercent20plasticcent3aper cent20theper cent20businessper cent20caseper cent20forper cent20measuringper cent2cper cent20managingper cent20andper cent20disclosingper cent20plasticper cent20useper cent20inper cent20theper cent20consumerper cent20goodsper cent20industry-2014Valuingper cent20plasticsF.pdf?sequence=8&isAllowed=y*

2 *UNEP (2018). SINGLE-USE PLASTICS:A Roadmap for Sustainability (Rev. ed., pp. vi; 6).*

3 *https://www.bagtheban.com/learn-the-facts/environment/*

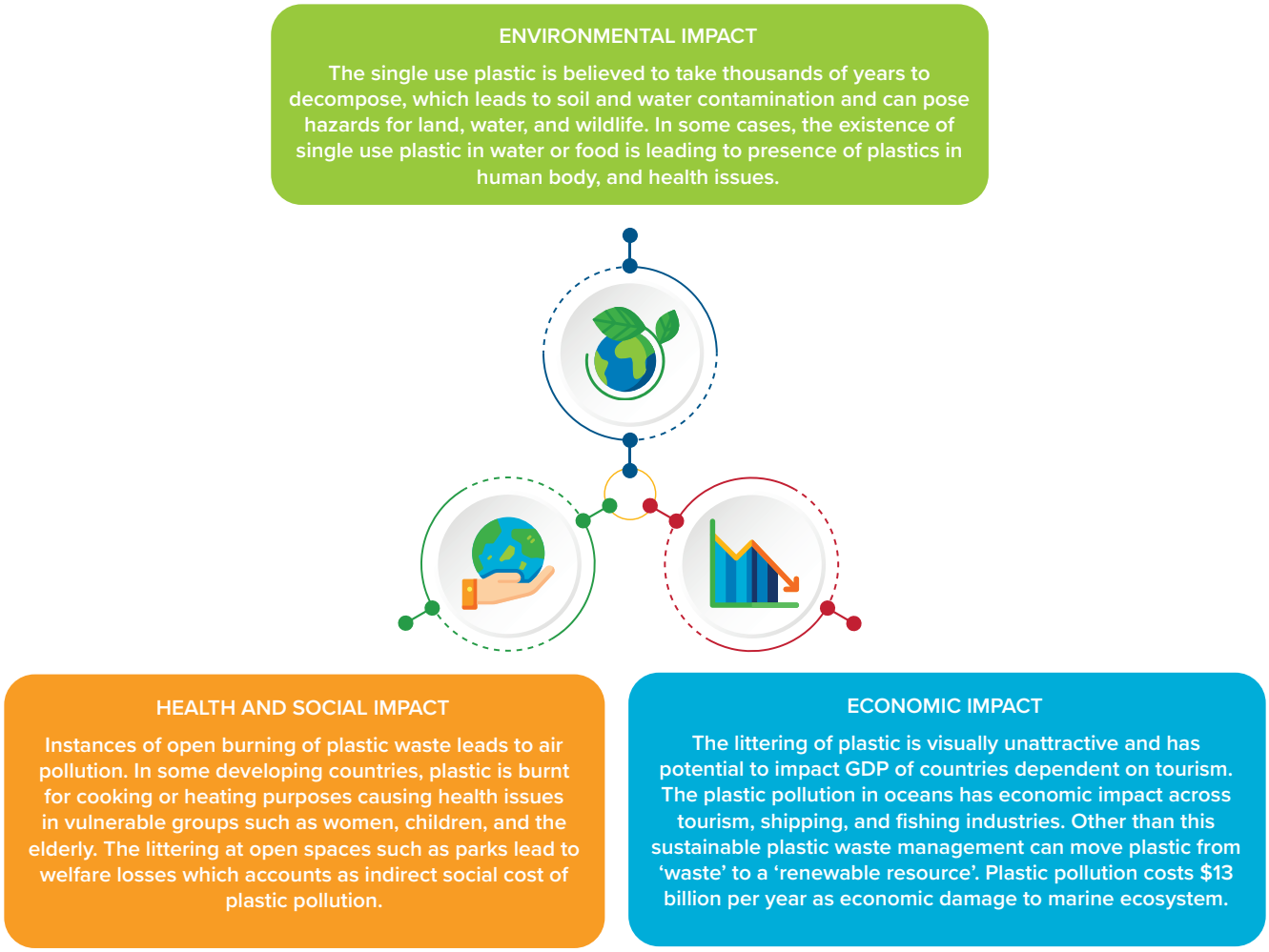


Figure 1 Environmental, health and economic impact of plastic waste

plastic pollution. The management of single-use plastic waste requires using an integrated model that focuses on minimizing plastic waste generation, improving waste management through improved collection services, a recycling industry and ensuring the safe disposal of waste to controlled (scientific) landfills. To do this, the model should focus on adopting a circular economy approach that looks at recycling good quality plastics and different ways of minimizing the production and usage of single-use plastic including plastic bags and styrofoam. The next section looks at the opportunities and challenges of plastic waste recycling.

1.1.2 Plastic waste recycling

In India, the Plastic Waste Management Rules of 2016 and 2018 and the recently announced amendment of 2021 focus on single-use plastics. The rules detail the various categories of plastics and recommend recycling methods based on the type of plastic polymer used. Additionally, as seen in figure 2, the Central Pollution

Control Board (CPCB) has defined the numerous applications of these categories under Guidelines for Disposal of Plastic Waste, 2017.[4]

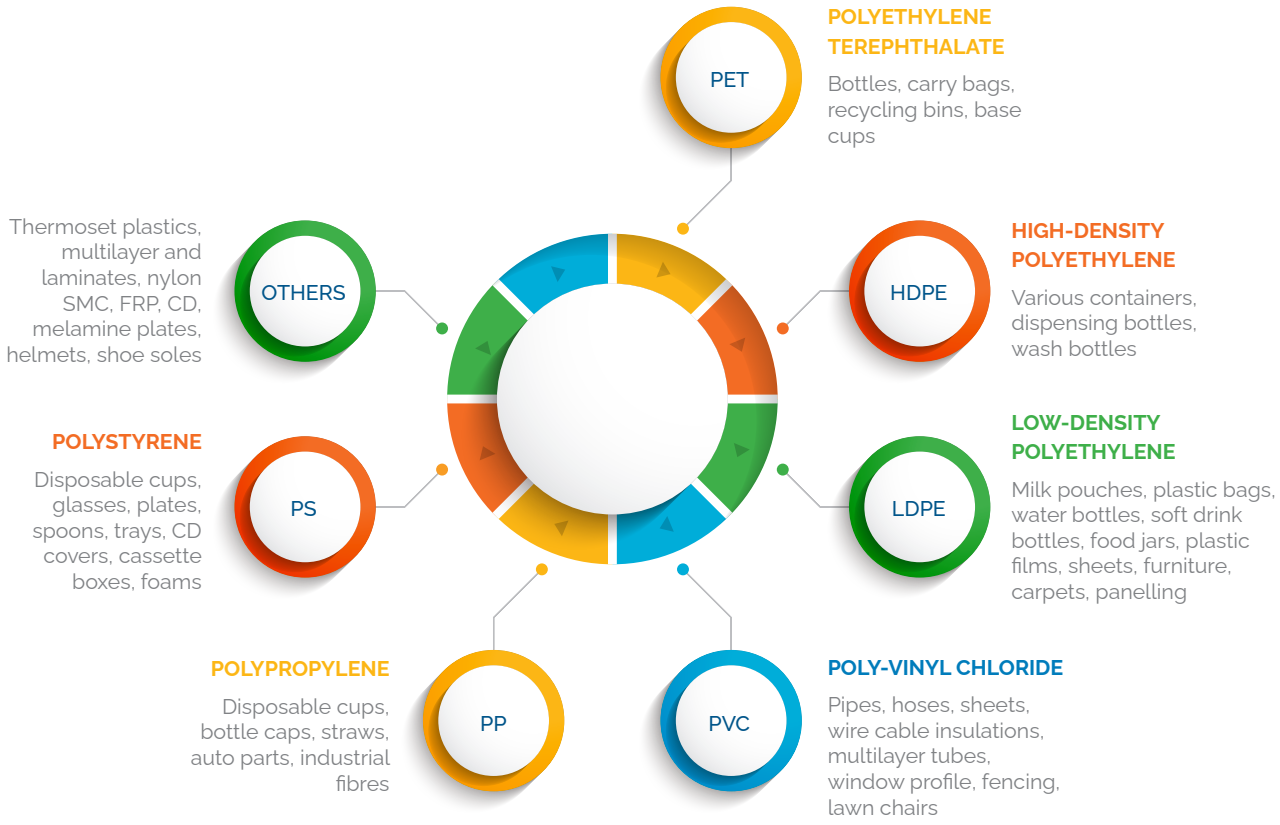


Figure 2 Types of plastics and their applications. Source: MoEFCC Rules on PWM

According to a Centre for Science and Environment (CSE) report titled 'Managing Plastic Waste in India', the plastic in polystyrene (PS) and other categories are non-recyclable and a threat to the environment. In addition, industries generating plastic waste, commonly known as pre-consumer waste, need as much attention as post-consumer waste. Various manufacturing industries across the globe produce 400 million tonnes of plastic waste per year, with the packaging industry being the largest contributor. According to a report by FICCI, 40 percent of the packaging needs in India are fulfilled using plastic.[5] The Plastic Waste Management Rules, 2016 and 2018, mention the extended producer responsibility (EPR) approach, which gives producers substantial responsibility (financial and/or physical) for the treatment and disposal of post-consumer plastic waste.

4. *CPCB's Consolidated Guidelines for Disposal of Plastic Waste, September 2017 http://cpcb.nic.in/uploads/plasticwaste/Consolidate_Guidelines_for_disposal_of_PW.pdf*
5 *https://ficci.in/spdocument/20690/plastic-packaging-report.pdf*

For sustainable PWM, all stakeholders from the private and public sectors, communities and other organizations need to adopt the circular economy approach, thereby reducing and offsetting the plastic waste going into landfills and posing serious threats to our environment, economy and health. The next section will look at the conceptual framework of the circular economy, including the business case for the plastic waste sector and enablers and barriers in India for this concept.

1.2 Conceptual framework of a circular economy

Since the second industrial revolution, our economy has been linear, working on take-make-use-dispose principles. On the one hand, this has resulted in increased economic benefits and prosperity, but on the other hand, it has also led to the overuse of resources by promoting a 'use-and-throw' approach. According to the Circular Gap Report 2021[6], 100 billion tonnes of different materials enter the Earth every year. This model not only leads to environment degradation and resource depletion, but it also increases the cost of products by disturbing the material supply system. This results from fluctuating raw material prices, low materials availability, geopolitical dependence on different materials and increasing demand.

To address this issue, we need to focus on resource efficiency by adopting a circular economy. The circular economy is defined as an alternative to the linear 'take-make-waste' approach. It seeks to design out waste, regenerate natural ecosystems and keep materials and products in use for as long as possible. To this end, resources are not consumed and discarded, destroying their value. Rather, their value is retained by reusing, repairing, remanufacturing or recycling.[7] The circular economy entails new business models, strategies and innovations focusing on the optimization of processes and products. Adopting a circular economy results in extended life of products and assets by recycling/upcycling end-of -life products and closing the loop.

The circular economy is defined as an alternative to the linear 'take-make-waste'. It seeks to design out waste, regenerate natural ecosystems and keep materials and products in use for as long as possible. To this end, resources are not consumed and discarded, destroying their value. Rather, their value is retained by reusing, repairing, remanufacturing or recycling.

1.2.1 Enablers and barriers to circular economy in India

In the Indian context, a circular economy can play a significant role in achieving environmental goals at the national and international levels, promoting sustainable ways to do business and limiting the over-extraction of natural resources.

The Indian Government has taken steps to mandate EPR under the Plastic Waste Management Rules 2016. EPR incorporates circularity by making producers responsible for the collection and processing of a product till the end of its

6 https://drive.google.com/file/d/1MP7EhRU-N8n1S3zpzqlshNWxqFR2hznd/edit
7 https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy

life. Organizations and industries are partnering with government stakeholders to implement integrated models focusing on a circular economy. In addition, to support the circular economy, emphasis has been laid on drafting policies and missions such as the Swachh Bharat Mission and Solid Waste Management Rules 2016, which focus on recycling resources.

For economies across the globe, adopting a circular economy can help achieve various Sustainable Development Goals (SDGs) directly or indirectly.

1.2.2 SDGs linkage

Plastic waste management brings a unique cross-cutting opportunity to contribute towards 14 of the 17 SDGs; bring more integration of various stakeholders to mutually invest for the cost to environment and natural capital.

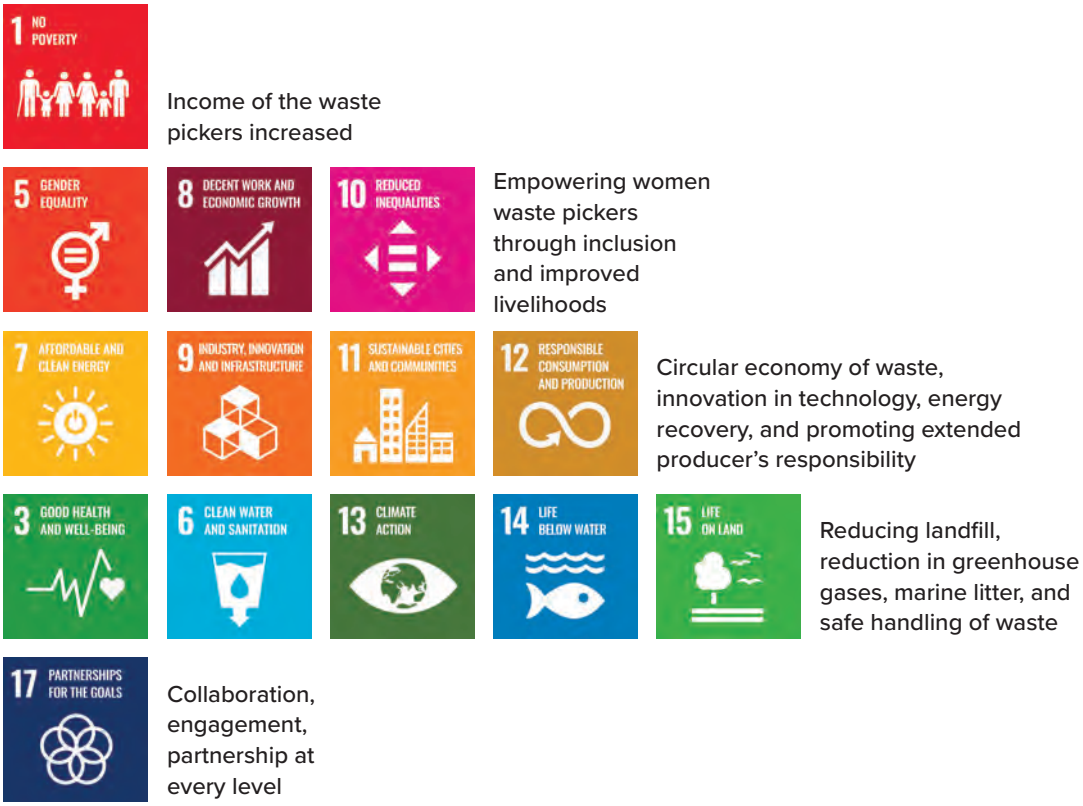


Figure 3 SDGs linkages through effective plastic waste management in a city

1.3 State of play: PWM in India and the global scenario

Globally, plastic pollution has emerged as a serious menace in the absence of streamlined PWM focusing on reuse, reduction, and recycling of plastic waste. The global recycling

percentage is low, only 9 percent, and this calls for immediate and integrated actions to manage plastic globally and focus on recycling or upcycling. All developed and developing countries are individually taking actions to manage plastic waste, but the onus is mainly on developing countries.

According to a report on PWM released by Ministry of Housing and Urban Affairs[8], the global average of plastic per capita consumption is 28 kg and India has a per capita plastic consumption of 11 kg. The CPCB Report (2019-20)[9] states that 3.4 million metric tonnes of plastic waste are generated in India annually.

1.4 Rules and guidelines – plastic waste management

To address the challenge of the mounting waste crisis in the country, India started setting up its regulatory framework on waste management almost two decades ago. In 2000, the Ministry of Environment, Forests and Climate Change notified the first-ever law on waste management in the form of the Municipal Solid Wastes (Management and Handling) Rules.[10] Since then, the country's waste management regulations have developed in several aspects and undergone a massive transformation.

Rules	Link to Access
Municipal Solid Waste Management Rules, 2016	**https://cpcb.nic.in/uploads/MSW/SWM_2016.pdf**
Plastic Waste Management Rules, 2016 and 2018 *Amendment 2021 yet to be notified on CPCB website	**https://cpcb.nic.in/displaypdf.php ?id=cGxhc3RpY3dhc3RlL1BXTV9HYXpldHRlLnBkZg==**

8 *http://164.100.228.143:8080/sbm/content/writereaddata/SBM%20Plastic%20Waste%20Book.pdf*
9 *https://cpcb.nic.in/uploads/plasticwaste/Annual_Report_2019-20_PWM.pdf*
10 *Municipal Solid Waste (Management and Handling) Rules 2000*

EPR

WHAT IS EXTENDED PRODUCER RESPONSIBILITY?

EPR refers to the responsibility of producers and brand owners to manage the disposal of products post use. It is a kind of reverse collection system ensuring recycling for end of life, post-consumer waste. It is based on the famous and important international environmental law principle of Polluter Pays, which implies that the one who pollutes must pay for keeping the environment clean and intact.

WHAT ARE PROs?

PROs are professional organizations entrusted with the responsibility of managing plastic waste under the principles of EPR enshrined in the Plastic Waste Management Rules 2016. They must mandatorily register themselves with the CPCB.

PROs

BUY BACK

WHAT IS A BUY BACK MODEL?

Buyback is an emerging model for managing plastic waste where the original seller of the goods buys them back post-consumer use.

The global recycling percentage is only 9 percent. There is an urgent need for immediate and integrated actions to manage plastic globally and focus on recycling or upcycling. To address the challenge of the mounting waste crisis in the country, India started setting up its regulatory framework on waste management almost two decades ago.

IMPLEMENTATION OF PWM IN A CITY

2

Overview of municipal solid waste management in a city

The Solid Waste Management Rules 2016 have given an important responsibility to urban local bodies (ULBs) to manage the municipal solid waste (MSW) at the city level. The MSW is collected from different sources of generation: households, offices, public institutions, and organizations. The waste is further divided into different categories as seen in figure 4 with the available processing procedures.

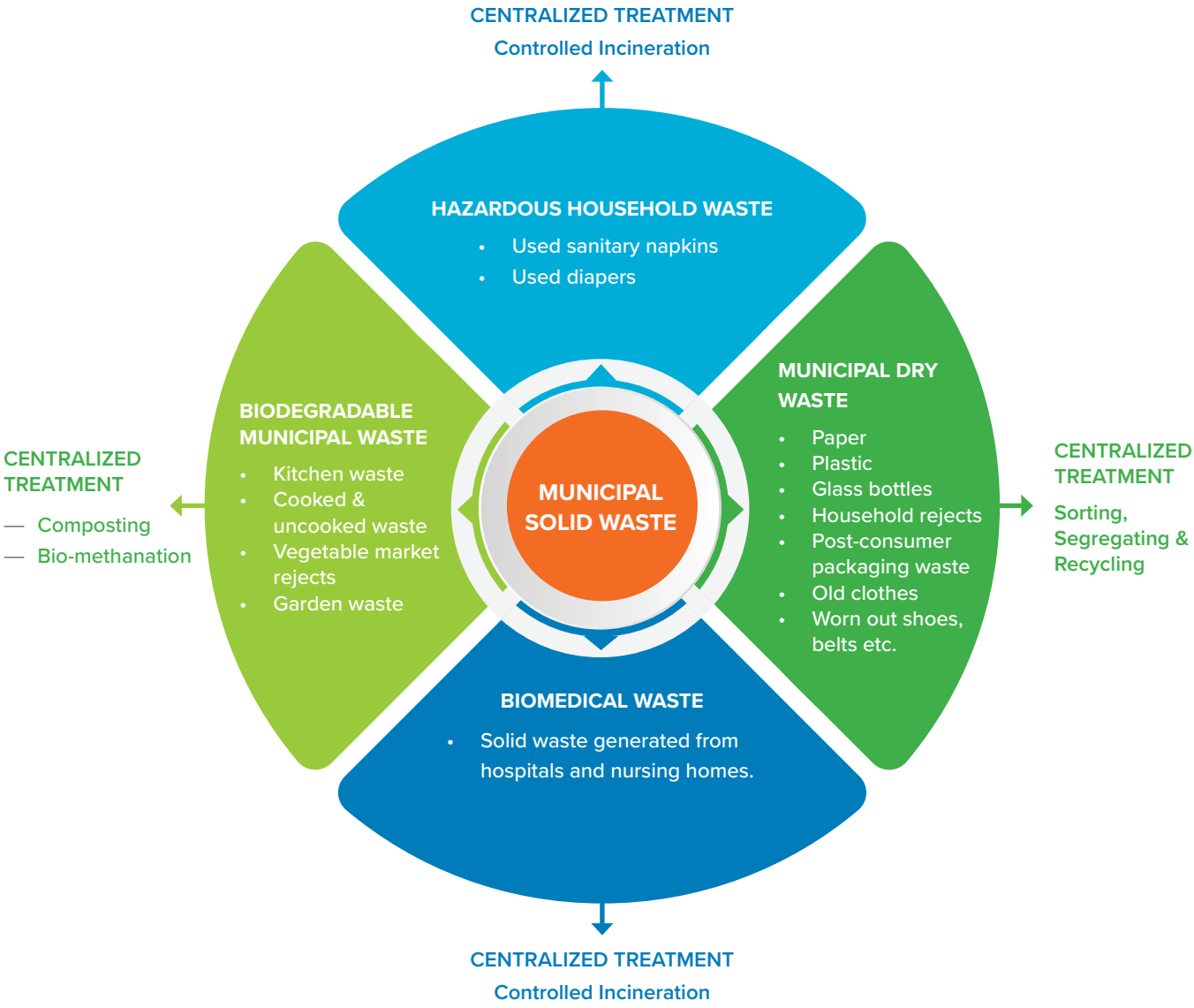


Figure 4 Characterization of Municipal Solid Waste. Source: CPCB

This handbook focuses on the efficient management of plastic waste in Indian cities. The process of setting up a PWM model has been divided into four components, and these components together act as a step-wise guide for ULBs. Every component is supported by case studies from across the country to provide a practical understanding of the various operations. These components are as follows:

- **Component 1:** Technical model for plastic waste recycling and management
- **Component 2:** Material recovery facilities (MRFs) for improved PWM implementation
- **Component 3:** Institutionalization of MRFs in governance bodies
- **Component 4:** Information, education and communication (IEC) and digitalization

2.1. Component 1 : Technical model for plastic waste recycling and management

This section discusses the decentralized dry waste management model, emphasizing PWM, and recycling. The door-to-door collection of municipal solid waste is handled by authorized agencies or contractors from sources such as households, condominiums, institutions, commercial buildings, etc. The waste is then transferred to small collection points called decentralized dry waste centres or transfer stations of ULBs. The waste at these transfer points is finally sent to MRFs.

> UNDP is implementing an integrated model to develop the MRF waste eco-system in the country. The model promotes an inclusive approach by involving different stakeholders and ensuring social benefits to the waste pickers.

Incoming waste is segregated at the MRF into dry and wet waste. The wet waste is processed and sent for composting, biogas generation and the residue is dumped in landfills. The dry waste is further segregated into different categories including plastics. Recyclable materials are sent for recycling and non-recyclables are treated for the end-of-life cycle. The flow of the process is depicted in figure.

