Building Sustainable Municipal Waste Management System through Private Participation : Insights from United Kingdom, Spain, Germany and China

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ADVOCACY • POLICY • CAPACITY BUILDING • CONFLICT MANAGEMENT

EXECUTIVE SUMMARY

Solid waste management (SWM) is a pertinent issue around the world that is rapidly exacerbating owing to a rise in population, production, and consumption. Significant strides have been made in India to address this issue, with the Government incorporating innovative technology and systems to bolster the capabilities of solid waste management right down to the grassroots level with initiatives like the Swachh Bharat Mission and the Waste to Wealth Mission. However, the rapid urbanization of the country necessitates the creation and implementation of better, more effective and efficient solutions to address the issue of municipal solid waste (MSW). A proper framework to include private sector participants offers a viable solution to this issue. While India does allow for private sector participants to partake in the waste management system, it is only in the capacity of an agent of the local authority. Provisions allowing and incentivising them to innovate and make greater contributions to waste management can bring about better, diverse, and more efficient services to the sector.

The report includes a comparative study of waste management systems, regulations, and practices in India, Germany, Spain, the UK, and China. Apart from their regulatory and policy frameworks, the report evaluates the approaches of the jurisdictions towards private sector participants in waste management, the environmental impact of waste, different stakeholders of the solid waste management system in the country, the role of local authorities in waste management, etc. The evaluation of the report is limited to the aforementioned jurisdictions only.

The report also proposes the inclusion of the informal sector to holistically address the socio-economic and environmental challenges within the SWM system in India. It also evaluates the impact that gender roles and perceptions have on waste management systems and recommends greater participation of women in decision-making roles.

The aims and objectives of this report are:

- To evaluate the solid waste management system in India with a comparative lens, against the regulatory frameworks and practices of Germany, Spain, the UK, and China.
- To analyse the case studies of successful government initiatives and private ventures working in the waste management sector.
- To evaluate how greater private sector participation can improve existing waste management practices.

Some of the recommendations proposed and detailed in this report are as follows:

- Implementing Landfill and Incineration Tax: It is suggested that taxes be imposed in cases where waste is disposed through landfill and incineration (particularly of unsegregated waste) to discourage these practices, and incentivise recycling, waste reduction, and other sustainable waste disposal/treatment methods. Exemptions may be carved out for incineration for energy recovery processes. Different brackets may be applied to different waste disposal practices.
- Developing an open competition policy to promote private sector participation: It is recommended that municipal waste management authorities allow public and private sector participants to partake in open, competitive, and independently evaluated tender processes to determine who

would provide the best services. An open system would promote transparency and accountability. It would also encourage innovation and private sector participation.

- Creating and maintaining a National Register of all Authorised Waste Operators in India: It is suggested that a National Register of all Authorised Waste Operators in India should be developed to serve as a centralized database for all entities involved in waste management. A central repository would allow access to all entities, and pertinent information regarding their services, capabilities, stakeholders, expertise, and track record. This would also facilitate better development and application of regulations.
- Monitoring System for Waste Management with Standardized Reporting: It is recommended that the central government may establish a monitoring system with standardized reporting on data pertaining to waste generation, collection, treatment and disposal. This would allow for effective, efficient, and targeted evaluation, and in developing data-driven policies and regulations.
- Establishing a Central Coordination Committee for Waste Management: It is recommended that a Central Coordination Committee for Waste Management be established for monitoring and regulating waste management activities. The Committee can be entrusted with setting up specialized working groups to implement laws, consolidate data, ensure transparency, work with local authorities, and maintain repositories of participants in the waste management sector. It can make relevant information available to the public to allow them easy access to the information about the waste management system in their locality.
- Developing independent notified bodies for supervision of waste management companies: it is suggested that a notified body may be developed to supervise waste management companies. A uniform fee may be charged across states from each waste management institution for certification of a specific waste management activity. The findings and reports by this body may be made public for greater transparency and accountability.
- Designing support mechanisms for waste management companies: It is suggested that a support mechanism be designed for the purpose of repair and renewal of waste infrastructural facilities. For instance, initiatives such as co-payment of premiums for waste infrastructure insurance can have premium contributions from the government.
- Implement Waste Tracking Systems: It is suggested that waste be tracked through electronic systems and vehicle locations across the waste management value chain to manage waste. Private companies that provide innovative solutions to this end may be incentivised.
- Amending existing laws to develop a regulated environment for waste management: Presently, the legal framework applicable to MSW management only permits companies to partake in the waste management process as agencies of local authorities. However, amendments allowing them to make significant contributions to the sector can revamp MSW management. It is recommended that a comprehensive framework, including licensing, authorization, and permitted functions for waste management companies be developed.
- Supporting and integrating the informal sector participants working in the waste management sector: It is recommended that the informal sector which already has a significant presence in the