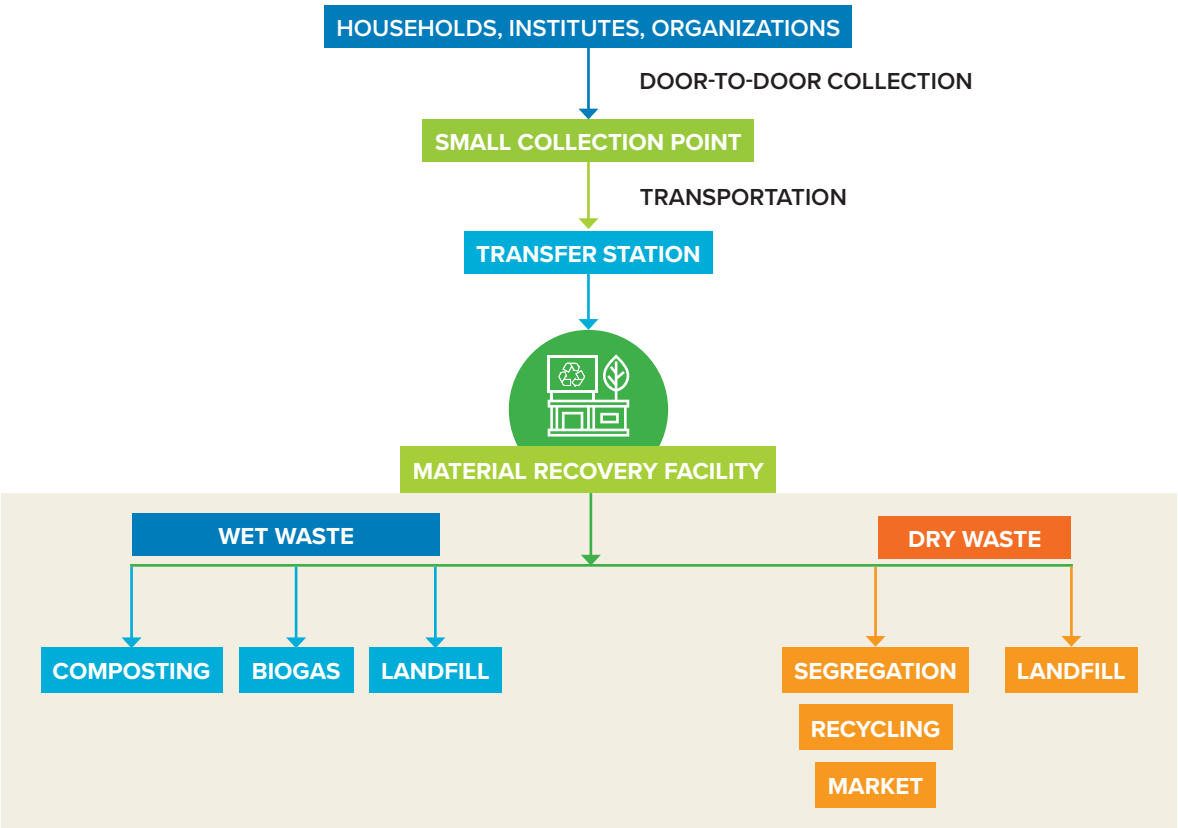


Figure 5 Municipal waste processing in India

Building on this process, UNDP is implementing an integrated model to develop the MRF waste eco-system in India. The model promotes an inclusive approach

by involving different stakeholders and ensuring social benefits to waste pickers. The schematic diagram of the model is detailed in figure 6. The details of its development and implementation are covered in sections ahead.

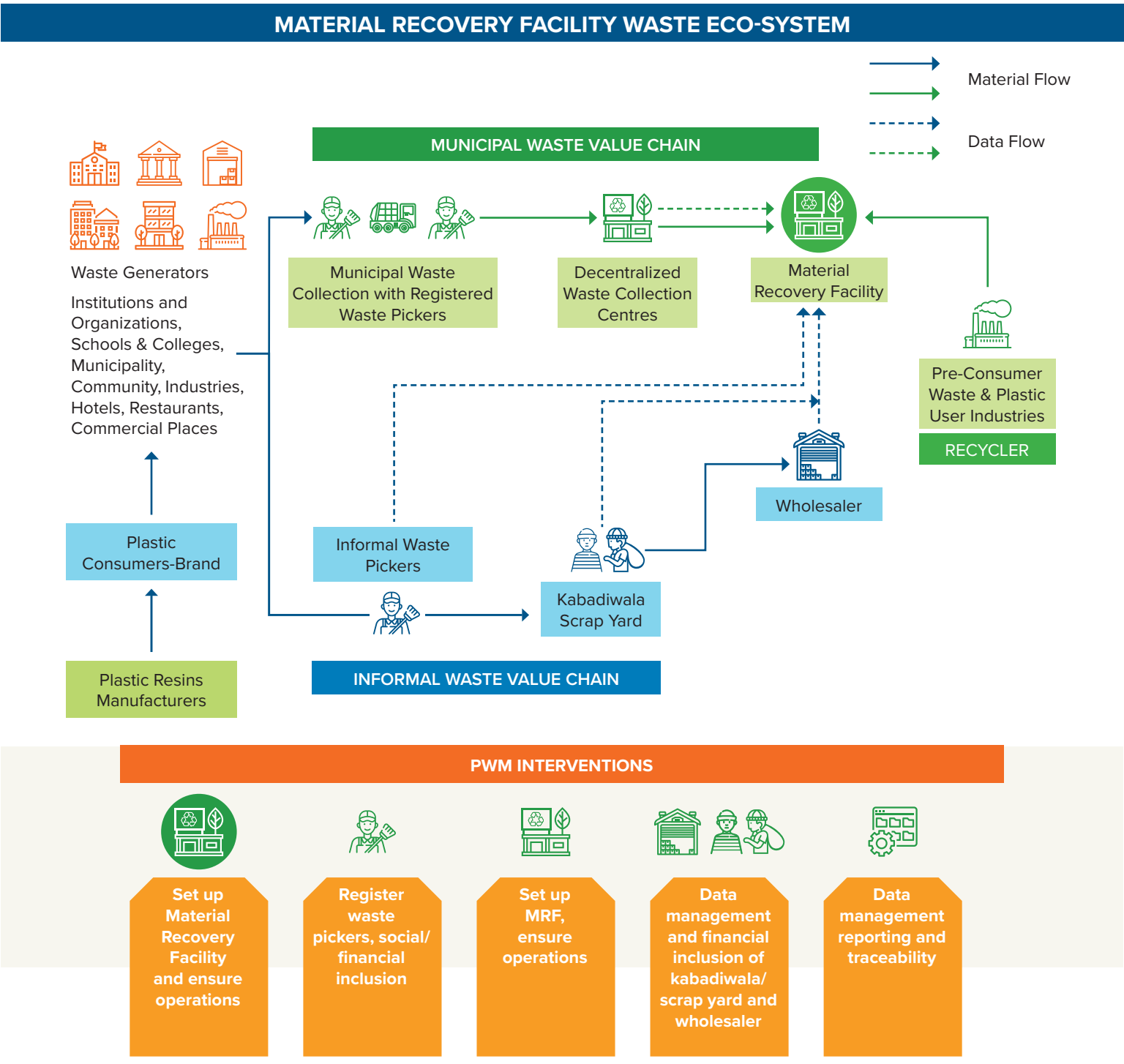


Figure 6 Technical model for MRF waste eco-system

I. Development of a framework for a baseline assessment of PWM

A baseline assessment would help assess the overall negative impacts (environmental and health) of plastic waste and look at the current practices and gaps in achieving sustainable waste management. As a first step, cities need to develop a baseline inventory (for the format see Annexure I) covering the following components.

- Inventory of different categories of plastic waste generated, such as PET, HDPE, LDPE, PP, PS, PVC. See figure 7 for the categories based on their identification codes.[11]
- Detailed mapping of the complete lifecycle of plastic waste up to the end-of-life stage, starting from collection, segregation, recycling, and other available options. This also includes situational analysis of the existing system by including waste pickers and their value in the supply chain.

II. Enabling environments for the creation of plastic waste recycling at the city level : Once the baseline study and assessment has been conducted, the second step involves enabling an environment for waste recycling.

- A waste management agency/organization should be chosen at the city level based on a pre-defined selection process by authorities. This organization will be involved in the model as a key stakeholder as they will facilitate the implementation of plastic recycling processes in the city.
- Post selection, training and exposure programmes for the shortlisted organization should be conducted utilizing training materials, including key learnings and challenges.
- Training and/or exposure programmes should be conducted for all other stakeholders, including ULB officials, self-help groups (SHGs), state pollution control boards (SPCBs) and communities etc. The training programme should focus on adequate knowledge sharing to develop implementation plans.
- Exposure visits should be organized between government and private players to strengthen inter-institutional learning and knowledge exchange.
- ULBs could provide the land to set up an MRF, which could be used by various industries to set up infrastructure for efficient PWM.
- In addition, workshops could be conducted to ensure sustainability of effective plastic waste recycling practices adopted and encourage knowledge sharing.

11 *Most post-consumer mixed MSW and unsorted household waste are known to contain a wide range of plastic polymer types, identifiable by their resin content label. This label is referred to as RIC (Resin Identification Code), and it represents the recyclability preference for each polymer. It is symbolized by a number (depicting preference with 1 being the most preferred) and three "chasing arrows".*

PET

POLYETHYLENE TEREPHTHALATE

Plastic bottles for soft drinks, water, juice, beer

Food jars for jelly and jam

Microwavable food trays

HDPE

HIGH DENSITY POLYETHYLENE

Bottles for milk, cosmetics, shampoo, household cleaners

Cereal box liners, oil bottles

PVC

POLYVINYL CHLORIDE

Rigid packaging like blister packs

Flexible packaging like blood bags. medical tubes,

Food wrap, vegetable oil bottles

LDPE

LOW DENSITY POLYETHYLENE

Plastic bags for breads, frozen foods. household garbage

Squeezable bottles

Coating for paper milk cartons and beverage cups

PP

POLYPROPYLENE

Containers for takeout meals

Medicine bottles

Bottle caps

Yogurt containers

PS

POLYSTYRENE

Food service items, cups, plates, bowls, cutlery, egg cartons

OTHER

OTHER

10 or 20 liters reusable water cans

Custom packaging

Figure 7 Categories of plastic. Source: American Chemistry Council

Note: Images are used for illustrative purposes only, and have been sourced via Google Images

III. Stakeholder identification and partnership

The following steps should be followed for stakeholder identification and establishing formal partnerships.

- ULBs with the support of multilateral agencies should conduct surveys to identify and select stakeholders at the city level. The different stakeholders include ULBs, waste management agencies/organizations, waste pickers, bulk waste generators (BWGs), waste aggregators and back-end recyclers.
- Based on discussions between the waste management agency/organization, ULB and other relevant stakeholders, wards should be selected to pilot the systemic approach, which can then be replicated across wards in the city. A certain number of waste pickers should be linked to collect plastic waste in every ward/city.
- The agreements to be obtained will include:
  - A signed agreement between the authorities and the waste management agency/organization to operate recycling activities (collection, segregation, recycling, etc.) through waste pickers and manage transfer stations and main recycling unit, i.e., the MRF.
  - A signed agreement between recyclers/co-processing units and waste pickers for the collection and segregation of plastic waste at pre-defined price rates.
  - A signed agreement between implementing agencies and local municipalities to provide land and set up recycling centres on the availability of resources like land, space, and machinery.
  - Mutually signed agreements with different stakeholders involving end-of life processors.

2.1.1 Recommended timelines for completion of Component 1

Below are recommended timelines for the completion of Component 1. The overall activity should be completed within four months.

Activities	Month I	Month 2	Month 3	Month 4
Development of a baseline system of PWM at the city level				
Enabling environments for the creation of plastic waste recycling at the city level				
Stakeholder identification and partnerships				

2.1.2 Case Studies

1 NO LONGER GOING TO WASTE: MADHYA PRADESH SHOWS THE WAY FOR INTEGRATED PWM

The city of Indore, which is home to almost 2 million people, generates 900–1,000[12] metric tonnes of waste every day, 14 percent of which is plastic, and this is enough to fill five to seven shipping containers. The city of Bhopal generates around 800 metric tonnes of waste per day. It is no surprise that urban waste management is one of the top priorities of the Government of India, and that local and affordable innovations in this sector are highly valued.

In this context, the concept of the 'circular economy' – an economic system intended to

12 *https://www.smartcityindore.org/solid-waste/*

eliminate waste and the ever-increasing use of resources – offers a pathway to more sustainable resource management. It means reduced production, use and disposal of plastics. Through the single, powerful objective of reduce > reuse > recycle, waste collectors in Bhopal and Indore are working to prevent cast-off plastic from entering the environment in the first place.

A plastic waste revolution

In Bhopal, ULBs in partnership with a local organization, have been working with waste collectors since 2008 to streamline plastic waste collection and sales to recyclers. The organization initially developed a sustainable integrated waste management system for five wards in Bhopal, which served as a model for the creation of a PWM policy at the state level in 2011. This model, now known as the 'Bhopal model', has been replicated in all states across India (and even onwards to Bangladesh). This innovative model recycles and processes plastic and reuses it in the construction of roads, benefiting over two million people.

Waste pickers collect and hand over plastic waste to collection centres run by the Bhopal Municipal Corporation. The plastic waste is scanned and segregated, and most single-use plastics – which comprise half of all the plastic in this waste stream – are shredded and baled.

The bales are then taken for co-processing at cement kilns or used to build roads. It's a win-win situation: for waste-collectors – one of the more vulnerable communities in Indian society – because it doubles their wages and ensures that something useful is done with the plastic litter. In 2010, in close collaboration with the Bhopal Municipal Corporation, UNDP's Small Grants Project (SGP) provided an initial grant that enabled a local organization to conduct focussed interventions in five wards. Part of the interventions included organizing waste pickers into SHGs. In 2014, the local organization was awarded another SGP grant to mobilize more than 2,000 unorganized waste pickers in 70 wards of Bhopal Municipal Corporation.

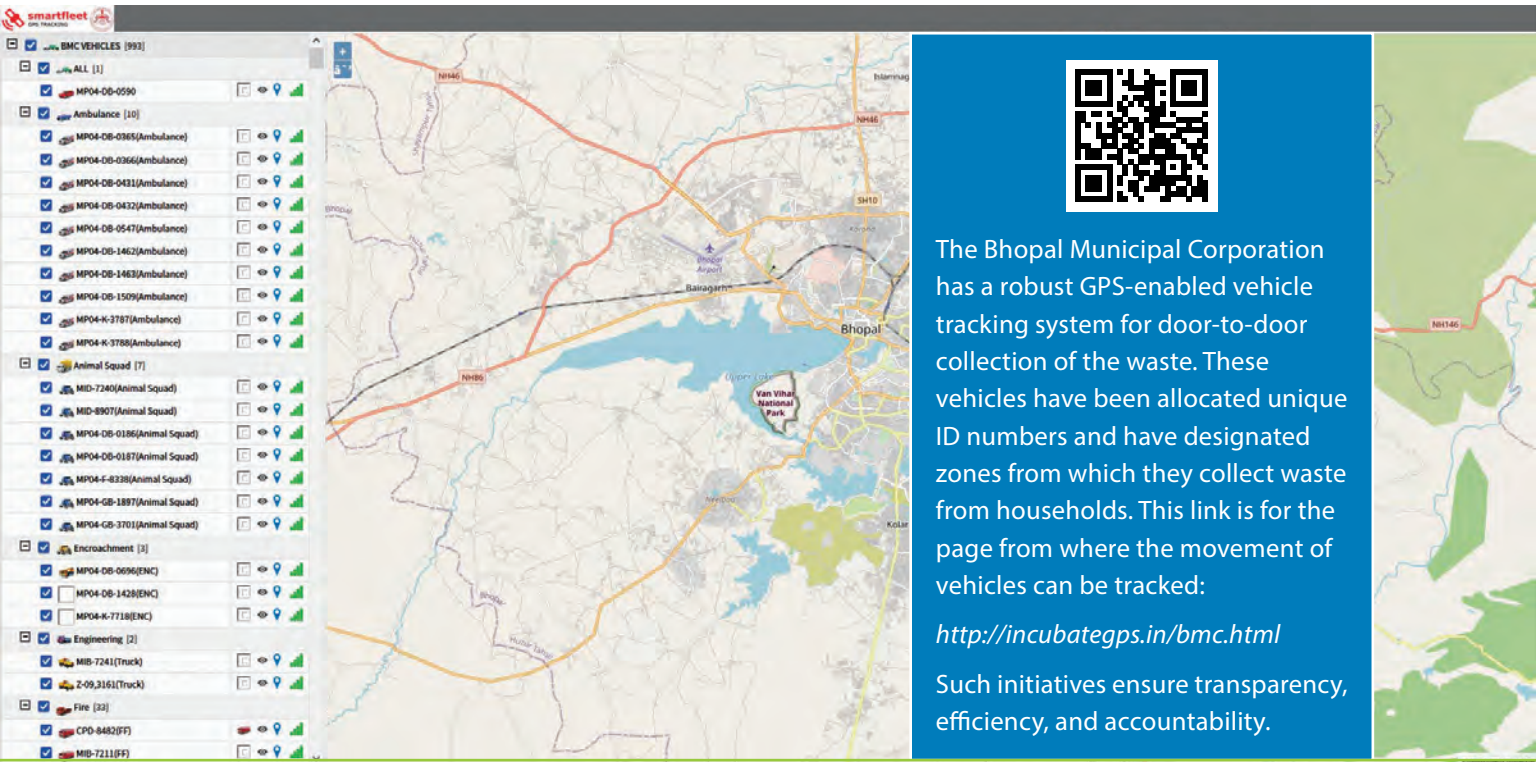
Lending legitimacy

A crucial element of the project's success was the organization's partnership with the ULBs and local industries. Through the SHGs, the waste collectors – many of whom are socially marginalized and illiterate women – were organized and trained in waste collection and recycling activities.

The majority of these waste collectors have been provided with municipal identity cards and uniforms through this project. While improving their livelihoods and protecting the environment, these women contributed approximately 10 tonnes of plastic waste collected at five recovery centres in Bhopal every day, which was recycled by cement industries in and around the city.

> 'I've been sorting waste for 15 years. Polythene bags, glass, plastic, and more: we pick up all of this stuff of the roads. We used to collect dirty plastic bags from the street and the plastic traders would offer us less money per kilogram because the bags were dirty. And people would stop us from collecting trash and tell us to leave their colony. Now that we work with the municipality, no one tells us to stop. In fact, they now ask us to come and pick up waste'
> *- Meera Gosai, waste picker.*

By the end of 2016, 646 waste pickers in Bhopal were organised into 42 SHGs. More than 60 percent of these waste pickers are women, who earn a daily living from selling plastic waste. Forty members from the various SHGs have also been trained in making bags out of used polythene, which are sold in exhibitions across India. The success of the Bhopal project led to the establishment of a pilot plastic recovery centre in Indore, and as a result, 3,500 waste pickers were organized into SHGs. In addition, given the occupational hazards involved, the local organization also conducted regular health camps, and over 850 waste collectors are now enrolled in health insurance schemes.



The Bhopal Municipal Corporation has a robust GPS-enabled vehicle tracking system for door-to-door collection of the waste. These vehicles have been allocated unique ID numbers and have designated zones from which they collect waste from households. This link is for the page from where the movement of vehicles can be tracked:

http://incubategps.in/bmc.html

Such initiatives ensure transparency, efficiency, and accountability.

From waste collection to waste recovery

By collaborating with local government bodies, the Bhopal Municipal Corporation allocated 230m^2 of land for waste collection centres. The Madhya Pradesh Pollution Control Board facilitated waste transportation to cement kilns, and the Bhopal Municipal Corporation provided 850 cycle rickshaws to the local organization to enable easier waste collection.

In 2014, five plastic waste collection centres in Bhopal were upgraded to plastic waste recovery centres. This included fitting the centres with plastic shredders, compressor scrap baling machines, and other necessary machinery. The centres are facilitated by the local organizations and managed by the women SHGs. Approximately 10 tonnes of plastic waste are collected at these centres every day. Around 45 tonnes of plastic waste is sold to cement industries in and around

Bhopal to be used as fuel in the furnaces. Around 60 tonnes of plastic waste is sold to the Madhya Pradesh Rural Road Development Authority every month to be used in road construction.

On the road

One of the most environmentally sensitive and economically useful means of repurposing plastic waste is using it in road-making. Higher-grade polyethylene is baled and sent to cement plants to be used as alternate fuel. These are non-recyclable plastics and can burn with coal at temperatures >1,300°C. In collaboration with the local organizations, the SHGs in Bhopal, who manage the plastic recovery centres, constitute small enterprises via the sales of processed plastic wastes to recyclers, road construction agencies and cement factories. Roads made with mixed plastic are highly durable due to their high resistance to water, which is significant for a region with an extended monsoon.

2 KARNATAKA: A TEXTBOOK MODEL FOR SUSTAINABLE PWM

Saahas Waste Management Pvt. Ltd. (Saahas Zero Waste, SZW) is a social enterprise, offering integrated waste management services to BWGs, corporations, apartments and government institutions. SZW offers plastic waste services to corporations through its EPR vertical.

The model currently provides consultancy services to help implement a holistic, decentralized waste management system, enabling the recovery of maximum value from waste. SZW has an ongoing project being implemented in these four locations: Udupi, Ramanagara, Mangalore and Ballari. This project entails the design and construction of an MRF, a semi-mechanized facility which receives and processes dry waste from BWGs, gram panchayats and ULBs. The set-up of the MRF entails capital expenditure, including investments in infrastructure, monitoring devices, material handling and safety equipment etc. The operating expenditure is recovered through collecting a user fee from waste generators, which is charged by the municipal corporation. SZW engages with ULBs towards the implementation of EPR by securing authorizations for collection of plastic waste pan-India.

Key highlights of the model

- End-to-end service: Sahaas offering holistic services including EPR registration, design of action plan, implementation of EPR, quarterly project report submission, reporting and fulfilling audit requirements.
- Reverse logistics: Saahas has a well-defined reverse supply chain that allows the effective transportation of post-consumer waste to the authorized end destinations.
- Rejected product collection services: SZW supports brands/producers in the collection and safe disposal of their expired/damaged products.

IMPACT OF THE MODEL

- 20,300+ metric tonnes (MTs) of waste diverted from source to authorized end destination.
- 37,000+ MTs of CO_2 emissions averted.
- 200,000 trees every year saved due to recycling paper.
- 252 people employed from lower socio-economic groups.
- Formalization of waste management and inclusion of informal workers.

- Traceability tool: SZW has developed tools for traceability, data monitoring and the digitization of data through software platforms and Internet of Things and for the computer-assisted sorting of waste, etc.
- Impact measurement: SZW is a member of UNDP's Business Call to Action, through which impact metrics is demonstrated for each EPR plastic waste collection centre. These impact metrics are aligned to the SDGs.

Implementation process of the model

The stages of PWM implementation include:

- Mapping the supply chain
- Enrolling waste pickers/scrap dealers/micro entrepreneurs and transporters
- Issuing purchase orders, SOPs and registering vendors with end destinations
- Data capturing for waste collection
- Dispatching plastic waste to authorized end destinations for recycling/co-processing
- Providing data reconciliation and obtaining recycling/co-processing certificates from end destinations

3 THE RECYCLING MODEL IN SURAT: ENSURING SUSTAINABLE PWM WITH MULTI-STAKEHOLDER PARTNERSHIPS

Surat is one of the busiest and major commercial hubs in the country. As per the Surat Municipal Corporation (SMC), the city has a population of more than 60 lakh people, and it generates almost 220 MTs of plastic waste every day. With guidance from the SMC, Ecovision, an environmental resource management consultancy firm, has been managing plastic waste in the city efficiently. Working closely with the SMC, it has emerged as a single point of integration for PWM initiatives in the city.

Ecovision manages nine MRFs in Surat and handles 65 to 70 MTs of plastic waste every day. It has developed a strong network of collection channels with the help of door-to-door agencies, residents' welfare associations, waste pickers and more. Ecovision has also set up nine separate collection centres at BWGs such as commercial stores, shopping malls and airports. The Company's collection rate has increased from 10 tonnes per day (TPD) of plastic waste in 2019 to 70 TPD in 2020.

Ecovision has also partnered with academic institutions like the Indian Institute of Management, Ahmedabad, Pandit Deendayal Energy University, Central Institute of Petrochemicals Engineering & Technology (CIPET), etc. Ecovision is also working on a tripartite community engagement model between educational institutes, citizenry and corporates. With the help of these associations, Ecovision has been designing artificial intelligence and digital-powered tools to clean waterbodies and streets among several other initiatives.

It works with more than 400 waste pickers and is working to bring them all under the ambit of the Workmen's Compensation Insurance Scheme. It is also closely coordinating with the SMC to ensure that these waste pickers have access to social security schemes and benefits like healthcare, education facilities, etc. During the pandemic, the organization also provided families of waste pickers with cooked meals and is now helping them with COVID-19 vaccination.

IMPACT OF THE MODEL

1. The collection rate has increased from 10 TPD of plastic waste to 70 TPD.
2. Working directly with 400 waste pickers, Ecovision ensures they are linked to social protection schemes.
3. Replicating the Surat model, Ecovision is now active in other cities of Gujarat as well, managing 40 percent of Gujarat's plastic waste.