waste management system, be actively integrated in the waste management supply chain by providing them with legal recognition, and identification, registration, and disbursement of social benefits to them. Municipalities may contribute to this by issuing identity cards, and facilitating the formation of co-operatives or small and medium-sized enterprises (SMEs) for the workers. It is also suggested that the government should create a dedicated digital platform to map informal waste workers, aiding them in connecting with potential opportunities from private entities and households. It is also proposed that urban planning initiatives at local, regional, and central levels should introduce an additional scoring criterion in government outsourcing processes for waste infrastructure construction or management services.

- Promoting the participation of women in the waste management sector: It is recommended that measures be taken to provide social and financial security to women in waste management and encourage greater participation by women in decision-making roles in this sector. This can be achieved through— (1) offering capacity building and training programs to women; (2) incorporation of a minimum percentage of female participation in state waste management plans to promote gender inclusive decision-making; (3) developing a professional network of women in waste management to allow them to share experiences, exchange best practices, and access resources; (4) allowing partial formalisation by recognising and supporting women in waste management by properly documenting them and their contributions, and providing them with access to social security benefits, and training and skill development opportunities; and (5) promoting gender-inclusive procurement policies by preferential procurement for women, reserved quotas, or financial incentives.

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LIST OF ABBREVIATIONS

CBO	Community-Based Organization
CCT	Compulsory Competitive Tendering
CLA	Contract Labour (Regulation and Abolition) Act
CPCB	Central Pollution Control Board
DBOFT	Design, Build, Own, Operate, and Transfer
DFID	Department for International Development
DIMITS	Delhi Integrated Multi-Model Transit System
DSD	Duales System Deutschland
EP Act	Environmental Protection Act
EPF	Employee Provident Fund
EPR	Extended Producer Responsibility
ESIC	Employees State Insurance Corporation
FCC	Fomento de Construcciones y Contratas
FES	Frankfurter Entsorgungsund Service GmbH
Gobardhan	Galvanizing Organic Bio-Agro Resources Dhan
IoT	Internet of Things
ITC	Indian Tobacco Company
IWP	Innovation in Waste Prevention
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KrWG	Kreislaufwirtschaftsgesetz
LCA	Life Cycle Assessment
MEE	Ministry of Ecology and Environment
MOC	Ministry of Commerce
MoEFCC	Municipal Solid Wastes (Management and Handling) Rules
MoHUA	Ministry of Housing and Urban Affairs
MOHURD	Ministry of Housing and Urban-Rural Development
MSW	Municipal Solid Waste
MSWM Rules	Municipal Solid Wastes (Management and Handling) Rules
NCEUS	National Commission for Enterprises in the Unorganised Sector
NDRC	National Development and Reform Commission
NGO	Non-Government Organisation
OEP	Office of Environment Protection
PCC	Pollution Control Committee
PCR	Public Contract Regulations
PFI	Private Finance Initiative
PM-SYM	Pradhan Mantri Shram Yogi Maan-dhan
PoS	Point of sale
PPP	Public-Private Partnership
PSP	Private Sector Partnership
PRO	Producer Responsibility Organisation
RZO	Recycling Center at Oberhausen GmbH
SBM	Swachh Bharat Mission