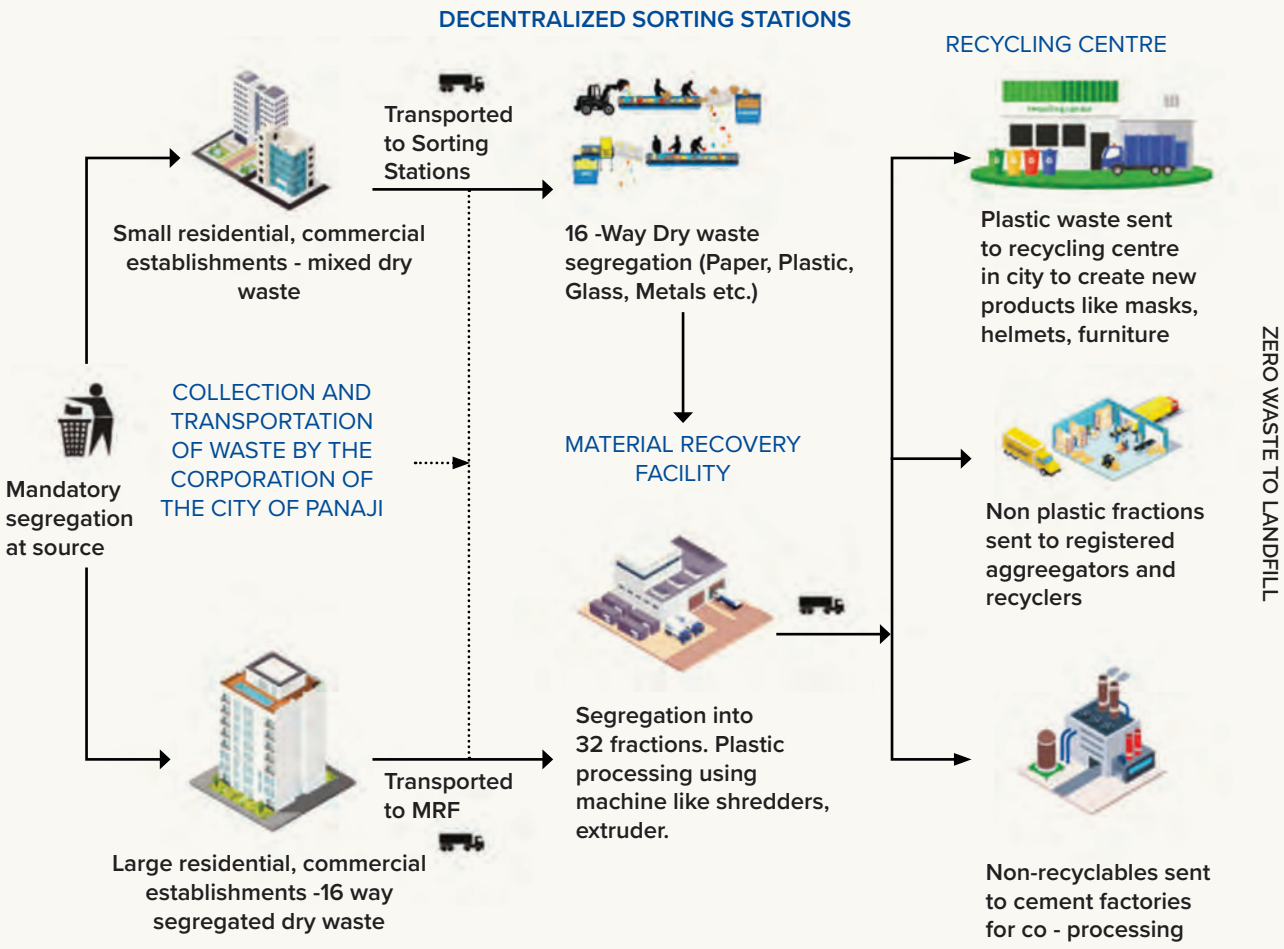
4 PANAJI'S 16-WAY SEGREGATION APPROACH SHOWS A NEW MODEL FOR SEGREGATION AT SOURCE

As an urban tourist city, Panaji generates around 42 TPD of waste. After segregation, the wet waste is composted, while the recyclable dry waste is sent to recyclers and the non-recyclables to cement factories as refuse-derived fuel for co-processing.

The city has implemented an innovative model for a 16-way segregation at source. Once segregated, the waste goes through different streams of recycling and resource recovery, therefore drastically reducing the waste that ends up in landfills. This system is cheaper, requires minimal manual or mechanical sorting, reduces the burden on the environment and the stretched waste system. More importantly, this innovative system reduces the occupational health risks for waste pickers who segregate the waste at MRFs.

Figure 8 Panaji's 16-way waste segregation approach (Left) Source: Panaji Municipal Corporation

Figure 9 Implementation process for 16-way segregation (Down) Source: Panaji Municipal Corporation



So far 60 percent (101) BWGs and housing societies have been reached and sensitized on the 16-way model. Forty-two of them have completed or in process of implementing the model. The buy-back system has been started in 33 entities.

The Panaji Municipal Corporation (PMC) in collaboration with the recycler, 21 Century Polymers, Mineral Foundation of Goa (organizations) and UNDP has targeted and onboarded 152 BWGs under the programme. Subsidies have been worked out with ULBs to reduce the capital cost of the infrastructure required for 16 bins. A buy-back system of dry waste has been introduced to incentivize those undertaking 16-way segregation. This will help offset implementation costs and generate long-term return on investment.

In October 2020, the PMC made 16-way segregation a part of the Solid Waste (Management and Handling) bylaws of the city, making it mandatory for all BWGs to follow the model.

5 DIVERTING 52 PERCENT OF PLASTIC WASTE AND SAVING RS 900 MILLION: WOMEN-LED SWACH REMAINS THE BEST EXAMPLE OF THE INFORMAL SECTOR LEADING WASTE MANAGEMENT

Pune based SWaCH is one of the country's oldest and first cooperatives owned by a self-employed waste pickers association. With more than 3,000 members, SWaCH has created a robust model that not only negotiates with the government as an equal stakeholder but has also succeeded in securing livelihoods for Pune's informal waste workers.

It primarily focuses on providing the best waste collection services in compliance with waste management laws and securing/upgrading the livelihoods of waste workers. SWaCH workers go door-to-door to collect recyclable waste, engage in manual segregation of recyclable waste at the premises of the waste generator and then sell these recyclables to small and medium scrap shops, which recycle these into new products.

The workers are entitled to a user fee from the waste generators for the waste management services provided by them. The Pune Municipal Corporation also provides these workers with health insurance and identity cards, a major step in ensuring they have recognition and social protection.

SWaCH engages in behavioral communication and education activities with RWAs, and it manages two helplines: one for members of the cooperative and the other for the complaints by residents.

Women comprise over 80 percent of the organizational membership, and there is strong representation from the scheduled castes and other backward classes. The recognition provided by SWaCH has empowered cooperative members from these communities and has minimized their exposure to social vulnerabilities like exploitation and harassment.

Started with just 50,000 properties in 2005, SWaCH has served more than 640,000 properties with 3,076 members in Pune until 2018. Today, it collects 30,000 tonnes of plastic waste every year, of which 15,000 tonnes are sorted and sent for recycling.

IMPACT OF THE MODEL

1. SWaCH diverts 52 percent of plastic waste from landfills and saves 900 million rupees in labour, transportation, and processing costs. This is around 46 percent of the entire capital budget of Pune's solid waste management system.
2. The informal workers working in the cooperative have secured access to waste, a stable flow of income, health insurance support, and identity cards.

2.1.3 Role of stakeholders

The below given figure illustrates the role of different stakeholders for completion of Component 1.

ULBs

The Urban Local Bodies will support the model by allocating the land and machinery support.

Organization

The selected local organization will manage the complete management of plastic waste recycling from collection to recycling. This will act as the main implementing agency for running the various models.

Multilateral

The multilateral can act as facilitator of all the activities mentioned in the component. They will provide knowledge and technical support for facilitation of the process with focus on sustainability and social inclusion.

Private Players

The brand owners or industries can play a major role by providing the financial investment and support to set up the MRF in selected cities. This can be considered under the EPR of particular industry or company.

Waste Pickers

Waste pickers will provide support in collection and segregation of the waste from generators to MRF.

End Recyclers

The end recyclers will act as key stakeholder to bring market driven approach and producing products based on market demand. The end recyclers will purchase processed material from MRF for recycling.

2.1.4 Cross reference with PWM and SWM rules of Government of India

Recommendations made under Component 1 are aligned to the Plastic Waste Management Rules 2016 and 2018 and its amendments. Some of the key cross-reference points can be accessed by referring to the following rules, and the page numbers have been mentioned for easy reference.

- Rule 5. Plastic waste management (page number 5)
- Rule 6. Responsibility of local body (page number 5-6)
- Rule 9. Responsibility of producers, importers and brand owners (page number 7)
- Rule 13. Registration of producers, recyclers and manufacturers (page number 9)

2.2 Component 2: MRFs for improved PWM implementation

MRFs are integrated waste management facilities required in a city to extract the recyclables from the inflow of MSW. An MRF is powered by advanced machinery and waste pickers to recycle all kinds of plastic waste along the value chain for shipment to manufacturers or recyclers as raw material. The viability of the process at the MRF completely depends on the quantum and market demand of recyclables because it is both labour and energy-intensive. In an ideal waste value chain system, an MRF plays a vital role in incorporating the circular economy approach. Figure 10 represents the ideal logistical route of MSW from the source of generation to an MRF to a recycling facility.

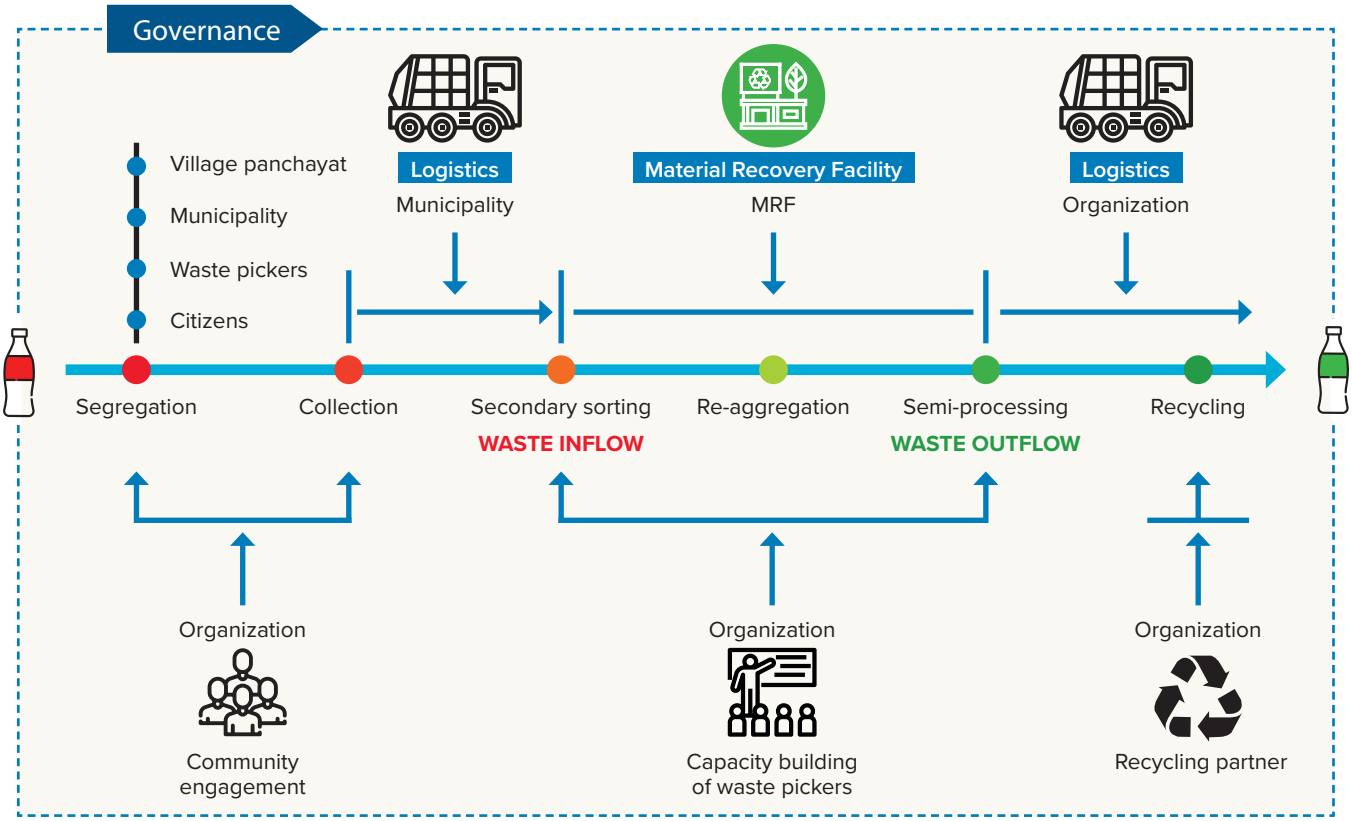


Figure 10 Waste logistics and traceability model. Source: UNDP

MRFs handle all kind of dry waste – separated at source and mixed – collected by city municipal corporations/nagar nigams/nagar panchayats/BWGs or by waste pickers, aggregators, organizations and others. Recyclable materials received at an MRF are sorted, cleaned, value added and transported to material-specific recyclers. Non-recyclable low-grade plastic material are sent to end-of-life processes. The dry waste generated at the household level or at municipal sources will be collected through a door-to-door collection system and transported to an

MATERIAL RECOVERY FACILITY – MATERIAL FLOWCHART

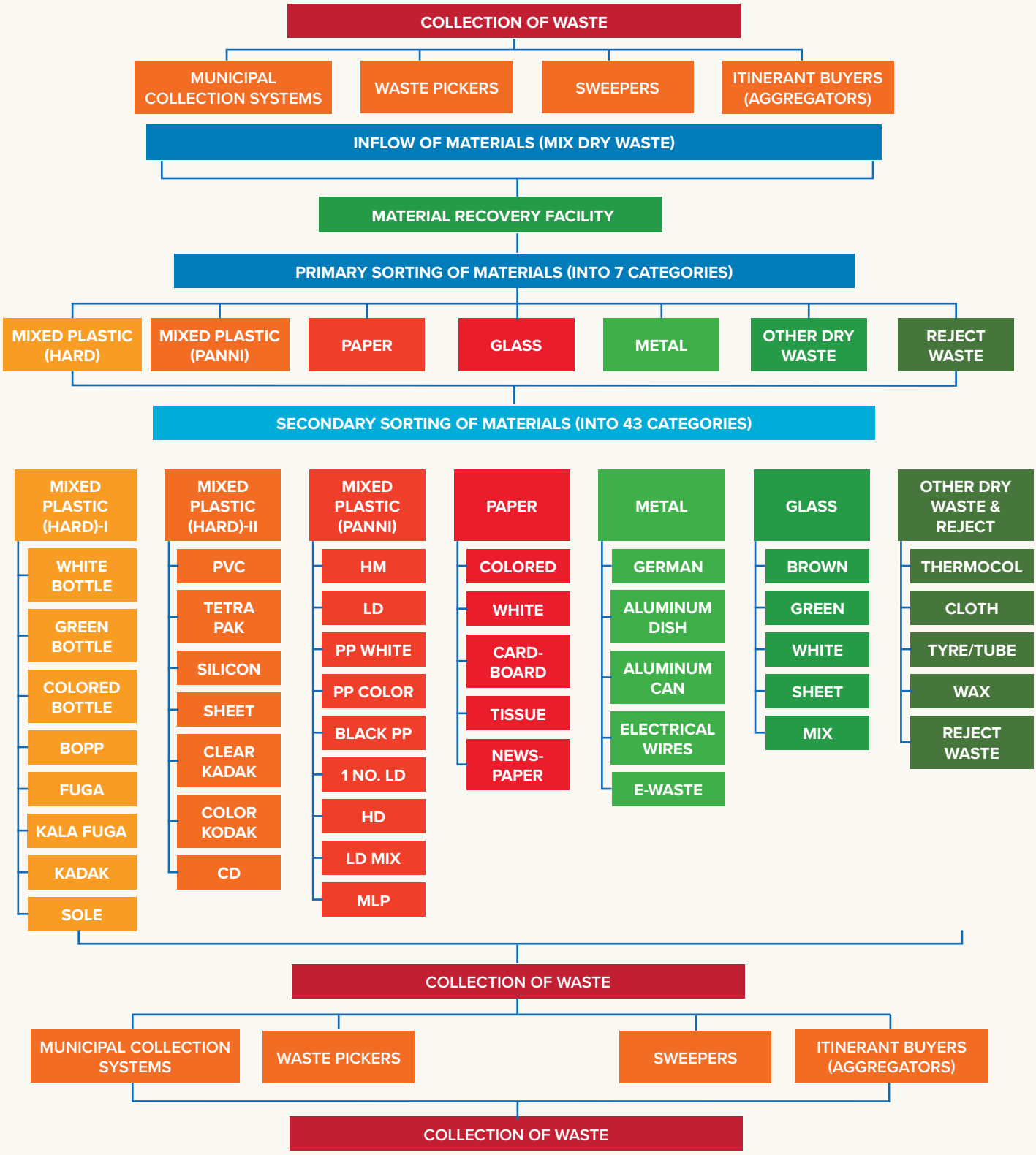


Figure 11 MRF material flow chart. Source: CPCB

MRF. The segregated waste is then categorized in a wide range, and which will then be recycled based on the quality of the waste.

MRFs have machinery and resources, which require efficient procedures for proper operation, monitoring and evaluations. The manual and digital systems can be used for weighing and recording incoming waste data daily. The waste is unloaded at a designated point, and sorting takes place on a conveyor belt. The materials recovered from the conveyor belt are further processed for value addition and ease of transportation.

A. MRF designing criteria

MRFs are designed based on two important criteria which define processes and equipment.

i. Population to be catered

ii. Quantum of waste generated

S.No.	Population	Per day capacity of the MRF (max.)	Required space
1	Less than 50,000	15 MTs of dry waste	2,000 sq. ft.
2	50,000 to 150,000	30 MTs of dry waste	3,000 sq. ft
3	Above 150,000	Centralized processing centre with multiple decentralized dry waste collection centres	5,000 sq. ft and above

Table 1 Types and sizes of MRF based on criteria

The conceptual layout plan for an MRF is shown in Figure 12 on next page. The layout and design can be modified based on the city, population and the amount of land available to construct the MRF. Cities with smaller populations can opt for one MRF and cities with larger populations can build a centralized MRF with multiple decentralized centres.

B. Site development, MRF construction and waste flows

For the site development of the MRF, the following steps need to be undertaken:

- Selection and allocation of location and site for the construction of MRF
- Identification of waste logistics in the city and estimation of the quantum of dry waste
- Civil work specifications including preparation of design and drawings
- Selection of plant and machinery capacity for waste processing

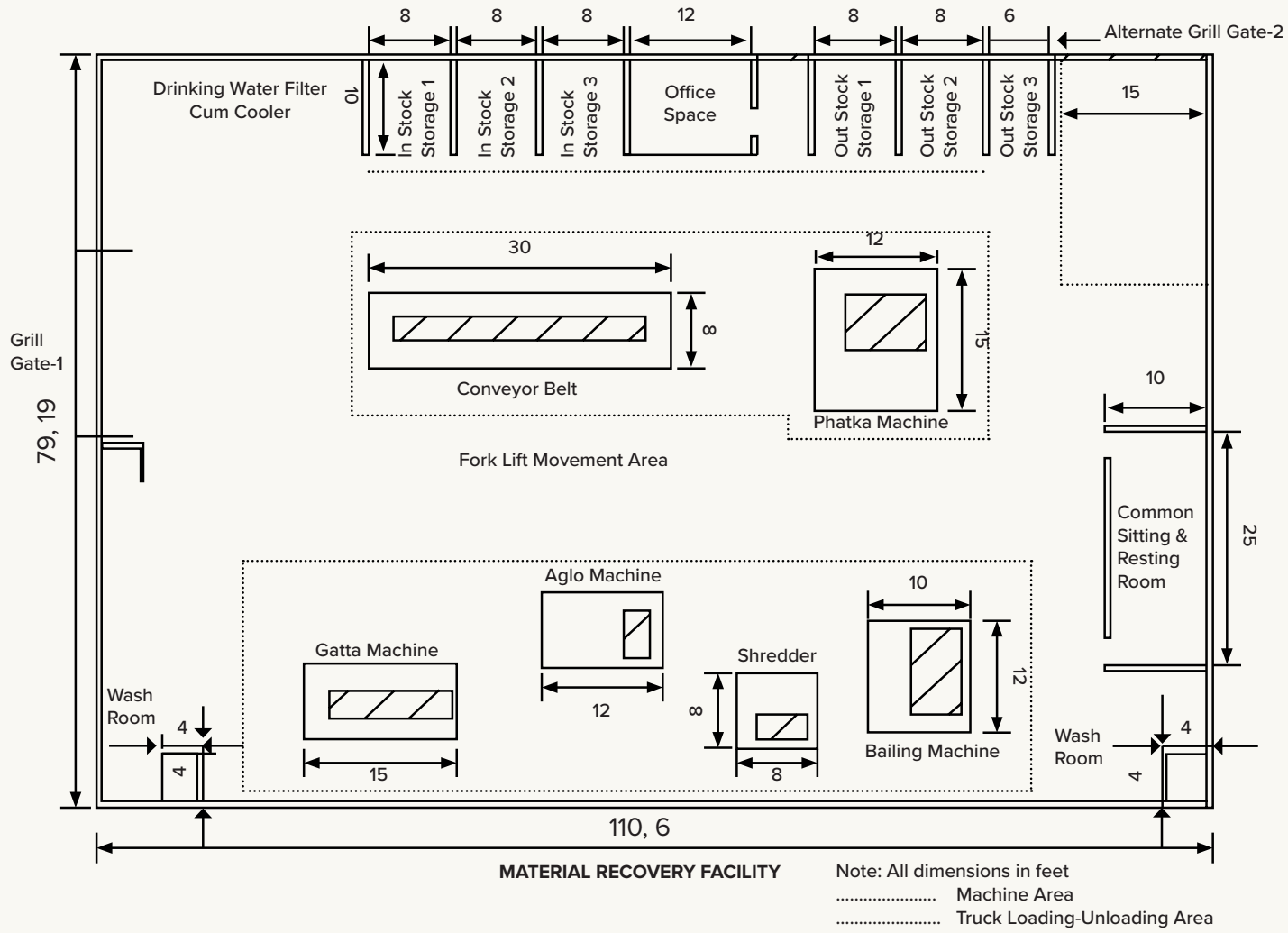


Figure 12 Conceptual layout plan of MRF. Source: UNDP

Based on finalized design MRF construction includes:

- Campus boundary
- Shed boundary
- Entrance and exit doors
- Emergency exit
- Machine layout (indicating machine input/output facing, placement of electric panel)
- Working space
- Platforms, working tables/benches, containers, etc. for all machineries as per process requirements
- Forklift movement area (if required)
- Electric panel and layout
- Office space
- Clean space for waste pickers (lunch area and crèche)
- Toilets
- Handwash area
- Drinking water cooler
- Incoming waste unloading area and a sorting area

- Stock storage and description of storage
- Fire extinguisher installation
- Exhaust fan
- Weighbridge demarcation and any other machines expected in future
- Water/cooling provision for *gatta* (if required)
- Installation of safety signages for the location
- Installation of MRF information board
- Installation of the dos and don'ts board

Once the infrastructure is completed, the estimation and linkage of waste inflows and outflows need to be conceptualized and established. The waste inflow sources and outflow process is represented in figure 13.

C. Waste processing at MRF

At an MRF, the inflow waste carrying vehicle is first weighed at the weighbridge or weighing machine depending on the quantity of waste. The incoming waste is recorded daily in manual and digital systems. The waste is unloaded at designated points at the MRF and then sorted or segregated on a conveyor belt. The plastic is segregated and separated based on the representation in figure 14.

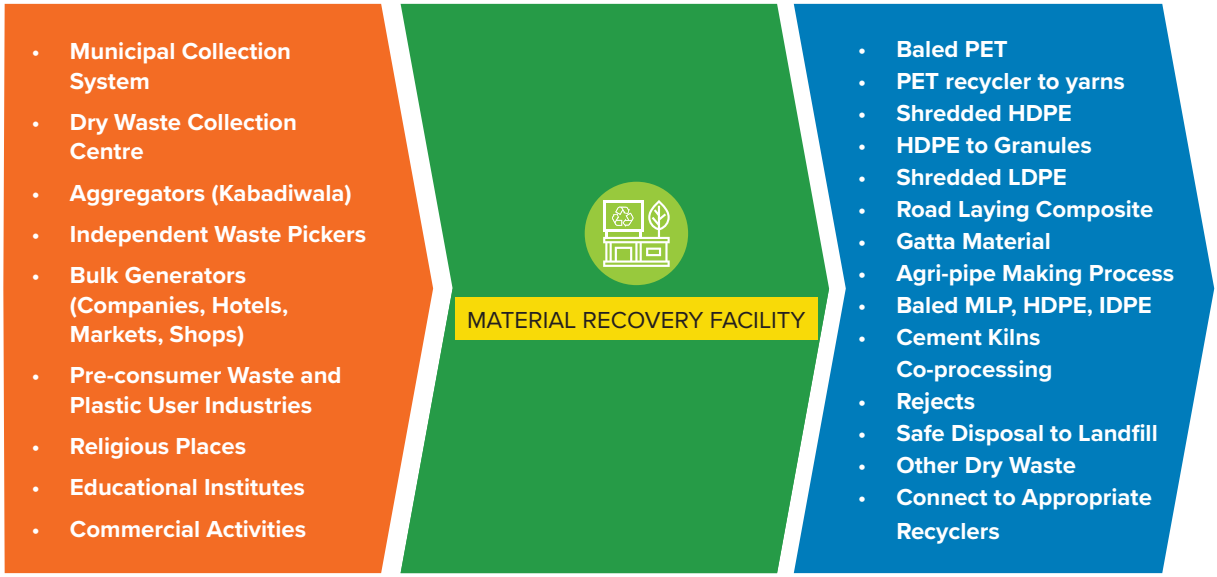


Figure 13 Waste inflow sources and outflow process

Figure 14 Plastic segregation representation. Source: CPCB Guidelines on Plastic Waste Management

The sorted/segregated waste is cleaned using an air blower (phatka machine) to remove the soil from the plastic. The cleaned plastic films/multi-layered plastics (MLPs) are baled or shredded for value addition and for ease of storage and transportation. The shredded plastic films are glued together and agglomerated to form plastic lumps and then sold to recyclers as raw material for the manufacture of various products. The baled plastic is stored or sent to cement kilns for co-processing. The pictorial representation of the required equipment and the waste management cycle at the MRF is shown in figure 15. The types and uses of the equipment are given in table 2.