SDG	Sustainable Development Goals
SEWA	Self-Employed Women's Association
SHG	Self-Help Group
SLRM	Solid and Liquid Resource Management
SPCB	State Pollution Control Board
Strategy 2030	Spanish Circular Economy Strategy 2030
SWaCH	Solid Waste Collection and Handling
SWM Rules	Solid Waste Management Rules
TPD	Tonnes per day
TSO	Technical Supervisory Organisation
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
ULBs	Urban Local Bodies
UMB	Urban Management Bureau
UWSSA	Unorganised Workers' Social Security Act
VAT	Value Added Tax
WCC	Waste Coordination Committee
WIDP	Waste Infrastructure Delivery Programme
WIEGO	Women in Informal Employment: Globalising and Organising

ABOUT BRIDGE POLICY THINK TANK

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SOLID WASTE MANAGEMENT IN INDIA

1 Overview of the Waste Management Sector

India faces significant challenges in managing its waste due to rapid urbanization, population growth, and changing consumption patterns. The country generates a substantial amount of waste, including municipal solid waste ("**MSW**"), biomedical waste, electronic waste, and hazardous waste. Based on the data provided in the Swachh Bharat Mission Urban portal developed by the Ministry of Housing and Urban Affairs, the total amount of solid waste generated in India amounts to around 56.7 million tonnes which is approximately 155,537.10 tonnes per day ("**TPD**"). Out of this total, around 68.3% of the total waste, i.e., 115,171.81 TPD, is processed.

Data available on waste indicates that there has been considerable improvement in the solid waste management system in India. However, the existence of 2,449 illegal legacy dumpsites with over 1000 tonnes of waste all over the country illustrates the issues pertaining to the management of solid waste and highlights the need for improved waste treatment measures and efforts to reduce unaccounted waste and dependency on landfills.

Recognizing the importance of addressing the various issues, India has implemented new and updated regulations and initiatives since 2014, such as the Swachh Bharat Mission and Waste to Wealth Mission, with a focus on improving the solid waste management system nationwide. Moreover, to effectively manage different types of waste, separate waste management rules have been established. These rules cover various categories, including e-waste, plastic waste, biomedical waste, hazardous waste, and solid waste. In 2016, the Solid Waste Management Rules 2016 were implemented replacing the previous Municipal Solid Waste (Management and Handling) Rules 2000 ("**MSWM Rules**"), and expanding the applicability of waste management beyond municipal areas. The new rules encompass urban agglomerations, census towns, notified industrial townships, areas under the control of Indian railways, airports, special economic zones, places of pilgrimage, religious and historical importance, and state and central government organizations. Furthermore, it addresses all waste, except industrial waste, bio-medical waste, e-waste, battery waste, and radioactive waste generated in the area. Additionally, the waste management regulations stipulate that each state must adhere to a waste hierarchy, with waste prevention being the most favoured approach and landfilling being the least favoured indicating the government's commitment to reducing the reliance on landfills and actively promoting waste minimization efforts.

The Indian government, along with various stakeholders, have been working to encourage sustainable waste management practices by promoting 100% door-to-door collection and source segregation in wards. Efforts are being made at various levels, including government initiatives, public participation, and technological advancements, to tackle the challenges of waste management. Through these collective efforts, India strives to improve waste management practices, mitigate environmental and health risks, and create a cleaner and more sustainable environment.

2 Regulatory Framework for Solid Waste Management in India

The regulatory framework for solid waste management in India has evolved significantly to address the growing concerns around waste generation and disposal. The Environmental Protection Act of 1986 ("**EP Act**") was the first significant legislation enacted by the Indian government to address pollution. Although the EP Act does not explicitly cover waste management, it empowers the government to implement rules in this regard. The need for specific regulations on SWM became evident only when a writ petition was filed before the Supreme Court requesting the government to take necessary action under the EP Act against increasing solid waste. The petition highlighted the status of MSW and the need to revamp the role of municipalities in waste disposal in urban areas. In response, the Supreme Court established a committee to examine the concerns around solid waste management and make recommendations for regulatory implementation. Based on the committee's report, the central government introduced the first-ever regulation regarding municipal solid waste—Municipal Solid Wastes (Management and Handling) Rules, 2000 or **MSWM Rules**.