Equipment	Uses
Conveyor Belt 	A conveyor belt eases the process of segregation and reduces workload for waste pickers.
Air Blower 	An air blower is used to dry clean thin plastic/MLPs by removing dust and moisture. Air is blown through a channel to separate the dirty material and remove dust and moisture from the waste.
Shredder 	Dry and dust-free thin plastic is shredded into 2–4 mm flakes. These shredders tear up the plastic into small pieces/flakes, preparing them for recycling into other products.
Agglomeration and Extrusion 	The material is agglomerated with frictional heat within a fraction of a second, right below the melting point, and this is a process of surface fusing. Valuable lightweight fused plastic particles are produced with minimum heat and thermo-degradable damage. Fused plastic produced from the agglomeration stage is fed through the feed hopper into the barrel of the extruder. The material is gradually melted by the heaters arranged along the barrel and is pushed forward by a mechanical screw inside the barrel. The molten polymer is collected as a lump, cooled and stored.
Bailing Machine 	A baling machine is used to compress high volumes of plastic waste/PET bottles into rectangular bales, which helps bind them. Bales are easy and safe to transport.

Equipment	Uses
Weighing Machine 	This is a platform weighing scale with a built-in thermal printer and an auto print facility. This means that this machine will provide a slip after weighing the waste with the details fed by the operators (e.g., operator's name/seller's name/ product name along with the details of rate and cost).
Weighbridge 	A weighbridge, or railroad scale, is a large set of scales, usually mounted permanently on a concrete foundation, used to weigh entire collected waste in the vehicle.

Table 2 Waste processing equipment and their uses

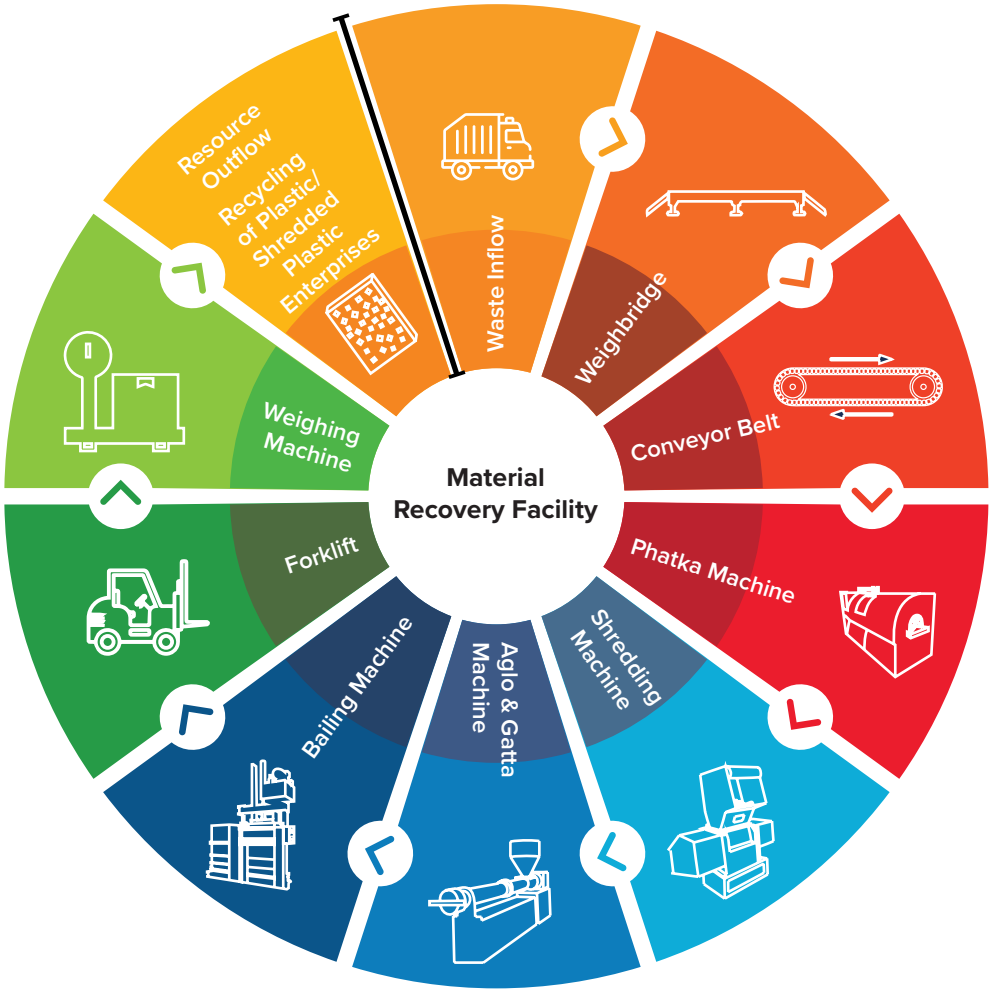


Figure 15 Waste management cycle at an MRF

D. Elements of the MRF

For an MRF to be economically sustainable, it needs to be equipped with processes and protocols which not only address dry waste management but also create a sustainable ecosystem for resource efficiency, environment compliances, basic amenities, health and safety and a socio-economic support system for key players such as waste pickers and recyclers. The key elements to be considered at MRF are:

1) The processing of waste using the machinery mentioned in table 2 should ensure resource efficiency, reduced manual labour, environment-friendly practices and low rejects going to landfills.

2) Developing an environment, health and safety plan, environment management plan and social management plan with a focus on:
   - Fair wages, equality and justified working hours for waste pickers.
   - A safe working environment including the provision of drinking water by installing a water purifier unit onsite, clean sanitation facilities for both male and female workers, handwashing point with continuous water supply, common rooms for changing clothes, and rest during breaks.
   - Availability of a first-aid kit.
   - Establishment of a children's creche and safe play area at the site.

3) Monthly health camps can be organized for connecting waste pickers to various medical schemes such as:
   - Ayushman Bharat Yojana
   - Janani Shishu Suraksha Karyakaram
   - Pradhan Mantri Matritva Vandana Yojana

4) Developing gender action plan for ensuring
   - Safe workplace for women.
   - Gender-inclusive workplace by involving women in management and leadership roles.
   - Gender-responsive health education, including nutrition, pregnancy prevention and care.
   - Menstrual health and hygiene.
   - Prevention from gender-based violence.

5) Financial inclusion for the opening of bank account and benefits of saving money on a longer term by engaging in various schemes:
   - Pradhan Mantri Jan Dhan Yojana (PMJDY)
   - Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY)
   - Pradhan Mantri Suraksha Bima Yojana (PMSBY)
   - Atal Pension Yojana (APY)

2.2.1 Standard operating procedures and guidelines

The standard operating procedures (SOPs) listed in this handbook are indicative and it is not mandatory for ULBs to follow the same pattern. Depending upon the local conditions, ULBs may amend and implement the same.

SOP for waste management agency (Organization - Responsibility & Working Conditions at MRF)

After allocation of the shed space to start an MRF, the organization needs to ensure that the following tasks are completed.

Operational:

1. Once the MRF area is allotted, a layout plan with the placement of equipment can be finalized. The organization needs to set up the MRF with basic facilities like chairs, tables, etc. as soon as the MRF is handed over for easy day-to-day operations.
2. Set up a three-phase electricity connection.
3. Set up the basic number of machines as per table 2.
4. Undertake regular performance checks and maintenance of the machines at least once a month.
5. Appoint appropriate staff such as a project coordinator, MRF supervisor (mukkadam) and five or six waste pickers after following a fair procedure of selection.
6. The project coordinator will be the focal point for all types of communication and establishing the processes of the MRF, including record-keeping and planning and monitoring the overall operations. Setting up all the necessary operations and systems with all production, dispatch and other activities in place is their responsibility.
7. Trainings should be organized for all waste pickers at the MRF to help them learn about the processes, machines and operations at the MRF. Training on recognizing the different grades of plastics for better segregation and, in turn, better prices and recycling should be provided. The organization should coordinate with respective stakeholders to schedule the training.
8. The collection system of the plastic waste should be put in place in parallel. The norms and rates for different grades of plastics collected by the waste pickers should be agreed upon.
9. A plan to reach out to the various BWGs like schools, colleges, hotels, RWAs, institutes etc. for the collection of dry waste. Organizations should make formal arrangements/letters of exchanges/agreements with these BWGs for the periodic pick-up of dry waste.

10. Organizations should agree and fix on the rates, systems and transportation of the baled plastic waste, gatta (extruded plastic), etc. from the MRFs with the recyclers.
11. Contracts should be made with nearby cement plants/waste-to-energy plants and municipal corporations to supply shredded plastics for road construction.
12. An on-call pickup facility should be created and managed at the organization-level in a city during the collection of waste and other issues.
13. The MRF should be registered with district industries centres and the necessary approvals from the SPCB should be taken.
14. Each MRF must have boards displaying dos and don'ts, safety rules, emergency contacts, information on gender equality, salary, insurance and other factors.
15. Other dry waste sorting and linking with markets needs to be done for metal, paper, glass, cloth, cardboard, wet waste and other medical waste if it comes. Similarly, recyclers needed to be finalized and rates agreed upon.

Occupational and Social:

1. All the machines, equipment and staff working on the machines should be insured by the organization.
2. The organization must provide suitable mats for waste pickers to sit on. They should also procure trunks and safes for the storage of documents and rolling money for the ease of operations at the MRF.

3. Children's play area/creche, should be well ventilated and safe with CCTV coverage.
4. Indoor air quality and adequate lighting should be maintained for a healthy working environment. During the operation phase at the MRF, dust emissions could be observed during the segregation and cleaning of thin plastic waste. Proper exhaust ventilation needs to be designed and installed at the MRF (especially near the phatka and gatta machines) to prevent the dispersion of dust, fumes and gases into the air which will cause harmful exposure. Such exhaust systems need to be designed so that dust, fumes or gases are not drawn into the work area.
5. The MRFs should have safety features including fire extinguishers, safety electric connection and fixtures, first-aid kits. Emergency contact numbers should be properly displayed.
6. Waste pickers should be given proper uniforms, safety equipment and other related materials.
7. The onboarding of waste pickers to the project should be facilitated. Their data should be collected and regular meetings should be conducted at least once in 15 days to assess, solve, and report issues faced by them.
8. Financial literacy and support events to encourage waste pickers to open bank accounts and register under social security schemes should be planned and conducted.
9. Necessary insurances for those working in the MRF should be undertaken.

Data Monitoring:

1. Registers should be maintained for making various logbooks, daily data entry registers, etc.
2. The revenue generation model is to be established and the system is to be recorded separately in the bookkeeping. All sales and purchase data should be recorded separately.

SOP for documents for monitoring and record-keeping at MRFs to be maintained by the organization

1. **Weighbridge slip:** The weighbridge manufacturer (vendor) will provide the software for generating the weighbridge slip.
    i. The slip must be issued and records maintained by the weighbridge operator after weighing vehicles.
    ii. It must contain details like the date, time, vehicle number, type of waste, waste quantity, source/area name from where waste was brought, name of person/waste picker/institution that brought the waste to the centre.

iii. Two copies of the slip should be generated, and both copies are to be signed by the weighbridge operator before handing over the original weighing slip to the waste picker or the person bringing in the waste. The second copy should be maintained at the MRF.

2. **Register 1 – Daily waste incoming/collection register**
3. **Register 2 – Daily sorting of plastics**
4. **Register 3 – Daily processing of plastics**
5. **Register 4 – Daily sale/dispatch**
6. **Register 5 – Daily expenditure**
7. **Invoice copy file:** For every sale, a tax invoice should be raised at the time of sale. The tax invoice will be in triplicate with the original given to the buyer, the second copy to the transporter, with the third copy being retained by the MRF for verification.
8. **Outward gate pass:** A gate pass must be maintained for the sale and dispatch of processed products to the recyclers/ customers.
9. **Attendance register:** A separate attendance register must be maintained for the MRF staff and waste pickers.
10. The organizations/directors/officials concerned need to verify all the books being maintained at the MRF every week.
11. **Assets register for machinery:** A record of the breakdown of machinery and preventive maintenance should be maintained by the organization. This record can be maintained in a simple logbook/off-the-shelf-register onsite. The register shall be maintained by the process in-charge/person concerned.
12. **Register for accidents:** Any accident at the MRF, fire incidences and safe man working hours should be recorded. This record can be maintained in a simple logbook/off-the-shelf register on-site. The register shall be maintained by the process in-charge/person concerned.

    a. General ledgers to be maintained for all the expenditures incurred with vouchers numbered in files.

    b. All types of expenditures made in terms of purchase of plastic waste/ daily purchase of consumables/any payment to person/waste pickers or organization/waste aggregator must be recorded as per the format – on daily basis (see Annexure III).

13. **Register for expenditure:** All expenditures should be logged by the organization.

    a. Payment is encouraged through bank transfers; payments made to scrap dealer/waste collector in cash must be recorded accordingly.

    b. Income from the sale of any semi-processed, finished products to recycler/ scrap dealers/rejects/services, etc. must be recorded daily.

c. Income receipts/payment are encouraged through bank transfers from scrap dealers, waste pickers and recyclers.

d. Cash payments received must be recorded accordingly.

e. Creditors' records must be kept separately, and can be maintained separately for different recyclers.

14. Register for income format

a. A general ledger should be maintained for revolving funds use and the timely recovery/receipt of funds from recyclers so that purchases/sales are conducted effectively.

b. The Sustainability Corpus Fund created in the project remains with the organization in a separate account and is transparently managed.

c. Till the project is functioning, the fund remains a part of the project and no expenditure can be taken from it.

d. Each organization should have a Goods and Services Tax (GST) number.

e. Organizations should pay the GST rates as applicable while purchasing the supply (plastic scrap), and they should pay income tax on accrued incomes on a quarterly basis as per the national IT rules.

f. Organizations may register as profit companies, any partnership concerns or proprietorship concerns in the Registrar of Companies (RoC).

SOPs for approaching BWGs

a. Identify the BWG, the quantum of waste they generate and their current practices to dispose of the waste.

b. Upon acceptance, a letter of agreement between the organization and the BWG should be exchanged and the BWG should be linked to the project.

c. Define a customized pickup/waste collection module: how the organization will arrange the collection from the BWG (on a weekly or monthly basis, etc.).

d. Define a reporting module for waste collection, processing and revenue generation (if needed).

e. Issue a certificate (of plastic processing) to the BWG (if required).

2.2.2 Recommended timelines for completion of Component 2

Given below are the recommended timelines for the completion of Component 2. The overall activity should be completed within six months.

Activities	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Selection and identification of location for setting up MRF						
Procurement of consent forms and all legal documentations						
Site development and construction						
Procurement of machinery and setting up systems as per SOP						

2.2.3 Case studies

6 TRIVANDRUM LEADS THE WAY TO STREAMLINE BULK WASTE GENERATORS

An effort to manage solid waste generated by BWGs in Trivandrum was undertaken by the Clean Kerala Company Limited (CKCL), who engaged in multiple discussions

Organization	Quantity of waste managed (since the date of agreement)	Types of materials managed	Machinery/ infrastructure installed
Trivandrum Central Railway Station	127.27 tonnes	Food waste, food containers, recyclable plastics, aluminium, foil, paper cups, plastic containers, newspapers, diapers, brown cover, packaging (plastic and paper), used clothes, glass bottles etc.	Plastic shredding machine, baling machine, air blower, biodigester with conveyor belt.
Government Secretariat	194.7 tonnes	Plastics, e-waste, furniture, particle board, metal, glass, thermocol etc.	No machinery was installed due to space constraints. Materials are aggregated regularly, collected, and processed in the district warehouse maintained by CKCL.

Table 3 Overview of operations managed by CKCL in Kerala. Source: CKCL

with them to understand their challenges in PWM. Following this, the CKCL set up a fully operational collection, segregation, storage and processing system in 2019.

As a pilot, CKCL started servicing three major BWGs in the city: the Vikram Sarabhai Space Centre, the Trivandrum Central Railway Station and the Government Secretariat. All three institutions generate large quantities of wet and dry waste, most of which was either dumped in common grounds or burnt in open air. CKCL entered formal partnerships with these organizations and implemented decentralized, on-site waste management systems for them.

CKCL entered into agreements with private organizations as part of this model. It manages operations and maintenance of the facility, and the organization bears the finances of the programme (staff wages, stationery, safety equipment for staff, etc.). This arrangement is mutually beneficial and involves sharing profits as well as disposal costs.

Workforce requirements for CKCL initiatives are met by the Kudumbashree Mission, the official poverty eradication mission launched by the Government of Kerala in 1998. CKCL's waste management projects with these three BWGs has provided decent livelihood opportunities for staff, especially women.

2.2.4 Role of stakeholders

This figure illustrates the role of different stakeholders in the completion of Component 2

2.2.5 Cross reference with PWM and SWM rules of Government of India

The suggestions made for implementation are cross-referenced with the Plastic Waste Management Rules 2016 and 2018. Some of the key cross-reference points can be accessed by referring to the following rules, and the page numbers have been mentioned for easy reference.

- 13. Registration of producer, recycler and manufacturer (Pages 9-10)
- 5. Plastic waste management (Page 5)
- 6. Responsibility of Local Body (Pages 5-6)

2.3 Component 3: Institutionalization of MRF in governance bodies

Institutionalization of MRFs and waste pickers is important in order to make the model sustainable. Scalability, sustainability and self-sufficiency are the key pillars contributing to the fulfilment of set targets. Additionally, the mainstreaming of waste pickers results in improved recognition and socio-economic conditions for them. In India, the responsibility of PWM lies with ULBs at the city level, and

MRFs and waste pickers need to be institutionalized by ULBs for long-term PWM sustainability. The next section details the SOPs and guidelines, recommended timelines, roles of different stakeholders and case studies focusing on the institutionalization of MRFs and improved socio-economic conditions of waste pickers.

Achieving institutionalization of PWM into ULBs

As per the Solid Waste Management Rules, 2016, waste pickers are defined as persons or groups of persons informally/formally engaged in the "collection of reusable and recyclable solid waste" for sale to recyclers directly or through intermediaries to earn their livelihood. The waste pickers in an informal set-up face various challenges which can be resolved through their institutionalization. The issues, process of mainstreaming and benefits incurred by waste pickers on their institutionalization is represented in figure 16.

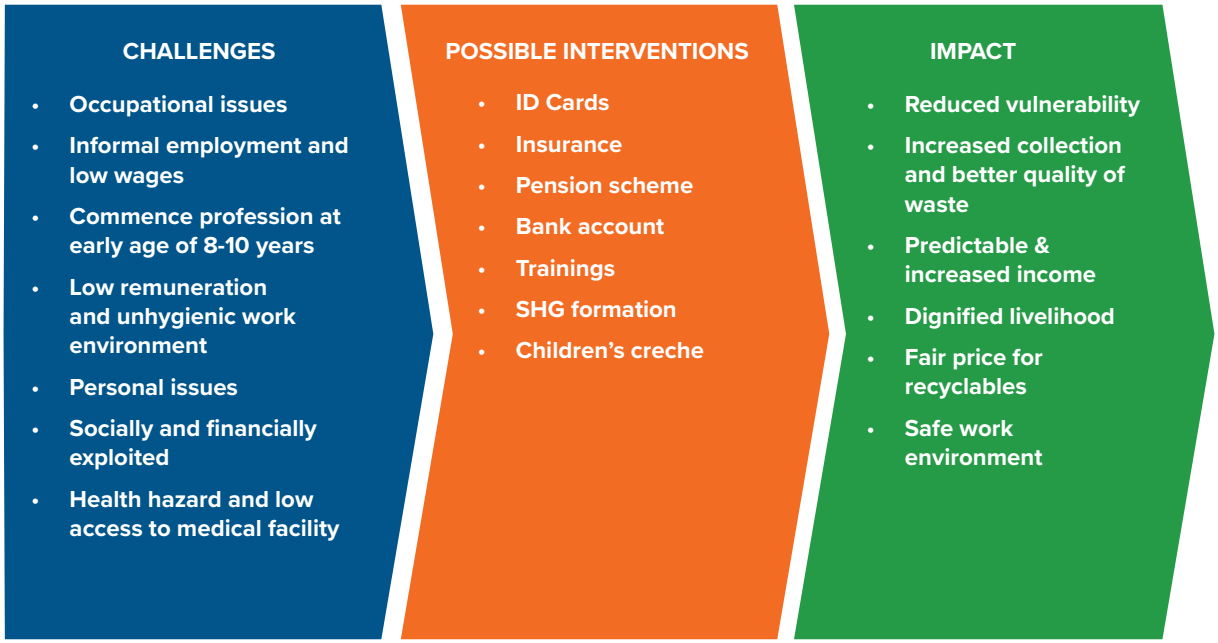


Figure 16 Mainstreaming of waste pickers

The complete list of activities to implement this component includes:

- **Mainstreaming:** Mainstreaming the services of waste pickers by linking them with MRFs.
- **Capacity building:** Conducting capacity building workshops and training for relevant stakeholders on material recognition and best practices for efficient and safe working conditions in waste management.
- **Social inclusion:** Enabling social inclusion and recognition by providing waste pickers with government ID cards.

- **Financial inclusion:** Creating financial inclusion by supporting waste pickers in opening bank accounts and linking the accounts to various social security schemes as mentioned in previous chapters.
- **Sensitization:** Educating and sensitizing waste pickers on the benefits of banking services, savings and access to various microfinancing opportunities.
- **Medical benefits:** Providing waste pickers with health benefits as detailed above.
- **Gender action plan:** Creating and establishing a gender action as detailed above.
- **Safety equipment:** Providing waste pickers with waste picking gear, gloves, protective and sorting tools to ensure primary safety.
- **SHGs:** Creating SHGs for the waste pickers for financial support to assist members in getting better livelihoods. Women SHGs can be formed and trained to be entrepreneurs for market-based items such as toys, rugs, bags, handicrafts, etc. made using plastic and related waste. The formation of SHGs goes through different phases as detailed below.

Phases	Rate/ Duration
RECOMMENDED DURATION	Rs. 10/kg (as per the standing government order)
PREPARATORY PHASE – Introducing the concept in the waste pickers community	1-2 Months
GROUP INITIATION – Helping groups formation and start meetings and savings	2-4 Months
GROUP STABILIZATION – Helping groups manage credit activities using their own savings	4-6 Months
GROUP CONSOLIDATION – Providing working capital assistance and strengthening groups (on-going process)	6-12 Months
SHG SELF-DEPENDENCE – Preparing groups for functioning on their own	1-2 Years

Table 4 Recommendations for implementing various phases of the SHG creation

2.3.1. SOPs and guidelines

SOP for organizing waste pickers and onboarding

- Initiate regular discussions with waste pickers to find out their interest in working with and within the MRF and inform them about the features of the MRF.
- Identify the issues waste pickers are facing related to their working conditions and in the locations in which they work, such as landfills and streets.
- Hold discussions with waste pickers about the process of formalizing them; those working with municipal officials should be provided ID cards.
- Organize mass meetings of the waste pickers community and educate them about the features of the MRF and the benefits associated with working directly or indirectly (through waste aggregators) with the MRF.
- Train waste pickers regularly on book-keeping, accounting, livelihood-based enterprises, women-related issues and hygiene issues. Additionally, exposure visits to similar initiatives and projects should be conducted to gain confidence.
- Maintain a reward system by choosing the best waste picker every month to boost their confidence and motivation. Meetings can be conducted to share uplifting stories and their experiences.

- Organize discussions with waste aggregators as many waste pickers work with them. The waste aggregators should be enrolled with the MRF and be provided with safety equipment, social safety schemes and other benefits.
- All waste pickers should be enrolled with the MRF and provided with safety equipment. Their phone numbers should be registered for regular updates on health camps, trainings and meetings.

SOP for financial inclusion of waste pickers

- The organization should identify a financial inclusion volunteer/employee who will periodically focus on achieving the target of financial inclusion for waste pickers.
- Develop a timeline and strategy for financial inclusion for waste pickers in every city.
- Identify an easy to access bank, preferably with core banking facility along with zero balance account.
- Identify a coordinator among the waste pickers who will, in coordination with the financial inclusion volunteer, address the queries of other waste pickers and help them produce the documents required for Know Your Customer (KYC) processes. For KYC requirements, waste pickers need to furnish a few documents, such as Aadhar card, local address proof, a mobile phone number and two photographs.

2.3.2 Risk matrix capturing failures and challenges

This table represents the risks associated with the institutionalization of MRF, probability of occurrence, severity of risks and associated consequences.

Risks	Probability	Severity	Consequences
No waste segregation at generation point	High	High	Increased environmental & health challenges.
Waste pickers unwilling to associate with Material Recovery Facility	Low	Medium	The collection and segregation of waste becomes problematic.
Delay in allocation of infrastructure and machinery	Medium	High	Delay in setting up the Material Recovery Facility and associated activities resulting in various losses.
Delay in documentation and institutionalization of waste pickers	Medium	High	Delay in benefits for waste pickers and their socio-economic development.
Irregular monitoring and compliance of Material Recovery Facility	Low	High	Without regular monitoring and compliance mechanism the functioning of Material Recovery Facility will disrupt and result in various losses.
No regular data management	Low	High	Lack of appropriate data for regular waste management.
Recyclers unwilling to associate with Material Recovery Facility	Medium	High	Recycling market acceptance is important and without this no model can sustain long-term.

Table 5 Matrix mapping risks and opportunities in the project

Note: For the detailed risk matrix, see Annexure II.

2.3.3 Recommended timelines for completion of Component 3

The table below represents the recommended timeline for completion of Component 3. The activities should ideally be completed within four months.

Activities	Month 1	Month 2	Month 3	Month 4
Identification and mobilizing the waste pickers in each city				
Discussions and training on association with MRF (directly or indirectly)				
Discussions with waste aggregators on benefits of linking with the MRF				
Discussion and institutionalization of waste pickers by the ULBs				

2.3.4 Case studies

7 A MODEL DRY WASTE COLLECTION APPROACH

Undertaken with guidance from the Bruhat Bengaluru Mahanagara Palike (BBMP), the Hasiru Dala MRF has proved to be an efficient intervention in improving and streamlining the plastic waste management process in the city of Bengaluru that generates 160 grams (per capita) of dry waste every day.

Phases	Rate
Type of waste	**Constitution in the city's total waste**
Multi-layered plastic, Tetra Pak, thermocol, highly recyclable material and material with low recycling rates	30%
Paper	20%
Reject	14%
Glass	10%
E-waste	8%

Phases	Rate
Type of waste	**Constitution in the city's total waste**
Cloth	7%
Metal	1%

Table 6 Type of waste and its constitution in the total waste generated in Bengaluru. Source: Hasiru Dala
10 percent loss is accounted to leaks in the waste value chain*

Most of the materials listed in table 6 have existing buyers and robust supply chains except plastic which with low recycling rates. Further, tetrapak, multi-layered plastic and thermocol, which constitute 15 percent of the total dry waste, have their recycling or disposal systems in place.

The waste pickers have very little incentive to collect or buy material with low recycling rates. Similarly, waste pickers do not have access to markets that offer fair prices for both low recyclable material and highly recyclable material. There are a few reliable buyers, who would take the material on time. This aspect is especially relevant during pandemics and lockdowns when most markets are shut.

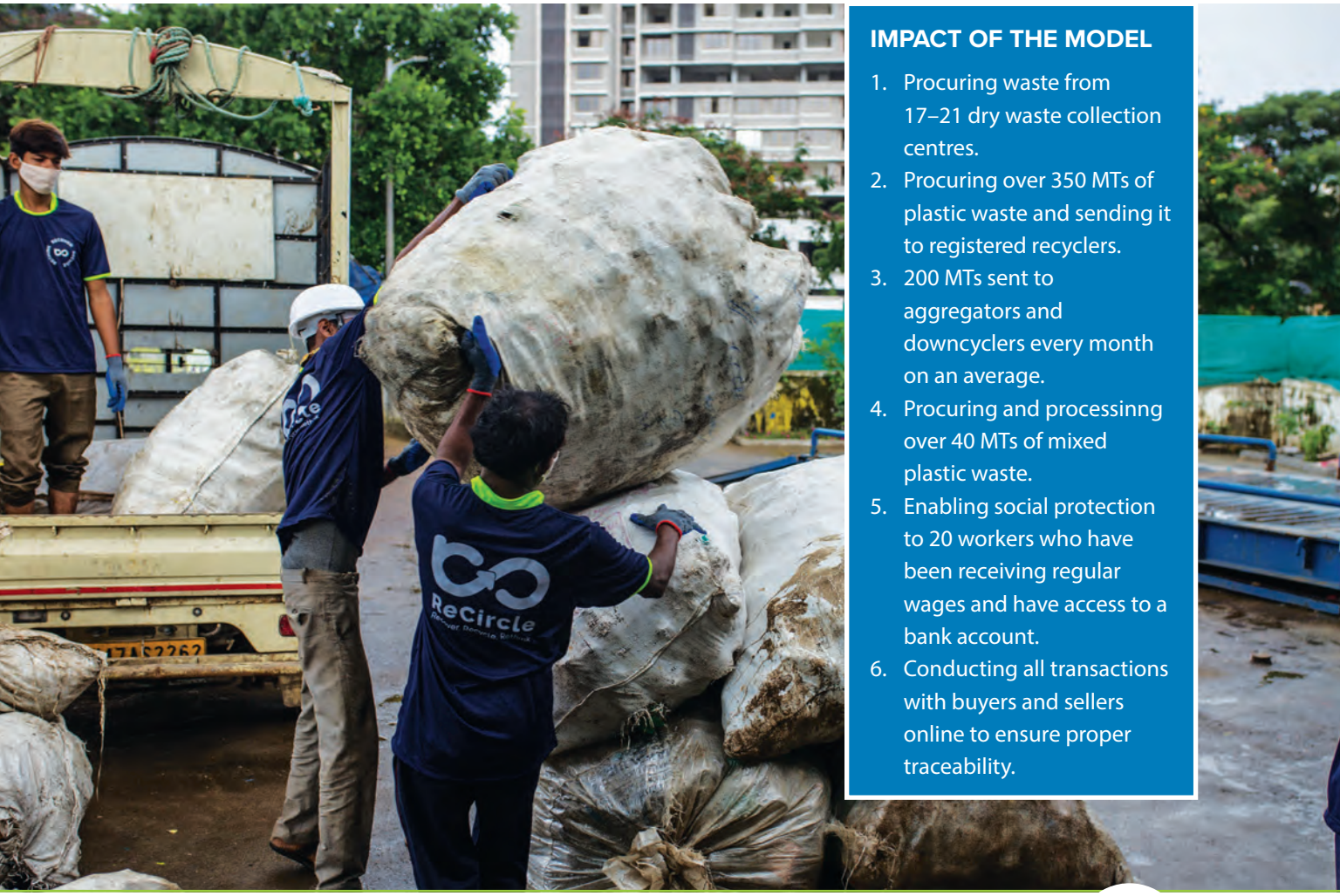
The MRF fills that vacuum as it cross-subsidizes its collection by taking in some high-value material like PET, HDPE, etc., thus, creating a business model which serves as a cushion for waste pickers operating the dry waste collection centres. They can now sell their material at a fairer price, higher than the market, especially when plastic prices dip or markets are closed.

"During the second lockdown, I had a lot of difficulties. While all the scrap aggregators were closed, the BBMP collected the MLP, but I had no place to sell the sorted plastic and paper. At that time, I was able to sell all the recyclables to the MRF. It was beneficial to me as I have 10 people working with me in the center, and I was able to pay their wages on time."

– Kumudha, Bengaluru

Some unique features of MRF

1. MRF employs waste pickers who have been thoroughly trained by qualified professionals, making the process very efficient.
2. It is mandatory to use protective gear while working at an MRF.
3. MRF is insured against any future damages. The employees go through fire drills and other emergency preparation regularly.
4. At an MRF, waste is weighed both at the time of its arrival and sale, and all transactions are recorded. The material is sold only to authorized or registered recyclers, who provide receipts whenever required.
5. MRF incorporates the essential requirements of any good EPR system: traceability and transparency.



IMPACT OF THE MODEL

1. Procuring waste from 17–21 dry waste collection centres.
2. Procuring over 350 MTs of plastic waste and sending it to registered recyclers.
3. 200 MTs sent to aggregators and downcyclers every month on an average.
4. Procuring and processinng over 40 MTs of mixed plastic waste.
5. Enabling social protection to 20 workers who have been receiving regular wages and have access to a bank account.
6. Conducting all transactions with buyers and sellers online to ensure proper traceability.

Hasiru Dala is also upgrading the system under which the MRF will enable EPR compliance for those producers who require to fulfil EPR targets from the waste collected and processed through the facility. This will trickle down to dry waste collection centres and other waste-pickers. Hasiru Dala will reach out to other actors in the informal waste supply chains, i.e., aggregators, stockists and re-processors who are currently working on the margins and involve them in upgrading their system so that traceability becomes possible in a wider ecosystem.

> "I have been employed at the MRF for the last one year. I have a monthly salary now with the benefits of employee state insurance and provident fund. I don't have to pick waste from the streets anymore, which was earlier affecting my health."
>
> *– Laxmi, sorter at the Hasiru Dala MRF*

8 BHUBANESHWAR CITY: A PWM MODEL ENABLING SOCIAL PROTECTION FOR WASTE PICKERS

The Bhubaneswar Municipal Corporation (BMC) and UNDP have joined hands to address PWM in the capital city of Odisha. Setting up an MRF has been the main objective of this partnership, which aims at enhancing sustainable PWM practices through a socio-technical model.

As per the BMC, Bhubaneswar generates around 540 MTs of waste daily, and a lack of processing and dumping waste in landfills were the major challenges for the city. A robust waste management mechanism, which would also enable Bhubaneshwar to improve performance in Swachh Survekshan Index, motivated the ULB to establish the centre.

The capacity of the MRF currently is 5 TPD. To segregate and process plastic waste, the MRF is equipped with state-of-the-art machinery, and the MRF has been tagged with 10 wards for daily collection. Channels for waste collection include door-to-door collection by the BMC, waste pickers, BWGs, RWAs and micro-entrepreneurs (kabadiwala). To help in daily collection, 12 high-bulk, low-cargo vehicles have been deployed.

The collection takes place using a well-designed route map, which helps in efficient resource allocation and mobilization. The collection vehicle is designed to keep wet and dry waste separate in two different compartments. After collection, the waste is unloaded at the MRF for primary manual segregation into plastic and non-plastic items via waste pickers.

After primary segregation, all the plastic items are brought to the conveyor belt in the MRF for secondary segregation. Once the segregation process is over, the materials are sent to the baler or shredder or air-blower machine for further

IMPACT OF THE MODEL

1. Segregated and processed more than 1,300 MTs of dry waste.
2. Onboarded more than 400 waste pickers.
3. More than 50 female waste pickers now work as van drivers, collecting door-to-door waste.
4. Improved source segregation rate at the household level.

processing. After this, the processed materials are moved to a dedicated storage space at the MRF. All the reject and inert waste is stored separately and sent to cement factories for co-processing.

For traceability, data is recorded at every level daily.

The MRF also promotes livelihood opportunities for waste pickers by mainstreaming them, and more than 400 waste pickers have been onboarded so far. The MRF conducts health camps for waste pickers every quarter and links them with state and central government social protection schemes. For fire safety purposes, fire extinguishers have been installed at the MRF and all the workers have been trained in fire safety protocols. PPE gear and project ID cards have also been distributed among the workers.

2.3.5 Role of stakeholders

This figure illustrates the role of different stakeholders in the completion of Component 3.

2.3.6 Cross-reference with PWM and SWM rules of Government of India

The suggestions made for implementation are cross-referenced with the Plastic Waste Management Rules 2016 and 2018. Some of the key cross-reference points can be accessed by referring to the following rules, and the page numbers have been mentioned for easy reference.

- Responsibility of local body. (Pages 5-6)
- Responsibility of waste generator. (Page 6)

2.4 Component 4: IEC and digitalization

For effective PWM, technology is an important cornerstone that covers traceability, accountability and digital governance. Mobile phone apps can be developed for this purpose and can be used by various stakeholders such as waste pickers, recyclers, ULBs and citizens in order to integrate everyone into one digital cloud. This would enable access of real-time data from the field to track the integrated plastic waste supply chain right from point of collection to the end recycler. It would also help address the PWM-compliance mandated by the CPCB and SPCBs.

Figure 17 : Digital monitoring of data related to waste

2.4.1 Recommended timelines for the completion of Component 4

The table below shows the recommended timeline for the completion of Component 4. The overall activity should be completed within four months, while the process of knowledge management and exchange could be an on-going one.

Activities	Month 1	Month 2	Month 3	Month 4
Identification of technology platform/ technical organization				
Linking relevant stakeholders such as BWGs, recyclers and waste pickers				
Development of protocols for online reporting, monitoring and information exchange				

2.4.2 Case studies

9 LEVERAGING TECHNOLOGY FOR A TRANSPARENT AND ACCOUNTABLE WASTE VALUE CHAIN

Partnering with more than 67 ULBs directly, 100+ partner brands, 150+ recyclers, and above 500+ aggregators, Recykal has successfully channelled and spread awareness on effective waste management. Marketplace, Smart Centre solutions, and EPR Loop are some of their major offerings. By the financial year 2025, they aim to channel more than 3 million MTs of plastic waste.

Using the support of ULBs, Recykal's ecosystem of digital platforms connects the fragmented waste management in India. Using platforms that bridge waste generators with waste recyclers, they provide transparent, traceable, and efficient systems. With pan-India operations, Recykal operates across 28 states and 6 Union Territories. Over the last year, they have successfully channelled more than 20,000 MTs of waste every month and aim to channel 30,000 MTs.

The five-step implementation process of the organization's products has evolved over the last couple of years. The following section is a generalized approach used to conceptualise the product targeted towards specific stakeholders.

1. Empathize

The initial stage began when the pain points in the waste management industry were identified. One uniform pain point across all sectors was the lack of transparency and traceability.

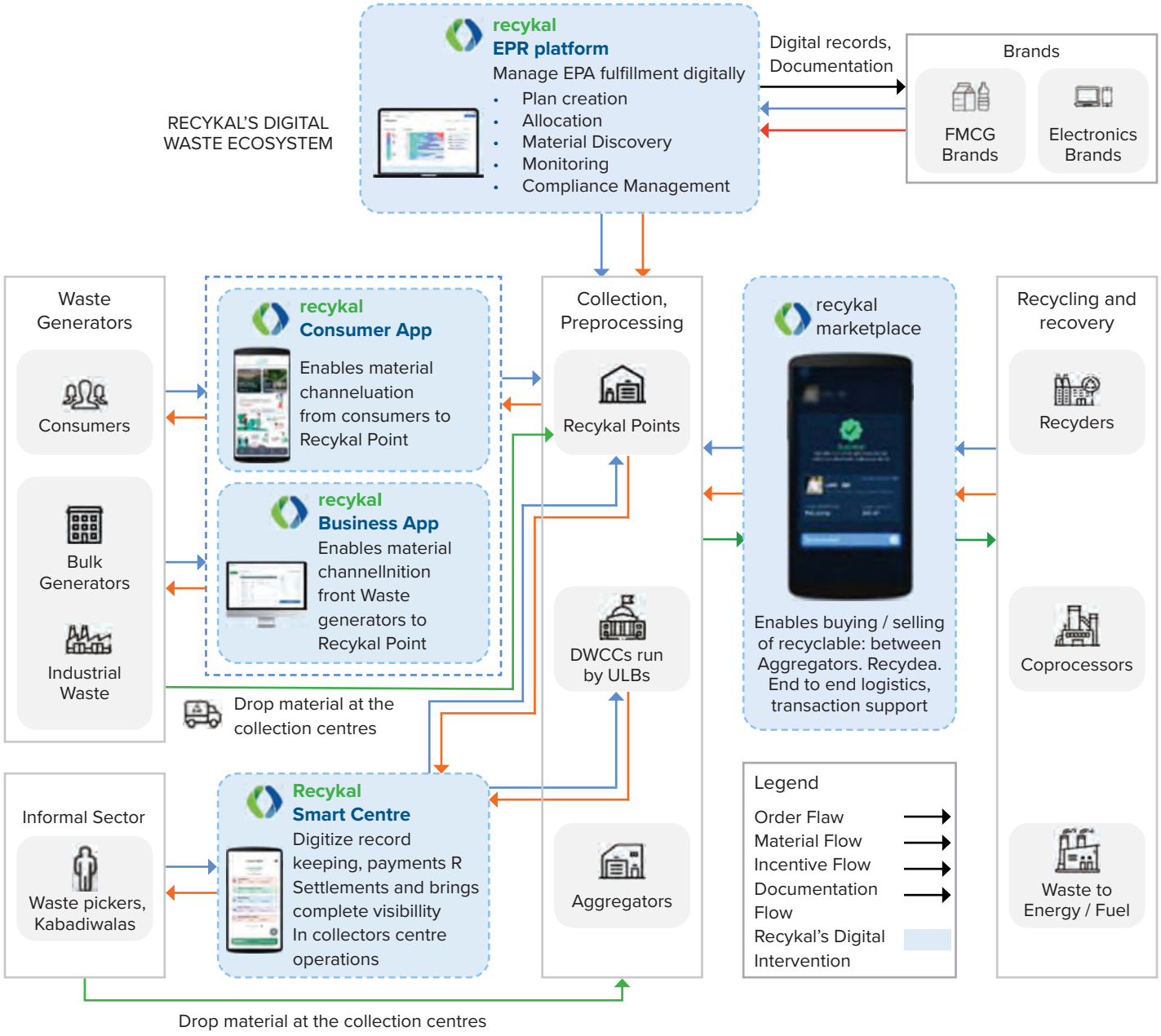


Figure 18 Digital Waste Ecosystem of Recykal. Source: Recykal

- For the recyclers and aggregators:
  - The team observed the gap in the demand and supply of recyclable plastic waste in the industry
  - There was a lack of fair prices for sellers
  - There was also a lack of access to quality material on the recyclers end
- Government authorities and municipalities faced challenges in monitoring the market and waste generation given a majority of the processes were

informally carried out. The fragmented and offline nature of the transactions led to poor data quality and a lack of monitoring tools.

- The informal sector workers were unrecognized in India. With more than 4 million informal waste collectors in India, they amounted to 90 percent of the total of plastic recycling in the country. There was an urgent need to formalize their livelihoods and help improve their income.
- There was also low participation of consumers and brands in recycling post-consumer use waste generated in households, schools and other institutions.

2. Define

The identified pain points needed to be addressed with ones with the largest impact being given priority.

- India generates 3.4 million tonnes of plastic waste every year, of which more than 40 percent goes uncollected. This is a significant number which needed to be addressed on priority.
- The other priority was the need to bridge the gap between the supply and demand of recyclable plastic waste in the country. With recyclers and waste aggregators distributed across the country, there was a gap in the system along with varying and questionable quality. Deep marketing research and support from the ULBs gave the company an insight into the problems of the industry and a direction to move forward to the next stage.
- The introduction of EPR guidelines in India gave producers, importers and brand owners the responsibility of collecting and recycling the post-consumer waste generated in India.

3. Ideate

- With a population of more than 1.3 billion people in India, consumers generate significant waste, which remains uncollected.
- There was a need to bridging the gap across the country with quality material at their disposal.
- There was also the need to bring 1,000+ brands in India under an umbrella tool to help them connect with recyclers, aggregators and government authorities.

Technology was the key. In the age of digital technology, Recykal decided to provide end-to-end solutions for the key stakeholders in the ecosystem. With nearly every Indian using a smartphone, creating a mobile application that is useable by all was the way forward.

For brands, a digital platform was considered as an option, and this worked as an extensive database to track, monitor and organize their waste collection efforts. A SaaS-based solution was proposed for the same described above specific to EPR.

4. Prototype

The first product was a consumer product, which catered to everyday consumers, who could easily arrange a pick-up for their recyclable products from the comfort of their homes using the mobile application.

To address the gap in demand and supply, the Recykal Marketplace was created. This is a digital platform where recyclable waste sellers can create a listing of the material they have, which can be booked by recyclers on the other end. EPR Loop took shape as an online solution for producers, importers and brand owners to meet their EPR requirements with the highest level of transparency and traceability.

5. Testing and implementation

Right from product ideation to development, there were continuous iterations of the products based on many brainstorming sessions and interviews with various stakeholders.

The prototypes were constantly tested and deployed. Post-deployment, the product was reiterated based on reviews by users and on the problems and challenges they faced.

IMPACT AND ADVANTAGES OF THE PRODUCT

- The advantages of technology have helped address key issues that gripped the waste management industry including:
  - Bridging the demand-supply gap.
  - Ensuring transparency.
  - Enabling source segregation.
  - Creating material traceability.
  - Collating data and actionable analytics.

It should be noted that based on market behaviour, the marketplace has taken a new form with specific applications for buyers and sellers. In the weeks to come, all the applications will be merged into a single application where sellers can list their materials and buyers can directly place their orders.

Socio-economic advantages to stakeholders

- Employment generation has increased, and approximately 10 percent of additional income opportunities, especially for the informal sector. The organization accepts all types of plastic waste, which enables local waste collectors to gain additional revenue.
- The creation of accessible waste disposal methods led to the optimal use of resources. Recykal has channelled nearly 0.5 million tonnes of plastic waste so far, which has saved energy, natural resources and created employment opportunities.
- Recykal's digital database has assisted local municipalities in making informed decisions.

10 INDORE: PROMOTING MASS AWARENESS WITH BEHAVIOUR CHANGE CAMPAIGNS

Indore is one of the cleanest cities in the country and has consistently performed well on the Swachh Survekshan Index. Persistent efforts to increase awareness and citizen engagement have enabled the city to achieve its vision of Swachh Bharat. The Indore Municipal Corporation (IMC) has worked closely with organizations to create a holistic waste management framework through a systems approach. With an extensive focus on IEC, the city has performed well on several parameters including segregation and collection.

The IMC with the support of Basix introduced a sustainable waste picker enterprise model in 2019 that conducted high-quality doorstep garbage collection from households in wards and newly established residential colonies every day. Under the model, almost 500 waste pickers were onboarded at the MRF, paper/cloth bag production units and transfer stations as maintenance staff and caretakers at compost units.

IMC with the support of a local organization went door-to-door in Indore to motivate residents to participate in public meetings and encourage them to make personal contributions to keeping the city clean and ensuring effective solid

Key highlights of the project by IMC and Basix:

1. More than 250 training programs organized for field staff of IMC on solid waste management and behaviour change.
2. 200,000 small bins and 15,000 big dustbins distributed at marriage halls for source segregation.

IMPACT OF THE MODEL

1. 100 percent of households and commercial establishments are covered under door-to-door collection system.
2. Daily doorstep awareness and monitoring introduced at 450,000 households in Indore.
3. Waste pickers earning up to Rs. 400 -1,000 per day by selling the dry waste, enabling them to buy meals two times for their kids.
4. Waste pickers saving up to Rs. 200 - 300 in their bank accounts, opened as a part of the social protection drive.
5. 500 waste pickers integrated with the project so far.

waste management. The team also mapped BWGs in the city and implemented a separate collection mechanism.

The increased levels satisfaction of the residents has been the biggest outcome of the project. Residents of the city have been cooperating with IMC and local organizations to segregate waste at source, educate others and proactively participate in various IEC initiatives like nukkad nataks, signature drives, rallies, etc.

11 JAMMU: A HOLISTIC IEC CAMPAIGN TO PROMOTE BEHAVIOURAL CHANGE ON WASTE MANAGEMENT

Behavioural change through citizen engagement and action is critical to achieving better management of waste. Jammu has undertaken extensive citizen engagement initiatives, including clean-up drives, river restoration projects, nukkad nataks, segregation drives, Swachhta Rath (mobile messaging vehicle), etc., as part of its IEC campaign that was launched in 2019.

The Jammu Municipal Corporation (JMC) engaged with Regional and Urban Development Agency (RUDA), a consulting firm in Jammu supporting sustainable development, to plan an IEC campaign identifying the threats caused by improper waste disposal like public health and environmental degradation. Additionally, the JMC and RUDA mapped the stakeholders responsible for the waste management process. They also focussed on BWGs while designing the campaign and devised a special strategy to reach out to these institutions.

The JMC with the support of RUDA implemented the following IEC initiatives:

IEC initiative	About the initiative
Plastic Lao Thaila Pao Campaign	This campaign is a part of an ongoing effort to spread awareness of the need for responsible plastic use and its disposal. A mini material recovery stall has been set up in a prominent market location to promote sustainable waste management practices as part of the campaign. Under the campaign, citizens are encouraged to deposit their household plastic waste at the stall in exchange for reusable & recycled cloth bags (1 kg of plastic waste = 1 cloth bag).
Save Tawi Campaign	RUDA initiated a massive campaign, 'Save Tawi' at Har Ki Pauri temple, collaborating with Jammu Municipal Corporation. The purpose of the campaign was to sensitize people who visit the temple to offer reverence in an eco-friendly manner and not throw plastics or other kinds of waste in the Tawi river. Volunteers were deputed to instruct people to follow physical distancing norms and throw waste, basis the categories. Awareness was created through public announcements and jingles in the temple premises. The campaign collected 1,220 kg of dry waste.
Swachhta Rath -Bin It Right Campaign	A vehicle, mostly a three-wheeler, is fitted with a speaker playing jingles and runs through the streets of Jammu to sensitize residents for segregation of their household waste and motivating them to put the right waste in the right dustbin.

12 HYDERABAD: STREAMLINED PROCESSES THROUGH DIGITIZATION AND STRONG DOCUMENTATION

Hyderabad generates 9,965 MTSs of waste per day from different sources, and approximately 15 percent is plastic waste.[13] In the beginning, the city government required support for more robust documentation with respect to waste management. In 2018, realizing the role that technology and digitization can play in managing waste, the Greater Hyderabad Municipal Corporation entered into an agreement with the Ramky Foundation to document all waste transactions. The Foundation believes that traceability and data management play a key role in the circular economy. It also provides efficient solutions to ULBs for viable waste collection methods and recovery solutions.

For transparency and traceability, new monitoring systems were introduced to track data along the waste value chain. These monitoring systems included record-keeping, data management and other improved documentation practices. SOPs were implemented to streamline the data at every stage. This enabled the tracking of waste inflow at every stage, including at the MRF. It also helped identify the source of waste and the concerned waste pickers.

13 *https://tspcb.cgg.gov.in/CBIPMP/MSWper cent20Annualper cent20reportper cent202017-18.pdf*

The monitoring system at the MRF follows a three-step reporting process to ensure the integrity of the entire system:

1. Register Data (also known as the Field Monitoring Registers):
   - Inward register: This register captures the inward volumes procured from various sources daily. The transactions are recorded in the register and supported by the purchase invoices/bills.
   - Outward register: This register captures data, which is processed and further sent to recyclers, aggregators, etc. The data is recorded in the register with supporting sale invoices/bills.
   - Asset register: The details of the assets are captured in a specific format and updated monthly.
   - Waste picker register: This register records the onboarding of new waste pickers and is updated regularly.