However, with the subsequent increase in waste generation, there was a need to revise and strengthen the rules and hence, in 2016, the Ministry of Environment, Forest, and Climate Change ("**MoEFCC"**) introduced the Solid Waste Management Rules, 2016 ("**SWM Rules**"), superseding the MSWM Rules. In addition to expanding territorial application, the SWM Rules introduced the concept of waste generators' duty and responsibility in the new rules.

Unlike the earlier law, Rule 3(46) of the SWM Rules defines solid waste instead of municipal waste. The definition of solid waste under SWM Rules is broader and encompasses a wide range of solid and semi-solid waste materials generated in various sectors, including residential, commercial, and institutional sources while the definition of municipal waste specifically outlines municipal waste as the waste generated within municipal or notified areas, excluding industrial hazardous waste. The SWM Rules 2016 also outline the process of authorization that urban local bodies or facility operators must obtain from the State Pollution Control Board ("**SPCB"**) or Pollution Control Committee ("**PCC**") for waste management activities in their respective areas. SPCB is responsible for examining and authorizing waste processing and disposal facilities, including landfill sites. They are also empowered to monitor compliance with the rules and the specified standards stipulated under Schedules I and II of the SWM Rules 2016. Although specific regulations highlighting extended producer responsibility and plastic waste management obligations on manufacturers, producers, and facility owners exist in the form of Plastic Waste Management Rules, 2016, the provisions under SWM Rules are also applicable to plastic waste generated in the country as per Schedule II, Plastic Waste Management (Amendment) Rules, 2022.

2.1 REGULATORY AUTHORITY

India has established a decentralized system for waste management, with responsibilities assigned to the government at various levels. The Constitution of India has designated waste and sanitation duties as part of the State subject, making it the responsibility of state governments to ensure the implementation of appropriate waste management practices. However, the Parliament holds the

authority to enact laws aligned with international agreements related to environmental matters. As a result, the Central Government's role in India is to develop policies, provide guidelines, and offer technical assistance in waste management. At the central level, MoEFCC serves as the nodal agency responsible for implementing India's environmental policies and programs. The MoEFCC assists state governments and local bodies in the development and execution of solid waste management projects. Additionally, the Ministry of Housing and Urban Affairs ("**MoHUA**") plays a significant role in SWM. MoHUA formulates policies, provides guidelines, and extends financial support to urban local bodies and municipal corporations for waste management projects through various schemes and programs.

The SWM Rules also outline specific duties under Rules 7, 8, and 9, to be carried out by various Ministries of the central government to contribute to the improvement of the waste management system. The Ministries of Power, New and Renewable Energy, and Agriculture, along with other relevant departments, collaborate to promote renewable energy, waste-to-energy technologies, organic waste management, and sustainable practices in various sectors for improved waste management. Each of these Ministries has a role to play in enhancing waste management practices in their respective domains. Furthermore, along with government bodies, statutory organizations have been established such as the CPCB for enforcing the duties and responsibilities outlined under Rules 14 and 16 of the SWM Rules 2016.

At the state level, the urban development departments of respective state governments are entrusted with enforcing and implementing the provisions of the waste management rules. Regional nodal agencies, such as the SPCB and PCC for states and union territories also coordinate with the CPCB and oversee the implementation of the SWM Rules 2016 in their respective areas.

Nevertheless, by virtue of the 74th Amendment to the Constitution, solid waste management is a decentralized responsibility devolved among local authorities within each jurisdiction. The local authorities directly handle the collection, transportation, treatment, and disposal of solid waste generated within their jurisdictions. Local authorities and village panchayats have several duties and responsibilities regarding SWM which includes preparing a waste management plan, ensuring door-to-door collection of segregated waste, integrating waste pickers and Self-Help Groups, framing bye-laws, collecting user fees, promoting waste segregation, establishing material recovery facilities, and setting up waste deposition centres. They are also responsible for the safe storage and transportation of hazardous waste, promoting composting and decentralized processing, and creating public awareness. To monitor waste management practices, the SPCB and PPC collect reports regarding solid waste management activities from the respective local authorities and submit them to the CPCB. The CPCB is responsible for reporting to the MoEFCC on the overall waste management status in the country.