IMPACT OF THE MODEL

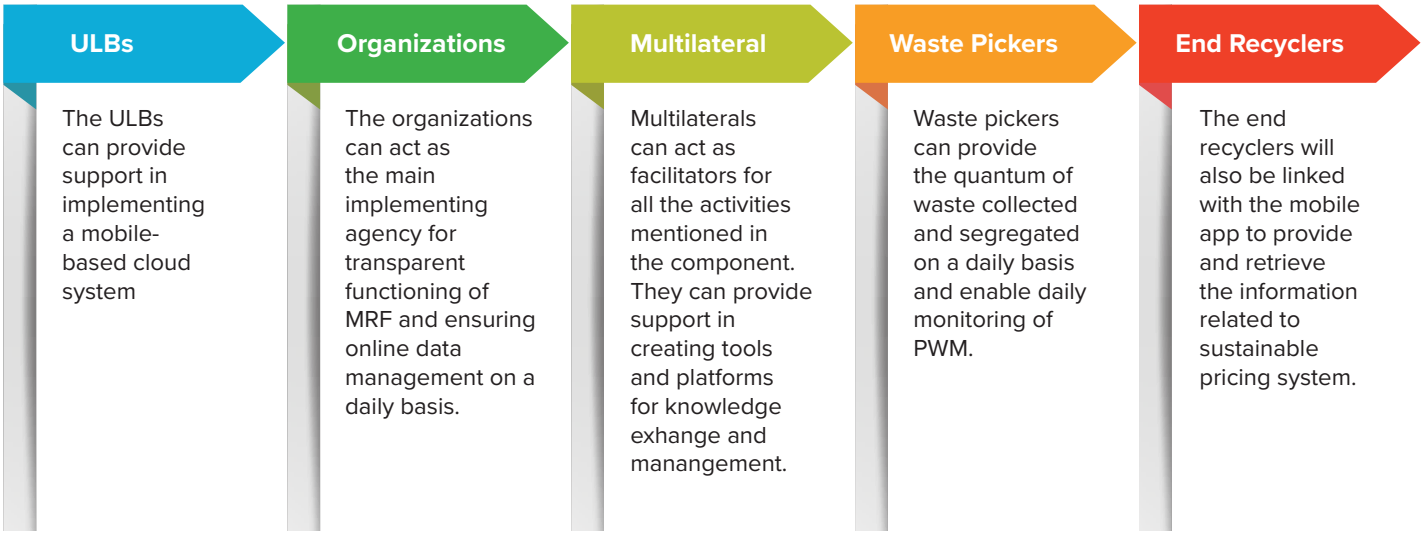
1. 100 percent compliance due to a strong understanding of processes and a committed team.
2. Availability of metrics for inward and outward volumes of material.
3. Availability of resin code-based classification of volumes of material. Such data is useful for effective planning of volumes and effective implementation of programmatic activities.
4. Excel-based digitization of registered data provides for analytics and smart data management, empowering the MRF operations.
5. Proper record and documentation of wages paid to waste pickers and other related details.

2. Datasheet: The datasheet consists of sub-sheets where daily data is recorded.
3. Reporting formats: Standard monthly, bimonthly, quarterly reports are shared and verified by the field team.

Digitizing the volumes of waste can help provide refined and accurate data for EPR compliance. The data can also be tailored for center-wise waste collection, irrespective of volumes being handled.

2.4.3 Role of stakeholders

The below given figure illustrates the role of different stakeholders for the completion of Component 4.



2.4.4 Cross-reference with PWM and SWM rules of Government of India

The suggestions made for implementation are cross-referenced with the Solid Waste Management Rules 2016 and 2018. Some of the key cross-reference points can be accessed by referring to the following rules, and the page numbers have been mentioned for easy reference.

- Responsibility of local body (page number 5-6)

FINANCE AND SUSTAINABILITY OF A PWM WORKING MODEL

3

The MRF model or DWCCs for PWM require to be funded and operated in the public-private partnership mode. The private funding can be provided by brand owners, producers, importers or CSR activities. The model is initially funded by private players, supported by ULBs and operated by service providers (local organizations/waste management agencies). The chapter will discuss the economic feasibility, ways of achieving break-even point, the model's profitability, and self-sustainability.

3.1 Techno-economic feasibility

For the techno-economic feasibility, the model should include the following components:

1) **Role of the ULBs at the city level:**
   - Acquisition of land and building for setting up the MRF
   - Power and water charges
   - Transportation of plastic (solid) waste from DWCCs

2) **Cash flows per month including operational revenue and expenditure:** Based on the target waste (TPD) every month, the components for operational revenue and expenses are to be considered.

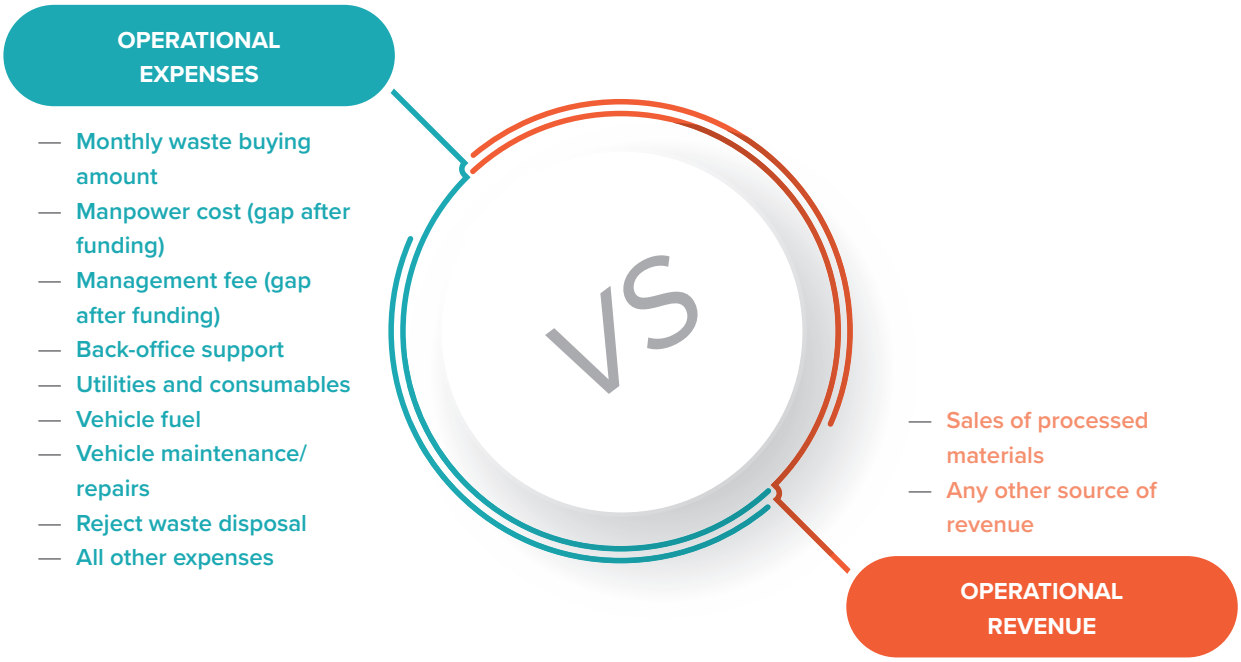


Figure 19 An overview of operational expenses versus the operational revenue of the project. Source: UNDP's on-ground learnings and analysis

With a monthly increase in target incoming waste, operational expenses and operational revenues, the model will start achieving profits from approximately the 12th month of the project. After adjusting the finances from funding, the gap shall be paid from the profit margins received by deducting operational revenues from expenditures. The consolidated sample sheet for calculating the cash flows is provided in Annexure VII.

3) **One-time costs for setting up MRF and IEC:** The model requires investment for machinery with support from ULBs and behaviour change communication. A break-up of one-time expenses is detailed in the table below.

Machinery by ULBs	IEC Activities
Weighing scale Baler Shredder	Waste picker mobilization SHG formation One-time rolling fund for procurement Formation of RWA Meetings, trainings and workshops Provision of safety gear for waste pickers Awareness campaigns and rallies Insurance for plant and machinery Documentation of best practices
Machinery from Funding Support	**Other One-Time Expenses**
Weighing scale Phatka/air blower machine Baler Aglo machine Gatta/extruder machine Shredder Collection vehicle	Office setup Biometric attendance Laptop/computer for office setup Fire extinguisher First-aid kit Uniforms & safety gears Drums, buckets Stationary & signboards Mobile phones

Table 7 List of one-time expenses for the project

4) **Daily or monthly waste transactions:** Every day or month, a certain amount of waste is bought in for processing and is later sold based on average buying and selling rates. The waste is processed across these categories:

- Category 1: Soiled PET jars
- Category 4: LDPE
- Category 2: HDPE
- Category 7: MLP, others
- Mixed plastic
- Category 3: PVC
- Category 5: PP
- Category 6: PS

Different categories of waste are processed in the MRF and after removing rejects the processed waste is further sold for recycling or upcycling to the recycling units. GST as applicable is added to the total sales of the processed waste.

3.2 Project break-even and profitability

The break-even point for any project is defined as the point where the cost of expenses becomes equal to the amount of revenue. A project becomes profitable when the revenues become more than the expenses. The model needs to consider various components to reach the break-even point and later achieve profits. The components include:

- Financially viable monthly/daily targets of incoming plastic waste in the MRF
- Financially viable buying rates for different waste categories to be processed in the MRF
- Financially viable selling rates for different waste categories for recycling/upcycling
- Provision of important sources such as land, building and machinery by ULBs at preferably no cost
- Linkage with recycling/upcycling units by signing contract between recycling units and organizations.

The other components to be considered include manpower, market demand and miscellaneous expenses which will depend on the population and size of MRF in the city.

3.3 Self-sustainability of project

The self-sustainability of the MRF model is a key component for the successful implementation of plastic waste management in a city. The financial availability and profitability of the model play an important role in the success of this model in the long run. For the self-sustainability of the model, the following components need to be considered:

- Funding for an initial period of approximately five to six years, including the cost of setting up the MRF, manpower costs and other one-time expenses. *(Note: Financial details under Annexure VII)*
- Allocation of land, machinery, initial support for power and water charges and waste transportation from the DWCCs.
- International agencies such as the UNDP, GIZ, UNIDO and ADB to facilitate linkages with banks for extending payments to waste pickers for PWM
- Linkages with recycling units to create a market-driven and profitable model to achieve self-sustainability.

A city will achieve financial sustainability in approximately five to six years if a dedicated amount of waste is processed and sold at feasible rates. Additionally, financial and infrastructure support is to be provided for setting up MRFs.

SOCIAL INCLUSION OF WASTE PICKERS

4

UNDP defines social protection as "a set of nationally owned policies and instruments that provide income support and facilitate access to goods and services by all households and individuals at least at minimally accepted levels, to protect them from deprivation and social exclusion, particularly during periods of insufficient income, incapacity or inability to work." Fifteen other multilateral agencies, such as the International Labour Organization (ILO), World Bank, United Nations Children's Fund (UNICEF), define social protection differently. Some focus

on the building blocks by defining it as the aggregate of social protection or insurances; others describe it as poverty and vulnerability reduction for individuals and protection along with development. While the approaches and interventions differ; the role of social protection in defining the policy framework is to address poverty and vulnerability.

In plastic or solid waste management, waste pickers are the most important players. They are also amongst the most vulnerable to health risks and occupational hazards and have a lack of access to social protection. In this context, it is important to understand social inclusion in the PWM process and its role in improving access to social protection for waste pickers. To develop a social protection framework, it is essential to understand the levels of existing vulnerabilities of waste pickers in India.

4.1 Existing vulnerabilities of waste pickers

According to the Solid Waste Management Rules 2016, waste pickers are a formal or informal group of people engaged in the collection and sorting/segregation of waste to a living. Based on estimates, there are around 4 million waste pickers making their livelihood from waste management in India. The informal waste pickers in India face different vulnerability levels, and they operate in a hazardous working environment leading to various health risks. The figure below details the vulnerabilities faced by waste pickers.

Figure 20 Vulnerabilities faced by waste pickers

4.2 Guiding framework for social protection of waste pickers

The vulnerabilities faced by waste pickers need to be addressed through a comprehensive and justifiable framework focusing on social protection. The guiding framework for the social protection of waste pickers is represented in the figure below.

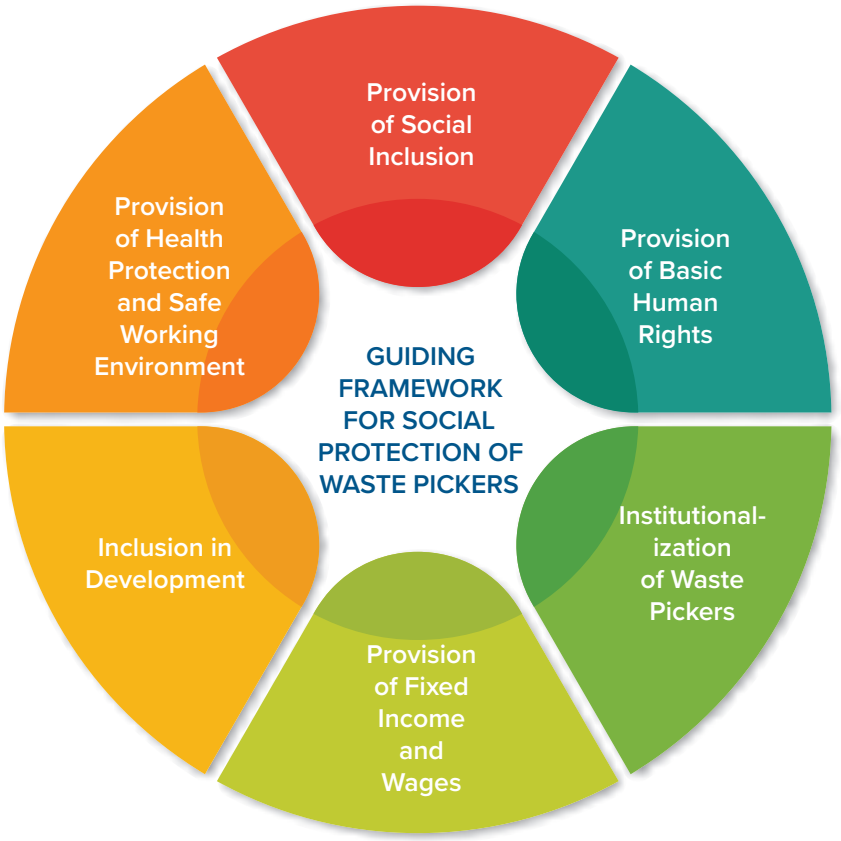


Figure 21 Guiding framework for social protection of waste pickers

This framework can be achieved by taking steps as detailed out under component 2.2 D (Elements of the MRF), with specific reference to points 4, 5 and 6.

4.2.1 Benefits of including social protection for waste pickers

The adoption and implementation of a social protection framework can help achieve the goal of PWM and improve the socio-economic conditions of waste pickers. The benefits include:

I. Resilience while facing future risks

II. Increase in mitigation capacities to counter vulnerabilities

III. Achievement of SDGs

IV. Legitimacy through ID cards and the right to work

V. Entrepreneurship opportunities

4.3 Case Studies

1 PROJECT UTTHAAN : HELPING WASTE PICKERS RISE WITH RESILIENCE

Project Utthaan is a social protection project by UNDP, launched in October 2020, in response to the COVID-19 pandemic. The project aims to strengthen access to social protection schemes and increase livelihood opportunities for waste pickers. The project conducted a baseline assessment of 9,302 waste pickers across 15 cities. The assessment evaluated the impact of COVID-19 on their livelihoods. The key findings from the survey are as follows:

- Around 65 percent of respondents reported having no formal education. This percentage is higher among socially disadvantaged groups.
- The average household size was around 4, with the number of family members ranging from 0 to 16.
- More than half of the respondents were employed as itinerant waste pickers, street sweepers and waste pickers at a landfill, which are highly informal employment categories. Further, socially disadvantaged groups and those with no formal education were heavily concentrated in such informal jobs.
- Ownership of identification documentation varied across the sample:
  - Around 90 percent indicated having of an Aadhar card.
  - Around 63 percent reported having a voter card, with more women (as compared to men) owning voter cards.
  - Less than 6 percent reported having a birth certificate.
  - Ownership of other identification documents such as caste and income certificates was even lower, at around 0.5 percent across the sample.
- Around 7 in 10 respondents reported having a monthly household income of less than Rs. 10,000. Only 4 per cent of respondents reported earning more than Rs. 20,000 a month.
- Around 67 percent individuals reported having a bank account. Three in 10 of these individuals reported that their bank accounts were linked with the Jan Dhan scheme.
- One in two individuals indicated the ownership of a beneficiary document such as a ration card. On the other hand, only 4 percent of individuals owned a health card.

Through Project Utthaan, UNDP has launched two social protection facilitation centers in Panaji and Bhubaneshwar. The primary functions of the facilitation centres include:

1. Identifying and recording information for eligible schemes for waste pickers related to:
   a. Health
   b. Education
   c. Financial Inclusion
   d. Food Security
2. Assisting waste pickers with the documentation required to register for schemes and claim benefits.
3. Providing information on and creating awareness of social protection.
4. Liasoning with ULBs and relevant departments.

2 FROM FAMILY COUNSELLING CENTRES TO MICRO CREDITING SERVICES: TRANSFORMING THE LIVES OF INFORMAL WORKERS IN MUMBAI

Established in 1975, Stree Mukti Sanghatana (SMS) has become the face of drastic transformation in the lives of informal women waste workers in the maximum city, Mumbai. SMS started organizing women workers, known as *Parisar Bhaginis,* at the Deonar landfill site, and today serves apartments, government institutes, educational campuses and more. Most importantly, SMS is no more just a waste collection initiative, but a holistic social protection-based institute.

SMS has been working hard to provide microcredit, mental health, family counselling, education, and public health support services to *Parisar Bhaginis.* Improving the standard of living of women members, creating zero waste communities, improving recycling rates and developing new technologies to handle waste are some of the SMS core objectives. The organization believes strongly in decentralized waste management systems and advocates for the same.

SMS follows a three-step model as detailed below:

Figure 22 Three step model of SMS. Source SMS

The SMS microcredit system is at the heart of the entire model. SMS created a federation of groups of women waste pickers who were saving together in 2005 known as the Parisar Vikas Bhagini Sangh (PVBS). It was also registered as a community development society with the Municipal Corporation of Greater Mumbai (MCGM). Approximately 200 saving groups or *bachat gats* joined the federation. Every *gat* comprised 10 members, and every group had to provide a fixed-time membership fee of Rs. 500 and a monthly charge of Rs. 100.

PVBS further charges an interest rate of 1.5 percent of the total loan given to the group and charges 2 percent to members. The federation internally discusses the details of every group before disbursing loans.

If a *gat* has performed well for six consecutive months, a grant of Rs. 1,000 is given to every member of the group, making a total of Rs. 10,000 per *gat*. This grant is provided under the Swarna Jayanti Shahri Rozgar Yojana (SJSRY). This acts as seed capital to set up a micro-enterprise. Of this Rs. 10,000, two components are created – Rs. 5,000 goes to the federation and Rs. 5,000 to *bachat gat*. This makes groups eligible to get a loan from the federation in case they need it.

Having a Below Poverty Line (BPL) card is mandatory to avail benefits of SJSRY. PVBS helps *bhaginis* to get these BPL cards. Several benefits are also available as part of the PVBS. Motorized vehicles for collecting waste and other necessary equipment are provided. Women members also have secured access to waste, sorting spaces, and recyclers. The federation collects waste from the women members directly at market rates, removing the role of the middleman in the process. Members are also eligible for a 4 percent bonus (amounting to Rs. 10,000 to 12,000) depending on the value of the waste collected in a year, and this bonus is given out during Diwali.

PVBS manages two canteens at the Tata Institute of Social Sciences (TISS), eight biogas plants and five sheds for sorting waste. They also have a dedicated and specialized system for handling Tetra Pak waste. The federation uses it for stationery purposes, with tie-ups from companies like L&T, TCS, and Tata Power.

All of this has resulted in a positive impact on the lives of the *bhaginis*. The formal training initiatives undertaken by SMS provide members with an opportunity to get new and improved jobs. Due to source segregation and an efficient recycling system, waste reaching the dump sites has also been reduced. SMS remains one of the most inspiring and impactful examples of integrating the informal waste sector in the country.

4.4 Financial models towards livelihood enhancement of waste pickers

There are different financial models which can be adopted for the economic inclusion and livelihood enhancement of waste pickers. The section focuses on three models based on various existing models and the learnings from them.

Model 1: Development of entrepreneurial opportunities for waste pickers

In this model, organizations working in the livelihood enhancement of waste pickers play a key role in facilitating and implementing the financial model. Organizations create an entrepreneurial environment for waste pickers, which enables them to create business and employment opportunities. Within this model, the waste pickers act as individual entrepreneurs and operate various activities, including door-to-door collection of waste, managing collection points, dry waste sorting centers and implementing app-based collection schemes.

The organizations, with guidance from the ULBs, train waste pickers, provide collection vehicles, a collection route and a standard process to follow. The organization can ensure quality by providing a manager with two or three waste pickers and accessible avenues for clients to share their concerns over the services provided. To successfully run a business, every entrepreneur should employ one driver, two collection workers and sorters as per requirement, and they should ensure the quality of the services provided.

The entrepreneurs will collect fees from households and the profits earned from recyclers. After four years, truck ownership can be moved to the entrepreneurs, which will require minimal maintenance and can be incentivized for their future assets. In this model, entrepreneurs can take up more collection routes when they are ready to expand their businesses. This model improves the livelihoods and financial conditions of waste pickers and brings discipline, professionalism, and social identity to their work lives as they are required to wear uniforms and safety equipment all the time. This model has been implemented in Mumbai, New Delhi, Bengaluru, etc.

Model 2: Development of waste pickers cooperatives to build their own non-profit organization

In this model, a group of waste pickers can register themselves as a cooperative, where their contributions can be divided as salaries at a flat rate or be based on contributions. The model has proved to be more transparent and profitable for waste pickers as they can also act as recyclers. Access to the public provident fund and loan facilities can be added as advantages in this model. ULBs can help cooperatives with land, infrastructure and the allocation of vehicles to transport and transfer waste. The model works on a profit-sharing basis with fair prices based on real-time market rates. Payments are made in cash without any delay, and cash receipts are also provided to the waste pickers. The small cooperatives can also join hands to become a larger entity based on the willingness and feasibility of the model.

Model 3: Development of a blended workforce combining waste pickers and non-waste pickers

Organizations can engage waste pickers in two ways: as a flexible workforce (on a per diem basis) and as a salaried workforce. The flexible workforce can be engaged in sorting and segregating waste, which can be done on an individual basis and be paid on a performance basis. This will benefit the waste pickers who like to work individually. For roles that require specific knowledge, a regular schedule and salaried workforce can be employed. The dual payment and employment method gives organizations the freedom to carry out waste management at MRFs without administrative formalities.

These are some examples of the existing financial models in India and other countries. For every livelihood enhancement model, it is important to include long-term livelihood sources which can bring about sustainability, feasibility, and reliable transportation processes.

INTERNATIONAL CASE STUDIES CAPTURING THE PRACTICES

5

1 DA NANG, VIETNAM: A PIONEERING EXAMPLE IN PLASTIC WASTE MANAGEMENT

Da Nang is a coastal city in Vietnam, and it is the fifth-largest city in the country with a population of more than 1.2 million. Almost 88 percent of the population lives in urban areas, whereas 12 percent reside in rural areas. The city generates more than 1,100 tonnes of solid waste per day, of which 150 tonnes per day is plastic waste (14 to 17 percent).[15] The absence of source segregation and holistic waste management systems are the hurdles in ensuring sustainable management of waste in the city.

However, since 2016, the city has been implementing a community plastic waste collection and recycling model. The model keeps women waste pickers at the centre as they are engaged in core activities like household collection, sorting, recycling and trading. These women waste pickers travel on their bicycles or rickshaws to cater to households and businesses. The model has creatively utilized the force of women waste pickers as specialized communicators on the issue of waste segregation, collection, and recycling. This has transformed the role of waste pickers, adding more value and respect to their role.

15 *https://www.weforum.org/agenda/2020/01/viet-nam-is-building-its-first-zero-plastic-waste-city-heres-how/*

These women go from door-to-door and educate households on waste segregation and handling. They also collect waste from construction and dumpsites. Women waste pickers collect high-value plastics and low-value plastics such as plastic carry bags, straws, plastic cutlery, shampoo sachets, etc.