3 Private Sector Participation in SWM

In the context of solid waste management, the municipal authorities hold overall responsibility. However, they encounter challenges related to infrastructure, technology, budget constraints, lack of strategic planning, and inefficiencies in service delivery. Recognizing these challenges, there has been

a growing emphasis on encouraging private sector participation to support municipal authorities in fulfilling their responsibilities. Private sector participation may offer a cost-effective and efficient approach to solid waste management, presenting a viable alternative. It can introduce advanced technologies and innovative solutions, which can improve waste management practices. Moreover, private sector participation brings about economic prospects, job creation, and potential investments in the SWM sector. It also fosters healthy competition, thereby improving the quality of services and ensuring greater accountability among service providers. The collaboration between municipal authorities and the private sector in waste management can contribute to a cleaner environment, improved public health, and sustainable development. Therefore, this study has been conducted to assess the current landscape of private sector participation in MSW management and provide recommendations for enhancing their participation based on case studies from other countries.

3.1 LEGAL ENVIRONMENT FOR PRIVATE SECTOR PARTICIPATION

A robust legal framework is crucial for facilitating private sector engagement and enabling effective waste management practices. In India, the primary law addressing solid waste management is the SWM Rules. However, it is important to note that while the central government promotes private sector engagement in waste management services through its initiatives and programs. the SWM rules do not explicitly outline provisions for private sector participation. Instead, the responsibility for engaging the private sector in solid waste management is delegated to local authorities, without a clear list of the specific activities that the private sector can undertake within waste management operations. Highlighting the different MSW Management related activities where private sector participation is encouraged would be beneficial. Despite the acknowledged significance of transparent contracting models for private sector engagement,[1] the primary law for waste management does not adequately incorporate provisions promoting private involvement.

Furthermore, local government bodies are also restricted by the Contract Labour (Regulation and Abolition) Act 1970 ("**CLA 1970**"). State governments have the authority to prohibit the contracting of certain services, including solid waste management services if it is deemed to have a negative impact on labour. While local governments have the option to seek exemption from this law, it acts as an obstacle within the waste management framework, impeding private sector participation. Notably, the Plastic Waste Management Rules 2016 emphasize private sector's responsibility in managing plastic waste. The rules introduce Extended Producer Responsibility ("**EPR**"), which mandates producers and generators to establish a collect-back system for plastic waste management. Further, entities involved in providing waste management services for plastic waste, including recycling and waste processing, must register with the relevant SPCB or PCC as per the prescribed application process.

EXISTING PRIVATE SECTOR PARTICIPATION IN SWM

Private sector participation in solid waste management in India has been on the rise since the 1990s, with Chennai being one of the early adopters by entering into a Public Private Partnership ("**PPP**") contract for collection and transportation of waste. Similar instances of the private sector providing

truck and transport services to municipalities in parts of Gujarat and Hyderabad have been documented as early as 1995. The private sector has played a crucial role in various aspects of SWM, including waste collection, transportation, processing, and disposal. PPP contracts have been awarded in cities like Bangalore, Ahmedabad, Surat, Hyderabad, Mumbai etc for various services such as door-to-door collection, street sweeping, treatment and disposal. To promote PPP model in solid waste management, MoHUA has prepared a toolkit for PPP in SWM. It serves as a guide for ULBs and private entities to PPP arrangements for SWM. Private companies providing SWM services have also been empanelled under MoHUA. Some examples of different waste management services provided by the private sector in recent years are discussed in the table below:

- *The **Government of Kerala** has appointed a private company as Technical Support Consultant to assist 4 districts and 28 Urban Local Bodies in the preparation and implementation of a comprehensive five-year city-wide SWM plan since 2022.*
- *The **Municipal Corporation of Indore** and a private company have joined forces to operate a dry waste plant. The plant generates an annual revenue of ~INR 4 crores by utilizing waste. The private company's investment of INR 30 crores in an artificial intelligence-based plant capable of processing 300 tons of dry waste has significantly contributed to the city's cleanliness. Notably, the city efficiently disposes of nearly 1,200 tons of waste on a daily basis.*
- *The **Kochi Municipal Corporation** initiated the Kochi Waste to Energy Project through an international competitive tender for the treatment and disposal of unsegregated Municipal Solid Waste (MSW) at Brahmapuram. The project operates on a PPP basis, with a private company responsible for designing, building, financing, operating, and transferring ("**DBOFT**") the facility over a period of 20 years. The entire capital expenditure of INR 375 crore for the project is being invested by the company, with no investment from the government.*
- *The **Coimbatore City Municipal Corporation** has entered into a Design, Build, Own, Operate, and Transfer ("**DBOOT**") contract with a private company. The contract spans a period of 20 years, starting from 2007-08, and aims to manage municipal waste and undertake waste processing activities within the municipal area of Coimbatore.*
- *Another prominent private player in the waste management services sector, has been contracted by the **Greater Chennai Corporation** for a duration of seven years, starting from 2021. The purpose of the partnership is to develop and deploy an Internet of Things (IoT) enabled solid waste collection program in four zones of Chennai: Tiruvottiyur, Manali, Madhavaram, and Ambattur. This initiative aims to ensure 100 percent segregation of waste at the source in all households within the designated area. The company has signed similar contracts with municipal corporations of Nagpur and Hyderabad.*
- *The **Municipal Corporation of Delhi** also utilizes the PPP model and follows a tender process to engage private companies for various waste management activities such as waste collection and transportation. These activities are carried out under the DBFOT model.*

The information presented in the table is a non-exhaustive list that highlights some examples of private sector involvement in waste management services. Nevertheless, it is clear that the involvement of private sector in waste management has brought several positives, including improved efficiency, innovation in waste processing techniques, and economic opportunities for both private companies

and local communities. However, there is no comprehensive registry or collective list available that outlines which waste management companies are working for specific municipalities at any given time.

The current state of information regarding SWM services in India is fragmented, involving various stakeholders such as NGOs, independent companies, and authorized private treatment facilities. It poses a challenge in obtaining a centralized overview of private sector participation in SWM. Despite the implementation of high door-to-door collection rates, a significant amount of waste remains unaccounted for, neither processed nor sent to sanitary landfills.

The private sector has the potential to address these gaps and contribute to improved waste management practices. Engaging the private sector in waste treatment requires the establishment of a clear and effective regulatory framework which can ensure accountability, enhance efficiency, and promote sustainable waste management practices. By leveraging the expertise and resources of the private sector, along with appropriate regulations and monitoring mechanisms, the gap between waste generation and effective waste treatment can be bridged, in a profitable way, promoting efficient and sustainable waste management practices in India.

4 Government Initiatives and Policies

The Government of India ("**GOI**") has recognized the need for a well-functioning waste management sector and acknowledges the limitations of urban local bodies ("**ULBs**") in efficiently delivering waste management services. Consequently, several initiatives have been undertaken to encourage private sector participation in waste management.

One of the early initiatives was the allocation of funds for PPPs in the waste management sector. In the 12th Financial Commission Report, the government allocated INR 5,000 crores to ULBs, with at least 50% of the grants suggested for use by ULBs in implementing PPPs in SWM programs between 2005 to 2010. Additionally, the Jawaharlal Nehru National Urban Renewal Mission ("**JNNURM**"), launched in 2005, encouraged PPP arrangements to improve waste collection, transportation, and disposal. It provided opportunities for expanding PPPs in SWM, with projects focusing on door-to-door collection, sanitary landfilling, and composting facilities. It aimed to attract significant private sector investments through PPP enabling risk-sharing between the private and public sectors.

In 2012, the government launched the Urban Infrastructure Development Scheme for Small and Medium Towns ("**UIDSSMT**") to enhance ULBs capacity building. The UIDSSMT scheme also included the provision of enhancing infrastructure facilities, including SWM projects through PPP. The government has issued various guidelines for projects/schemes under JNNURM and UIDSSMT, mandating reforms and promoting PPPs.