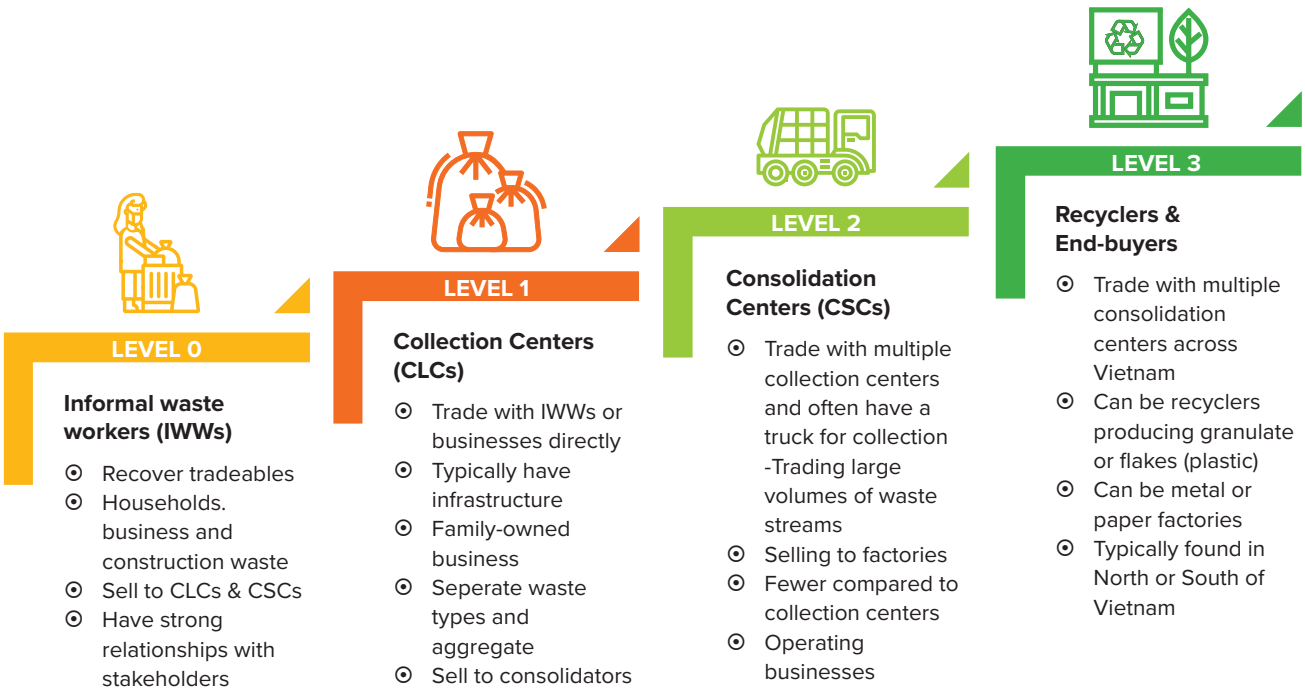


Figure 23 Waste collection, recycling, and trading cycle in Vietnam. Source: UNDP Vietnam

The women waste pickers take their waste to small scrap aggregators, who have a dedicated space or a shop to sort and recover the material. The material segregation and recovery are based on the potential of the sellability of the materials downstream.

Along with market linkages, the model emphasizes the social protection of these women waste pickers. More than 1,000 women waste pickers have been integrated with the Women's Union, a socio-political organization that represents and defends women's legal rights and interests in Vietnam. This has provided them with a livelihood, a stable income and social security benefits like health care access, education for children, etc. Some women members have reported an almost 10 percent increase in their income post their inclusion in the project.

"My income has increased to 5.300.00 VND from 4.700.00 VND thanks to having access to more stable sorted waste resources."

Ms. Nguyen Thi Bay, waste picker in Son Tra district, Da Nang city

IMPACT OF THE MODEL: The model has encouraged 21,000 households, 31 schools, 200 hotels and restaurant owners to commit to source segregation and plastic recycling. The Da Nang model has become a leading example of how gender equity and combating plastic pollution can go hand in hand.

2 COMING TOGETHER TO BEAT PLASTIC POLLUTION IN PASIG CITY, PHILIPPINES

Situated in Metro Manila, Pasig City is one of the most urbanized and the ninth-most populated city in the country, with a population of around 800,000. The city is situated on the Pasig River system, which is the world's eighth-most polluted river globally; around 65 percent of its water is polluted due to household waste. The city generates 345.12 MTs of municipal waste daily, of which approximately 19 percent is plastic.[16]

After pledging to reduce 20 percent of waste generation by 2025, the citizens of Pasig have rallied behind the vision and efforts of Mayor Vico Sotto to make it a 'Green City.' The government of Pasig City has collaborated with one of the fast-moving consumer goods company to implement 'Walastik na Pasig', a plastic collection programme.

16 *https://www.who.int/water_sanitation_health/resourcesquality/wpccasestudy3.pdf*

As a part of the campaign, citizens collect, clean and deposit single-use plastics, like shampoo sachets, carry bags, chocolate wrappers and straws, in designated junk shops located in their neighbourhood. In return, a cash incentive based on per kilogram of properly deposited waste is provided to the participating households and shop owners.

This enables source segregation and community recycling of single-use plastic, diverting it from landfills and waterbodies. An extensive, behavioural communication programme will soon follow the campaign.

Pasig City is also partnering with multinational corporations and supporting local circular economy start-ups like Sari-cycling and Cloop. Sari-cycling follows a similar model: three separate bins are installed next to sari-sari shops (go-to neighbourhood stores for low-income households providing items in small quantities, mostly sachets, for their daily needs). Citizens segregate waste into three categories – plastic, metal, and bottles. A cash incentive is provided to participating households and shop owners.

The waste collected under this initiative is managed by Cloop, a local plastic recycling and upcycling start-up. Cloop uses MRFs to not just sort and recover materials but also for advocacy on PWM.

3 ZERO-WASTE CITY: SURABAYA, INDONESIA LEADS THE WAY WITH WASTE BANKS

Surabaya is the second-largest city in Indonesia and is situated in the eastern part of Java Island. The city generates 1,512 tonnes of solid waste per day, of which (57 percent) is organic waste, and (16 percent) is plastic waste.[17] In 2001,

Surabaya peaked at 2,000 tons of solid waste generation in a day. At the same time, one of the city's landfills – Kpeutih – was also shut down, leading to massive littering on the streets. This was a turning point in the history of the city.

In 2004, the city government prepared itself for the long fight against the menace of solid waste and laid down an action plan. Surabaya launched a 3 Rs (reduce, reuse, and recycle) community-based waste management programme, also known as the Surabaya Green and Clean campaign. The campaign focussed on educating citizens on waste management, planting trees and saving energy.

The primary challenge for the city government was to promote source segregation amongst households. The city government collaborated with Japan-based Kitakyushu International Techno-cooperative Association (KITA), who

17 *https://wedocs.unep.org/bitstream/handle/20.500.11822/32898/NPWRSI.pdf?sequence=1&isAllowed=y*

worked with the city government to introduce quick, low-tech and inexpensive means of household composting. This pushed households to start segregating the waste at source.

By 2009, more than 20,000 households started practicing household composting and 21 composting centres were established. The model reduced waste generation by 30 percent. To ensure the sustainability and implementation of the campaign, the Surabaya City government recruited approximately 420 facilitators and 28,000 environmental cadres to manage their community-based waste management initiatives. The campaign also included neighbourhood competitions in which the communities were judged based on cleanliness, tree plantation and waste management efforts.

Complementing this was Surabaya's other impactful initiative of installing 'waste banks,' which started in 2009. The waste banks initiative was launched under the Surabaya Clean and Green campaign to manage dry waste. It functions like a formal bank system, and the savings are not financial but dry waste. The deposited dry waste undergoes a weighing process, and accordingly, payment is made to the account holder.

The waste bank is not just an environmental initiative but is also an economic model. Citizens are paid to sort the waste at source and this ensures their participation in the city's waste management process. The waste collected by the bank is further sold to large aggregators or recyclers, who use it to make other recycled material. The model of the waste bank has ensured an increase in the informal sector income.

As of today, the city has maintained sustainability of its models via various innovative strategies. The city's transportation system has been adapted to reduce plastics. Bus units in Surabaya allows people to pay their fares using plastic bottles.

4 CUTTING LANDFILL WASTE IN VIETNAM BY 70 PERCENT: A WOMEN-LED WASTE COLLECTION PROGRAMME IN HOI AN CITY:

A tourist and a port city, Hoi An in Vietnam witnesses a footfall of 20 million tourists annually, and the city generates 27,000 tonnes of solid waste per year.[18] Initially, all of it was beng dumped in landfills, waterbodies or streets, and residents and city authorities had a tough time managing the waste.

In 2010, the Hoi An Women's Union took charge of waste management in the city. Under the project 'Socialization of solid waste management in Hoi An', the Women's Union prepared a long-term strategy to manage the waste crisis in the city. Innovation and advocacy were the two central pillars of the project.

Implemented in close coordination with the Vietnam Office of Natural Resources and Environment and the Public Works Agency, the project worked to sustainably develop the city while preserving its cultural heritage. Hoi An is famous for its

18 *https://undp.shorthandstories.com/gef-sgp-waste-not-waste-not/*

pagodas, temples, ancient wells and tombs; improper waste management was a big threat for the city.

Sorting waste at the source was a key idea behind the project. Recyclable, biodegradable and persistent (organic pollutants) were the three categories created for households to segregate their waste. The Women's Union initiated an exhaustive communication and education campaign via community radio, local fairs, door-to-door outreach, etc., to make residents understand the importance of source segregation.

The project made biodegradable waste to compost at the household level, which farmers later used in their fields. Recyclables like plastic, metal, glass, etc., were collected and sold for recycling. The persistent waste was handed over to the city government for disposal. The city authorities provided their full cooperation and streamlined the process by creating waste management plans.

The project did not only enable source segregation and channelize the collection of the waste, but it also created income support for women members. The project devised a revolving credit scheme to provide loans to them, ensuring that the waste management programme became self-sustainable and viable.

The union utilized these funds to purchase necessary infrastructure like trolleys, bicycles, uniforms, etc. The project helped increase the quantity of recovered, recycled waste and the income of women members.

IMPACT OF THE MODEL:

The efforts by the Hoi An Women's Union resulted in a 70 percent diversion of the waste from the city's landfill. The model is an important example not only for plastic recycling but also for gender equity and the social protection of women waste pickers. The model is now being scaled up at a provincial level.

Plastic waste has emerged as a threat in

WAY FORWARD AND CONCLUSION

6

recent years and needs different models for sustainable PWM. The adoption of a circular economy in PWM will support the sustainable utilization of natural resources and boost the economy.

In India, the Plastic Waste Management Rules were mandated in 2016, amended in 2018 and 2021, to manage waste at the city level. There are different categories of plastic waste defined by the CPCB, which should be processed and recycled by recycling units. Single-use and multi-layered plastics can be considered the most difficult to process or recycle. While there have been numerous policy interventions to institutionalize PWM, managing solid waste, mainly plastic waste, has been a challenge for ULBs across the country.

This handbook will provide a roadmap for a sustainable and inclusive PWM model for the ULBs. The handbook details the MRF model, which the ULB can implement in a public-private partnership mode. The brand owners or producers under EPR or CSR activities can provide financial support to develop the infrastructure and machinery required for the MRFs. Steps and processes to set up, operationalize and make the model self-sustaining by becoming a profitable model have been

detailed in this handbook. This model ensures compliance with regulations and improves resource utilization. It not only focuses on managing plastic waste but also on the social inclusion and protection of waste pickers by improving their socio-economic conditions.

To successfully implement the model, all stakeholders need to be integrated and institutionalize the complete process. The handbook details the role of different stakeholders, such as ULBs, recyclers, service providers, brand owners and waste pickers for each of the components. The segregation of waste at generation points and the formalization of recycling units by registering as per CPCB rules are critical to implementing the MRF model.

This handbook will act as an important tool for ULBs in the successful plastic waste management in their respective cities.

Annexures

1) ANNEXURE I : Baseline format for Municipal Solid (Plastic) Waste Management including comprehensive questionnaire for capturing the information on Solid (Plastic) Waste at the city or town level.

2) ANNEXURE II : Risk Matrix – Plastic Waste Management comprises different risk matrix like operational, occupational, financial, and institutional and recycler linkages. The details captured for each risk include associated risks, degree of risk for MRFs as high/medium/low, impact, and action plans.

3) ANNEXURE III: Suggestive template for reporting & data monitoring comprises of six formats for the reporting and data monitoring purposes at MRF. The six formats mentioned in this annexure are Daily Inward Register, Daily Outward/Sale Register, Waste Picker Registration Details, Self-Help Group Details, Infrastructure Fixed Assets Details, and Recycler Details.

4) ANNEXURE IV: Checklist for recyclers (as per Plastic Waste Management Rules 2016, FORM II) includes the details for recyclers to set up and operate recycling units. The annexure also details the suggestive measures for recyclers while setting up and running their units.

5) ANNEXURE V : Checklist for ULBs (Framework for Entering into a City for Establishing Plastic Waste Management System) includes the details and prerequisites for setting up MRF. It consists of details starting from level 0 (City Review and Scope of Intervention) to level 6 (IEC and Awareness Activities). It is assumed that the PWM system needs to be established in the city from scratch; Level 0 considered as an initiation point.

6) ANNEXURE VI : Checklist for ULBs (Framework for partial establishment of Plastic Waste Management System in a city) includes details on the assumption that PWM system is partially established in the city and divided into activities already done and activities that are left to be done for setting up a comprehensive waste management system at the city level.

7) ANNEXURE VII: Templates for cash flows and maintaining financial sustainability.

Annexure I – Baseline Format for Municipal Solid (Plastic) Waste

Name of City/Town and State	
Population	
Area in square kilometres	
Name & address of the local body, contact details (email, phone)	
Name of officer in-charge dealing with solid/plastic waste management	
Phone no./Fax/Email	
Number of households in the city/town	
Number of non-residential premises in the city	
Number of election/administrative wards in the city	
Total quantity of solid (plastic) waste generated	
Estimated quantity of waste generated in the local body area per day in metric tones	
Quantity of waste collected per day	
Per capita waste collected per year	
Quantity of waste processed	
Quantity of waste disposed at dumpsite/landfill	
Status of waste management services:	
Segregation and storage of waste at source	
Whether waste is stored at source in domestic/commercial/ institutional bins. If yes,	
Percentage of households practicing storage of waste at source in domestic bins	
Percentage of non-residential premises practicing storage of waste at source	
Percentage of household disposing or throwing waste on the streets	
Percentage of non-residential premises disposing or throwing solid waste on the streets	
Whether waste is stored at source in segregated form. If yes,	
Percentage of premises segregating the waste at source	
Door-to-door collection of solid (plastic) waste	
Whether door-to-door collection is being done in the city/town	

Number of wards covered in door-to-door collection of waste		
No. of households covered		
No. of non-residential premises including commercial establishments, hotels, restaurants, educational institutions/ offices etc. covered		
Percentage of residential and non-residential premises covered in door-to-door collection through: → Motorized vehicle → Containerized tricycle/handcart → Others		
If not, method of primary collection adopted → Sweeping of streets → Length of roads streets, lanes, bye lanes in the city		
Tools used :		
Manual sweeping	%	
Mechanical sweeping	%	
Whether long handle broom used by sanitation workers	Yes/No	
Whether each sanitation worker is given handcart/tricycle for collection of waste	Yes/No	
Whether handcart/tricycle is containerized		
Whether the collection tool synchronizes with collection/waste storage containers utilized		
Secondary waste storage facilities		
No. and type of waste storage depots in the city/town → Open waste storage sites → Masonry bins → Cement concrete cylinder bins → Dhalaos/covered rooms/space → Covered metals/plastic containers → Bin less city	No. capacity in m^3	
Ward wise details of waste storage depots :		
Frequency of collection of waste from the depots	Frequency	No. of bins
Number of bins cleared	Daily	
	Alternate day	
	Twice a week	
	Once a week	
	Occasionally	

Whether storage depots have the facility for storage of segregated waste in green, blue and black bins	Yes/No	
	(if yes, add details)	
Whether lifting of solid waste from storage depots is manual or mechanical. Give percentage		
(%) of Manual lifting of solid waste	(%)	
(%) of Mechanical lifting	(%)	
If mechanical – specify the method used		
Whether lifted from door to door and transported to treatment plant directly in a segregated form	Yes/No	
	(If yes, specify)	
Waste transportation per day		
Type and number of vehicles used → Animal cart tractors → Non tipping → Truck → Tipping truck → Dumper placers → Refuse → Collectors → Others → JCB/loader		
Frequency of transportation of waste		
Quantity of waste transported each day		
Percentage of total waste transported daily		
Waste treatment technologies used		
Whether solid waste processed daily		
If yes, quantity of waste processed daily	tpd	
Whether treatment is done by local body or through an agency		
Processing (in Hectares)		
Land currently utilized for waste processing		
Solid waste processing facilities in operation		
Solid waste processing facilities under construction		
Distance of processing facilities from City/Town boundary		

Details of technologies adopted	
Composting	Qty. raw material processed Qty. final product produced Qty. sold Qty. waste landfilled
Vermi-composting	Qty. raw material processed Qty. final product produced Qty. sold quantity of waste landfilled
Bio-methanation	Qty raw material processed Qty. final product produced Qty. sold quantity of residual waste landfilled
Refuse derived fuel	Qty. raw material processed Qty. final product produced Qty. sold quantity of residual waste landfilled
Waste to energy technology such as incineration, gasification, pyrolysis or any other technology (give detail)	Qty. raw material processed Qty. final product produced Qty. sold quantity of residual waste landfilled
Co-processing	Qty. raw material processed
Combustible waste supplied to cement plant	
Combustible waste supplied to solid waste based power plants	
Other	Qty.
Solid waste disposal facilities	
No. of dumpsites available with the local body	
No. of sanitary landfill sites available with the local body	
Area of the site available for waste disposal sites	
Distance of the dumpsite/landfill facility from city/town	
Distance from the nearest habitation	
Distance from water body	
Distance from state/national highway	
Distance from the airport	
Distance from important religious place or historical monuments	

Whether it falls in flood prone area	
Whether it falls in earthquake fault line area	
Quantity of waste landfill each day	
Whether landfill site is fenced	
Whether landfill facility is available on site	
Whether weighbridge facility available	
Vehicles and equipment used at landfill (specify)	
Manpower deployed at landfill site	
Whether covering is done on daily basis	
If not, frequency of covering the waste deposited at landfill	
Cover material used	
Whether adequate covering material is available. Provisions for gas venting provided. Provisions for leachate collection. Whether an action plan has been prepared for improving solid waste management practices ? What separate provisions are made for ?	
→ Dairy-related activities	
→ Slaughterhouse waste	
→ C&D waste (construction debris)	
→ Details of post closure plan	
How many slums are landfill and whether these are provided with waste management facilities:	**(If yes, attach details)**
Give details of	
Local body's own manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal waste	
Give details of	
Contractor/concessionaire's manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste	
Mention briefly, the difficulties being experienced by the local body in compliance with provisions of these rules	
Mention briefly, if any innovative idea is being implemented to tackle a problem to solid waste, which could be replicated by other local bodies	

Annexure II – Risk Matrix-Plastic Waste Management

S.No.	Issue	Risks	Degree of risk (High/ Medium/ Low)	Impact	Action Plan
Operational Risks - Collection System, Material Recovery Facility & Final Disposal/Processing					
1	Identification of land and obtaining permission/ approvals with local authorities	Delays in getting land and necessary approvals for initiating the operations	High	Inability to establish the PWM system in place.	The land is allotted by local authorities for establishing Material Recovery Facility. Obtaining approvals is a prerequisite for initiating the operations and establishing the decentralised system in the city. The local authorities to fast track the approval process and designate area for establishing Material Recovery Facility
2	Establishing robust collection system with daily tonnage/target	The daily collection system varies from city to city depending on generation and the way it is collected e.g. - door to door, community based etc. If a minimum threshold of collection target is not met, then the MRF cannot run at its full capacity.	Medium	Inability of meeting the agreed pre-decided timelines in setting the system. The PWM system will operate at reduced capacity.	Planning & pre-deciding the route map with local authorities, creating awareness, engaging local communities, etc.

S.No.	Issue	Risks	Degree of risk (High/ Medium/ Low)	Impact	Action Plan
3	Onboarding/ appointment of waste management agency/partner to operate the Material Recovery Facility	Availability of skilled human resource across cities. With waste management being an unorganized and complex sector in India, it is difficult to find human resources who have the skill sets that match the requirement of the project both in the teams and service providers.	High	Long-time taken by project team and service providers in delivering the activity outputs (results).	Transparent tendering process with experience-based selection of the partner agency. Regular capacity building to be undertaken.
4	Channelization of recyclable plastic waste fraction to recyclers & their linkages	Non-Compliance with guidelines laid by CPCB	High	There is a lack of registered recyclers in the country and as per CPCB 100% channelization of recyclable plastic waste should happen to be registered recyclers.	Encouraging small & large aggregators to register themselves with SPCBs to create enough infrastructure. Engaging with registered recyclers to be emphasised.
5	Unprecedented situations / events outside the control of projects	Outbreak of a pandemics (COVID) and related events, social unrest – Riots, civil disobedience movements. Natural disasters, floods etc.	High	→ Inability of abiding by the pre-decided timelines and results. → High costs for recycling challenging the business model approaches. → Jobs, income of waste pickers is impacted, and school children are drop-outs.	Capacity building & training in case of man-made hazards. In case of natural disasters, a proper contingency plan to be prepared & adopted.

S.No.	Issue	Risks	Degree of risk (High/ Medium/ Low)	Impact	Action Plan
				→ Distress sale of assets, domestic violence increases, indebtedness increases, greater drudgery for women. Implementation partner runs into losses due to higher operational costs.	
Occupational Risks at Material Recovery Facilities					
1	Physical hazards	The most common hazards include injury from sharp items, use of hand and power tools, and material handling, slips, and falls, and temperature extremes.	High	Injury/loss of life	Use of safety gears like gloves, mask, boots and proper clothing will minimize the risk and prevent potential accidents at the site. A safety briefing at the project site should be conducted every month as a healthy practice to prevent physical hazards.
2	Exposure to site contaminants	Personnel could contact waste and the typical pathogens contained therein most notably is tetanus.	Medium	Water/food-borne diseases	Site personnel should be provided with tetanus immunizations before mobilizing to the site. They will also be required towash their hands at the end of work and before handling food. It is also suggested to keep a workplace uniform to maximize the prevention of contamination.

S.No.	Issue	Risks	Degree of risk (High/ Medium/ Low)	Impact	Action Plan
3	Biological hazards	During the operation at the site, there is potential for workers to encounter biological hazards such as animals, insects, and plants. Animals such as dogs, cats, rats, mice, and snakes may be encountered.	Medium	Injury	Workers shall be well instructed to avoid all contact with animals. If these animals present a problem, efforts will be made to remove these animals from the site by contacting a licensed animal control expert.
4	Fire hazards	Material recovery facility deals with dry waste there is a potential hazard of ignition of the dry waste trough external agents like flash, electric spark, nearby fire etc.	High	Injury	Installation of fire extinguisher is must at Material Recovery Facility. Recommended to have fire hydrant system installed.
Financial Risks					
1	Sustainable investments in monitoring and evaluation systems in project	Governance and management level issue	High	The rate of change in terms of social benefits, empowerment is compromised. High management costs and operational inefficiencies not addressed.	Robust planning & scaling up of business model for waste management system.
2	Higher cost of material & quality of incoming material	Net loss	Medium	Impact on operational costs of the project.	Comparison with multiple vendors and select appropriate vendor.

S.No.	Issue	Risks	Degree of risk (High/ Medium/ Low)	Impact	Action Plan
3	Shortage of material	Difficulty in meeting target & processing challenges	Medium	Impact on operational costs of the project.	Planning of pickup of material as per the availability of material.
4	Increase in logistics cost spent per kg of plastic waste	Effect on gross margins	Medium	Impact on operational costs of the project.	Sending material to region specific recyclers for reducing logistics cost.
Institutional Risks					
1	Policies, delayed, change in frameworks in the implementation of Plastic Waste Management Rules/ Solid Waste Management Rules	Fluctuating oil prices making virgin plastics cheap than the recycled plastics. Leads to poor linkages to markets, recyclers resulting in losses in recycling.	High	→ Inability of abiding by the pre-decided timelines of the project. → Income of waste pickers is impacted. → Investments in the plastic waste have low rate of returns. → Less interest by the private sector in the systematized investments by the private sector and ULBs.	
Recycler Linkages					
1	Onboarding recycler/ dismantler not listed in CPCB list	Client disagreement in approving the onboarded recycler/ dismantler	Medium	Non-Compliance with the Rules	Verification of recyclers
2	Onboarding a non-compliant recycler/ dismantler	Business loss	Medium	Non-Compliance with the Rules	Training recyclers on documentation compliances

S.No.	Issue	Risks	Degree of risk (High/ Medium/ Low)	Impact	Action Plan
Social Risks					
1	Child labour in centers	Risk of children working below 18 years. Violation of labour laws	High	Violation of labour laws, effect on childhood, health and emotional well being.	Material Recovery Facility should establish strict policies to address child labour issues.
2	Fair wages to all working in the center	Risk of not addressing the gender parity and equal wages to all working in Material Recovery Facilities	Medium	Impact on equal work opportunities to men and women, performance issues.	Internal policies/SOPS to adhere to fair wages.
3	Issuance of ID cards to waste pickers	Recognition to waste pickers working at Material Recovery Facilities	Medium	Impact on recognition to waste pickers, encouraging better collection and dignity.	Internal policies/SOPs to issue ID cards.
4	Inclusion of informal sector/ waste pickers	Risk of low collections.	Medium	Impact on collection volumes, recognition to waste pickers	Ensuring waste pickers are integrated in the system and benefitted with various schemes available.
5	Migratory risks of waste pickers	Risk of inconsistent collection volumes	Medium	Impact on collection volumes.	Ensuring waste pickers are integrated in the system and benefitted with various schemes available.

Annexure III - Suggestive Template for Reporting & Data Monitoring

a) Format for Register I Daily Inward Register - Material Recovery Facility (City Name & Service Provider Name)

No.	Date dd/mm/yyyy	Name: Source of incoming	Type of Source Name of waste picker / SHG / Bulk Generator / ULB / First Point of Sale / Others	Ward Name / No	Vehicle No / Others (Handcart, Rickshaw, etc.)	Incoming waste (Kgs)	Type of waste (Code ID)	Unit rate paid/ kg to SS / Others	Bill No. - by IP/Buyer	Total amount (Rs)	Mode of payment (by bank transfer/ cheque or cash)	Weigh scale in-charge signature available in registry	Receivers signature available in registry
1													
2													

b) Format for Register II Daily Outward/Sale Register - Material Recovery Facility (City Name & Service Provider Name)

No.	Date dd/mm/yyyy	Recycler name/address	Vehicle no./others	Weighbridge slip no.	Net weight in kg	Type of product name (Code ID)	Invoice no. & date	Rate/Kg	Invoice total Amount (INR)	Account incharge signature of service provider
1										
2										

c) Format for Register III Waste Picker Registration Details - Material Recovery Facility (City Name & Service Provider Name)

No.	Name of the SHG	Female waste pickerss	Male waste pickers	Total No of members	Date of formation	Bank name	Account no	Address
1								
2								

d) Format for Register IV Self Help Group Details - Material Recovery Facility (City Name & Service Provider Name)

No.	Name of the SHG	Female waste pickers	Male waste pickers	Total no of members	Date of formation	Bank name	Account no	Address
1								
2								

e) Format for Register V Infrastructure - Fixed Asset Details - Material Recovery Facility (City Name & Service Provider Name)

No	Land area (sq. ft)	Shed area (sq. ft)	Owned by	Amount of rent paid (if any in INR)	Sanctioned power (kW)	Facilities (Toilet, office room, dress changing room, etc)	Health, safety equipments
1							
2							

No.	Machinery	Location	Owned by	Operational since (date)	Capacity	Number of machines	Power (kW)
1	Weighing scale						
2	Baler						
3	Conveyor belt						
4	Shredder						
5	Phatka						
6	Aglo Gatta machine						
7	Mobile phone						
8	Trolley						
9	Sorting table						
10	Incinerator						
11	Extrusion						
12	Sewing machine						
13	Other						

Format for Register VI Recycler Details - Material Recovery Facility (City Name & Service Provider Name)

No.	Material	Name	Address	Distance from MRF	Recycler	Recycling capacity (tons per month)	List of machineries	Recycling process	Certificate available	Registration number	Purchase rate
1											
2											

Annexure IV – Checklist for Recyclers (as per Plastic Waste Management Rules 2016, FORM II)

Part I - Plastic Waste Management Rules 2016					
S. No	Item	Detail	Availability		Remarks
			Yes	No	
1	Name and address of the unit				
2	Contact person with designation				
3	Date of commencement				
4	Number of workers (including contract labour)				
5	Consent validity	i. Water (Prevention & Control of Pollution) Act 1974 ii. Air (Prevention & Control of Pollution) Act 1981 iii. EIA clearance (optional) iv. Hazardous/explosive item license			
6	Manufacturing process	Please attach a flow diagram of the manufacturing process flow diagram for each product			
7	Products and installed capacity of production (MTA)	i. Products ii. Installed capacity			
8	Waste management: i. Waste generation in processing plastic waste. ii. Waste collection and transportation (attach details). iii. Waste disposal details. iv. Provide details of the disposal facility, whether the facility is authorized by SPCB or CPCB.				

Part I - Plastic Waste Management Rules 2016					
S. No	Item	Detail	Availability		Remarks
			Yes	No	
	v. Please attach analysis report characterization of waste generated (including leachate test, if applicable).				
9	Details of plastic waste proposed to be acquired through sale, auction, contract or import as the case may be, for the use of raw material.	i. Name ii. Quantity required/year			
10	Occupational safety and health aspects i. Disaster management plans, mock drills etc. ii. Incident/accident register iii. EHS policy iv. SOPs and updated manuals v. Fire license vi. Critical hazard and environmental risk mitigation control plan vii. Availability of PPEs viii. Area for storage, design approval, etc.				
11	Pollution control measures i. Whether the unit has adequate pollution control systems or equipments to meet the standards of emissions or effluents. ii. Whether the unit is in compliance with conditions laid down in the said rule. iii. Whether conditions exist or are like to exist of the material being handled or processed posing adverse immediate or delayed impacts on the environment.				

Part I - Plastic Waste Management Rules 2016					
S. No	Item	Detail	Availability		Remarks
			Yes	No	
11	iv. Whether conditions exist or are likely to exist of the material being handled or processed by any means capable of yielding any other material (ex. leachate) which may possess eco-toxicity.				
12	List of enclosures as per rule.				
13	Recycling or processing of plastic waste shall prepare and submit an annual report in Form-IV to the local body concerned under intimation to the concerned SPCB or Pollution Control Committee by the April 30, of every year.				
14	Ensuring that no damage is caused to the environment in recycling the plastic waste.				
15	Details of machinery installed & its operating capacity.				

Part II - Suggestive measures					
S. No	Item	Detail	Availability		Remarks
			Yes	No	
1	Incoming plastic waste register				
2	E-way bill and other transportation documents				
3	Weighbridge receipts and pictures of vehicles showing their registration number				
4	Outgoing processed material register from Material Recovery Facility				
5	Transaction details as proof of plastic waste processing				
6	Certificate of recycling to be obtained/generated				
7	Air/water/noise/soil monitoring reports as per CTO - Air & Water Act				
8	Hazardous residues/waste safe disposal proof such as TSDF certificate				
9	Due diligence report				
10	ESIC liability insurance				
11	Legal compliance register, legal notices or any ongoing legal proceedings				
12	List of agreements with transporters, PROs, channel partners etc.				
13	Business continuity and developmental plans				

Annexure V – Checklist for ULBs (Framework for Entering into a City for Establishing Plastic Waste Management System)

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 0	1	**City review and scope of interventions**				
	A	Establishing Plastic Waste Management in new city for project implementation, an initial survey on inflow and outflow of waste value chain to be undertaken as a baseline.				
	B	Location of Material Recovery Facility				
	C	Identification of wards				
	D	Routes for collection of plastic waste & other collection mechanism				
	E	Analysis of data on dry/plastic waste from primary and secondary sources, including bulk generators like resident welfare associations (RWAs), commercial and religious establishments including schools, hotels, etc.				
Level 1	2	**Urban Local Body (ULB) engagement and approval**				
	A	Engagement with Commissioner/ Secretariat of the city ULB/ Municipality/(SPCB) to set up the Material Recovery Facility.				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 1	B	Letter of approval for space, shed etc.				
	C	Conduct meetings/workshops with government officials, bulk generators, industrial and hotel associations, waste aggregators, RWAs, etc. for collection/recycling of all plastic/dry waste.				
Level 2	**3**	**Request for project implementation in the city**				
	A	Onboard an implementing/service partner in the city i. Preparation of Terms of Reference for selection of implementation/service partner ii. Floating the Request for Proposal through local tendering process iii. Evaluation & Selection of partner agency with technical & operational experience in waste management domain iv. Engagement of Waste pickers in the city for collection of plastic waste v. Capacity building of partner agency on procurement, social inclusion and stakeholder engagement best practices.				
Level 3	**4**	**Set up infrastructure, plant & machinery of Material Recovery Facility**				
	A	Site preparation for operational and requisite construction with all relevant infrastructure including toilets, electricity etc.				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3	B	Implementation process and ensure procurement/installation/ operation/maintenance of machinery from selected vendors.				
	C	Requisite safety measures (fire safety, first aid, etc.) to be ensured in the centre				
	D	Operators of machinery and staff in Material Recovery Facility trained and exposure in operations, maintenance, occupational safety and best practices of running Material Recovery Facility				
	E	Consent to establish i. Site Plan/Location Plan Of The Industry ii. Detailed project report which includes the details of raw material, product to be manufactured, the capital cost of the unit (land, building, and plant machinery), water-balance, source of water, and its required quantity iii. Land documents such as Registration deed/ Rent deed/ Lease deed iv. Details of Water Pollution Control/Air Pollution Control instruments	i. Water (prevention & Control of Pollution) Act 1974 ii. Air (Prevention & Control of Pollution) Act 1981 iii. EIA clearance (optional)			
		v. MOA /partnership deed				
		Consent to operate i. Copy of last consent issued ii. Layout plan showing the details of all manufacturing processes				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3		iii. Latest analysis report of solid waste, effluent, hazardous wastes, and fuel gases iv. Copy of balance sheet duly attested by CA or CA certificate v. Detail of land in case the effluent is discharged on land for percolation vi. Occupation certificate issued by Town & Country Planning Department, in case of building & construction projects/area development projects.	i. Water (Prevention & Control of Pollution) Act 1974 ii. Air (Prevention & Control of Pollution) Act 1981			
	F	vii. MOA /partnership deed	iii. EIA clearance (optional)			
	G	Waste inflow and outflow plan	i. Types of materials (bailed PET, shredded HDPE, Ghatta material, rejects etc.) ii. Mapping of the sources (educational institutes, religious places, municipal system, aggregators, etc.)			
	H	Machinery installation and details i. Weighbridge ii. Conveyor belt iii. Fatka machine iv. Shredding machine v. Aglo & gatta machine vi. Bailing machine vii. Weighing machine				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3	I	List of processes at the MRF i. Manual separation at the conveyor belt ii. Cleaning using air blower method iii. Shredding of thin plastic iv. Grinding of hard plastic v. Agglomeration of the shredded plastic vi. Extrusion of the agglomerated plastic vii. Bailing of the thin plastic viii. Use of forklifts				
	J	Occupational safety and health aspects: i. Clean drinking water facility - RO/UV ii. Social management policy/ EHS policy iii. Clean sanitation facility iv. Common room for changing clothes v. Children creche and safe play area vi. First aid kit vii. Personal protective equipments				
	5	**Onboarding waste pickers and Inclusion interventions**				
	A	Identify the waste picker communities, and register the waste pickers for the engagement				
	B	Regular meetings with waste pickers for the following				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3		Social protection measures: i. Issuing occupational identity cards for the waste pickers ii. Issuing mandatory identity cards for the waste pickers (like ration cards, Aadhaar card, voter ID etc.) iii. Opening of bank accounts iv. Education and linkage with various government. schemes v. Financial education vi. Gender action plan vii. Fair wages policy viii. Monthly health camps ix. Appropriate working hours x. ESIC liability insurance xi. SHG formation xii. Regular capacity building	Key social protection policies: i. Pradhan Mantri Jan Dhan Yojana ii. Pradhan Mantri Jeevan Jyoti Beema Yojana iii. Pradhan Mantri Suraksha Beema Yojana iv. Atal Pension Yojana v. Ayushman Bharat Yojana vi. Janani Shishu Suraksha Yojana vii. Mission Indradhanush Gender action plan i. Implementing PoSH ii. Promoting gender sensitive trainings iii. Supporting menstrual health and hygiene iv. Preventing and responding to gender-based violence			
Level 4	6	**Linkages to bulk generators & recyclers**				
	A	Identification of recyclers and bulk generators of plastic waste in the city for collection of segregated/ processed waste.				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 4	B	Recyclers should be registered and have appropriate approvals and compliances to ensure traceability of the waste collected from Material Recovery Facility (Refer the Annexure - Checklist for Recyclers)				
	C	Collection & logistics for the Material Recovery Facility defined with the partners such as ULB/ Municipality/ bulk generators/ recyclers.				
Level 5	**7**	**Compliance system as per PWM Rules, 2016 - collection, reporting, bookkeeping and accounts**				
	A	Incoming plastic waste register				
	B	E-way bill and other transportation documents				
	C	Dharm Kanta receipts and pictures of vehicles showing their registration number				
	D	Outgoing plastic waste register				
	E	Transaction details as proof of plastic waste processing				
	F	Waste pickers onboarding details				
Level 6	**8**	**Awareness and IEC Activities**				
	A	Continuous campaigns of awareness activities for schools, citizen and stakeholders' sensitization to promote plastic waste management best practices such as source segregation.				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 6	B	Engage with new media such as digital platforms and bloggers/ influencers for placement of stories .				
	C	Innovative media partnerships with leading channels				
	D	Workshops/webinars/trainings				
Assumption:		The PWM system needs to be established in the city from scratch; Level 0 to be considered as an initiation point.				

Annexure VI – Checklist for ULBs (Framework for Partial Establishment of Plastic Waste Management System in a City)

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 0	1	**City Review and scope of interventions**				
	A	Establishing Plastic Waste Management in New city for project implementation, an initial survey on inflow and outflow of waste value chain to be undertaken as a baseline.				
	B	Location of Material Recovery Facility				
	C	Identification of wards				
	D	Routes for Collection of Plastic Waste & other Collection Mechanism				
	E	Analysis of data on dry/plastic waste from primary and secondary sources, including bulk generators like resident welfare associations (RWAs), commercial and religious establishments including schools, hotels etc				
Level 1	2	**Urban Local Body (ULB) Engagement and Approval**				
	A	Engagement with Commissioner/Secretariat of the city ULB/ Municipality/State Pollution Control Board (SPCB) to set up the Material Recovery Facility.				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 2	B	Letter of Approval for space, shed etc.				
	C	Conduct meetings/workshops with government officials, bulk generators, industrial and hotel associations, waste aggregators, RWAs etc. for collection/recycling of all plastic/dry waste.				
	3	**Request for Project Implementation in the city**				
	A	Onboard an implementing/ service partner in the city i. Preparation of Terms of Reference for selection of Implementation/Service Partner ii. Floating the Request for Proposal through local tendering process iii. Evaluation & Selection of of Partner Agency with Technical & operational Experience in Waste management domain iv. Engagement of Waste pickers in the city for collection of plastic waste v. Capacity building of Partner agency on procurement, social inclusion and stakeholder engagement best practices.				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3	**4**	**Set up Infrastructure, Plant & Machinery of Material Recovery Facility**				
	A	Site preparation for Operational and Requisite Construction with all relevant infrastructure including Toilets, Electricity etc.				
	B	Implementation process and ensure procurement/ installation/ operation/ maintenance of machinery from selected vendors.				
	C	Requisite safety measures (fire safety, first aid etc.) to be ensured in the centre				
	D	Operators of machinery and staff in Material Recovery Facility trained and exposure in operations, maintenance, occupational safety and best practices of running Material Recovery Facility				
	E	Consent To Establish i. Site Plan/Location Plan of the industry ii. Detailed Project Report which includes the details of raw material, product to be manufactured, the capital cost of the unit (land, building, and plant machinery), water-balance, source of water, and its required quantity	i. Water (prevention & Control of Pollution) Act 1974 ii. Air (Prevention & Control of Pollution) Act 1981 iii. EIA clearance (optional)			

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3		iii. Land documents such as Registration deed/ Rent deed/Lease deed iv. Details of Water Pollution Control/Air Pollution Control instruments v. MOA /partnership Deed				
	F	Consent To Operate i. Copy of last consent issued ii. Layout plan showing the details of all manufacturing processes iii. Latest analysis report of solid waste, effluent, hazardous wastes, and fuel gases iv. Copy of balance sheet duly attested by CA or CA certificate v. Detail of land in case the effluent is discharged on land for percolation vi. Occupation certificate issued by Town & Country Planning Department, in case of Building & construction projects/area development projects. vii. MOA /partnership Deed	i. Water (prevention & Control of Pollution) Act 1974 ii. Air (Prevention & Control of Pollution) Act 1981 iii. EIA clearance (optional)			
	G	Waste inflow and outflow plan	i. Types of materials (bailed PET, shredded HDPE, Ghatta material, rejects etc.) ii. Mapping of the sources (educational institutes, religious places, municipal system, aggregators etc.)			

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3	H	Machinery installation and details i. Weighbridge ii. Conveyor belt iii. Phatka Machine iv. Shredding Machine v. Aglo & Gatta Machine vi. Bailing Machine vii. Weighing Machine				
	I	List of processes at the MRF i. Manual separation at the conveyor belt ii. Cleaning using air blower method iii. Shredding of thin plastic iv. Grinding of hard plastic v. Agglomeration of the shredded plastic vi. Extrusion of the agglomerated plastic vii. Bailing of the thin plastic viii. Use of forklifts				
	J	Occupational safety and health aspects: i. Clean drinking water facility - RO/UV ii. Social management policy/ EHS policy iii Clean sanitation facility iv. Common room for changing clothes v. Children creche and safe play area vi. First aid kit vii. Personal Protective Equipments				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 3	5	**Onboarding Waste pickers and Inclusion interventions**				
	A	Identify the waste picker communities, and register the waste pickers for the engagement				
	b	Regular meetings with waste pickers for the following -				
		Social protection measures: i. Issuing occupational identity cards for the waste pickers ii. Issuing mandatory identity cards for the waste pickers (like ration cards, Aadhaar card, voter ID etc.) iii. Opening of bank accounts iv. Education and linkage with various govt. schemes v. Financial education vi. Gender action plan vii. Fair wages policy viii. Monthly health camps ix. Appropriate working hours x. ESIC liability insurance xi. SHG formation xii. Regular capacity building	Key social protection policies: i. Pradhan Mantri Jan Dhan Yojana ii. Pradhan Mantri Jeevan Jyoti Beema Yojana iii. Pradhan Mantri Suraksha Beema Yojana iv. Atal Pension Yojana v. Ayushman Bharat Yojana vi. Janani Shishu Suraksha Yojana vii. Mission Indradhanush Gender action plan i. Implementing PoSH ii. Promoting gender sensitive trainings iii. Supporting menstrual health and hygiene iv. Preventing and responding to gender-based violence			
Level 4	6	**Linkages to Bulk Generators, Recyclers, Co - Processing/ Road Laying**				
	A	Identification of Recyclers and Bulk Generators of plastic waste in the city for collection of segregated/processed waste.				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
	B	Recyclers should be registered and have appropriate approvals and compliances to ensure traceability of the waste collected from Material Recovery Facility (Refer the Annexure - Checklist for Recyclers)				
	C	Collection & logistics for the Material Recovery Facility defined with the partners such as ULB/ Municipality/ bulk generators/ recyclers.				
	D	Linkages with Coprocessing & Road Laying Organizations for final processing of plastic waste				
Level 5	**7**	**Compliance System as per PWM Rules, 2016 - Collection, Reporting, Bookkeeping and Accounts**				
	A	Incoming plastic waste register				
	B	E-way bill and other transportation documents				
	C	Dharm Kanta receipts and pictures of vehicles showing their registration number				
	D	Outgoing plastic waste register				
	E	Transaction details as proof of plastic waste processing				
	F	Waste pickers Onboarding Details				

Level	S. No	Items	Detail	Availability		Remarks
				Yes	No	
Level 5	G	Certificates from Recyclers, Co processing, Road Laying for plastic waste processing				
Level 6	**8**	**Awareness and IEC Activities**				
	A	Continuous campaigns of awareness activities for schools, citizen and stakeholders' sensitization to promote plastic waste management best practices such as source segregation				
	B	Engage with new media such as digital platforms and bloggers/ influencers for placement of stories				
	C	Innovative media partnerships with leading channels				
	D	Workshops/Webinars/Training				
Assumption:		Represents those certain aspects of the items are already done/established				
		Represents those aspects that needs to be developed and established in the city				

Annexure VII:
Material Recovery Facility – Cash Flow

Target Tons Per Day	3.2	3.3	3.4	3.5	3.6	3.7	3.8	4.0
Operational Expenses	**Month 1**	**Month 2**	**Month 3**	**Month 4**	**Month 5**	**Month 6**	**Month 7**	**Month 8**
Monthly waste buying amount								
Manpower cost (gap after funding)								
Management fee (gap after funding)								
Back office support								
Utilities & consumables								
Vehicle fuel								
Vehicle maintenance/ repairs								
Reject waste disposal								
All other expenses								
Total GST per month								
Total cost								
Operational Revenue	**Month 1**	**Month 2**	**Month 3**	**Month 4**	**Month 5**	**Month 6**	**Month 7**	**Month 8**
Sales of processed materials								
Any other source of revenue								
Total revenue								
Monthly Revenue vs Expenditure								

Support sought from ULB

– Land and building
– Power and water charges
– Transportation of MLP from DWCCs

	4.1	4.2	4.3	4.5	4.6	4.7	4.9	5.0	5.2	5.3
	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18
	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18

Material Recovery Facility – Waste Transactions

Number of Working Days in a Month 25

Assumptions										
Category of plastic	Expected monthly quantity (Kg)	Expected daily quantity (Kg)	Average buying rate (INR/Kg)	Total daily buying amount (INR)	Processing loss (%)	Quantity after processing (Kg)	Average selling rates INR)	Total daily selling amount (INR)	Add GST as applicable	Processing
Soiled PET (Pickle Jars, Oil Jars etc)	10,000	400	21	8,400	15%	340	32	10,880	1,958.40	Washed and shred/ flaked
LDPE	10,000	400	25	10,000	15%	340	40	13,600	2,448.00	Washed, shred and gatta
HDPE	10,000	400	18	7,200	15%	340	26	8,840	1,591.20	Washed, shred and gatta
MLP	18,000	720	1	720	15%	612	2	1,224	220.32	Shred and baled
Mix Plastic	12,500	500	18	9,000	15%	425	26	11,050	1,989.00	Bag filling
PVC	5,000	200	3	600	15%	170	4	680	122.40	Bag filling
PP	5,000	200	20	4,000	15%	170	29	4,930	887.40	Shred & gatta
PS	5,000	200	2	400	15%	170	3	425	76.50	Baled
Others	5,000	200	4	800	15%	170	5	850	153.00	Baled
Total	80,500	3,220		₹ 41,120				₹ 52,479	₹ 9,446	

Total rejects: 483

Manpower cost on Project with Existing Funding and Gap						
		Monthly salary per person	**No of Staff employed for 5 TPD**	**Manpower Cost per month**	**Funded as applicable**	**Gap**
1	Project manager & overall in-charge	25,000	1	25,000	20,000	5,000
2	Center In-charge	20,000	1	20,000	15,000	5,000
3	Field supervisor	18,000	2	36,000	26,000	10,000
4	Site executive	15,000	2	30,000	20,000	10,000
		78,000	**6**	**1,11,000**	**81,000**	**30,000**
	As per minimum wages					
5	Drivers	15,000	2	30,000	-	30,000
6	Machine operators	12,000	5	60,000	24,000	36,000
7	Sorters	12,000	10	1,20,000	-	1,20,000
8	Loaders	12,000	3	36,000	-	36,000
		51,000	**20**	**2,46,000**	**24,000**	**2,22,000**
	Total	**Total monthly salary**	**Total number of staff employed for 5 TPD**	**Total manpower cost per month**	**Amount funded as applicable**	**Actual monthly gap**
		1,29,000	26	3,57,000	1,05,000	2,52,000
9	Back office support	15,000	1	15,000	-	15,000
10	Management fee	25,000	1	25,000	22,500	2,500

Material Recovery Facility – Assets and Infra

Machinery by ULB / Others			
No	Machinery	Amount	Remarks
1	Weighing scale	-	
2	Baler	5,00,000	
3	Shredder	5,00,000	
4	Aglo machine	2,06,250	
	Total	12,06,250	

Land & Building			
No	Land & Building	Amount	Remarks
1	Total land area	-	
2	Modifications to Existing sheds	-	
3	New building costs	-	
4	Advance/one-time cost for shed	-	
	Total	-	

Machinery by Project		
No	Machinery	Amount
1	Weighing scale	1,00,000
2	Phatka/Air blower machine	2,00,000
3	Baler	4,50,000
4	Aglo machine	3,50,000
5	Ghatta/extruder machiner	7,00,000
6	Shredder	2,00,000
7	Vehicle	6,00,000
	Total	26,00,000

Other one-time expenses		
No	Machinery	Amount
1	Office setup	20,000
2	Biometric attendance	50,000
3	Laptop/computer for office setup	50,000
4	Fire extinguisher	10,000
5	First-aid kit	5,000
6	Uniforms & safety gears	10,000
7	Drums, buckets	10,000
8	Stationary & signboards	10,000
9	Mobile phones	25,000
	Total	1,90,000

Material Recovery Facility – Operational Expenses

Monthly Operational Expenses		
No	**Expected Expenses**	**Amount**
1	Reject waste disposal	36,225
2	Vehicle fuel	10,000
3	Vehicle maintenance	10,000
4	Tools & equipments	2,500
5	Utilities & consumables	10,000
6	Uniforms	2,500
7	Internet	5,000
8	Printing & stationery	5,000
9	Safety equiments	5,000
10	Miscellaneous	15,000
11	Adhoc hiring of vehicles	20,000
	Total	1,21,225

IEC Expenses		One-time cost
1	Wastepicker mobilization	20,000
2	SHG formation	20,000
3	One-time rolling fund for procurement	3,50,000
4	Formation of RWA	20,000
5	Meetings, trainings & workshops	3,000
6	Provision of safety gears to wastpickers	-
7	Awareness campaigns & rallies	-
8	Insurance for plant & machinery	20,000
9	Documentation of best practices	25,000
	Total	4,58,000
10	Miscellaneous	15,000
11	Adhoc hiring of vehicles	20,000
	Total	1,21,225


PAYAL


ReCircle
Recover Recycle Rethink

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