The government has also released guidelines for the utilization of 12th Finance Commission grant for MSW, emphasizing the methods that may be adopted for the processing and disposal of MSW. It highlights the importance of recycling to recover valuable resources and advocated for waste to be sent to scientifically engineered landfills, containing only residual waste that cannot be utilized through other processing methods. The government also encouraged ULBs to adopt PPPs in waste management for sustainable environmental outcomes. Furthermore, the Swachh Bharat Mission

("**SBM**") launched in 2014 aimed to be the country's largest pro-sanitation scheme, covering hygiene, sanitation, and waste management. SBM's waste management strategies include home composting and centralized composting for wet waste, bio-methanation for food waste, material recovery facilities and waste-to-energy plants for dry waste, specialized disposal for sanitary napkins/diapers, and separate sanitary landfills with fees based on waste quantity/quality. SBM emphasized the need for convergence and collaboration between various stakeholders, including the government, local bodies, private sector entities, and community organizations.

In 2021, SBM was updated as Swachh Bharat Mission 2.0 ("**SBM 2.0**"), with a focus on achieving garbage-free cities, waste segregation at the source, door-to-door collection, and safe and scientific waste processing. The implementation cost of SBM-U 2.0 is estimated at INR 1,41,600 crores, with GOI contributing INR 36,465 crores. The remaining cost shall be shared by beneficiaries, states, union territories, ULBs, and the private sector. In addition, the government has announced the Swachhata Start-Up challenge as part of the SBM 2.0 to provide a boost to innovative start-ups and encourage them to showcase their innovative solutions and technologies related to waste management and sanitation. Financial assistance of INR 25 lakhs along with professional assistance for a period of 1 year has been promised to 10 startups selected under the challenge.

The government has also launched the Waste-to-Wealth mission, to foster collaboration between public and private sector participants to develop technologies that convert waste into valuable resources. Guidelines for establishing waste-to-energy plants were released in 2014, with the waste-to-energy and waste management sector expected to become a USD 14 billion opportunity by 2025 and potentially generating up to 3 GW of electricity from waste by 2050. The Electricity Tariff Policy of 2006 also contains provisions mandating the purchase of power generated from MSW at a determined rate by state electricity distribution companies.

Further, to support waste-to-energy ("**WTE**") projects, the central government has allocated USD 73 million for the financial years 2021-22 to 2025-26. It covers biogas, power, and bio-CNG projects utilizing waste from urban, industrial, and agricultural areas. Also, the Galvanizing Organic Bio-Agro Resources Dhan ("**Gobardhan**") initiative was implemented in 2018 under the Waste-to-Wealth Mission by the Ministry of Drinking Water & Sanitation in rural India for solid and liquid waste management to convert biowaste into compost or energy. It provides central financial assistance to public and private developers involved in setting up WTE projects.

The different policies and initiatives the government has rolled out to promote private participation in the waste management space are enumerated in the table below:

Policy	Year	Description
National Urban Sanitation Policy (NUSP)	2008	Promoting PPP for urban sanitation purposes was one of the mechanisms envisaged for the achievement of urban sanitation goals by the government under this policy
Jawaharlal Nehru National Urban	2005-12	Under JNNURM, ULBs were advised to encourage PPP in their SWM projects, along with encouraging involvement from NGOs and

Renewal Mission (JNNURM)		Community based Organisations in SWM. UIDSSMT was also implemented under JNNURM.
Swachh Bharat Abhiyan ("**SBA**")	2014	One of the key components of the mission was capacity augmentation for ULBs to create an enabling environment for private sector participation.
a) Municipal Solid Waste Management (MSWM) Manual	2016	Framed as part of SBM, it suggested technological solutions for SWM and for adopting an integrated SWM hierarchy. Notably, the manual provide framework for contracting models & private sector responsibilities and implementation of PPP projects in SWM.
Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and AMRUT Mission 2.0	2015 and 2021	AMRUT Mission was initially launched in 2015 for development of basic infrastructure such as water supply, sewage, drainage and green spaces. The mission was later subsumed by AMRUT 2.0, which mandated PPP in cities with more than 10 Lakh people, to at least allocate 10% of its funds to PPP projects.
The National Action Plan for MSWM	2016	The plan suggested that State governments should facilitate local bodies to create an arrangement wherein waste processing and disposal services can be operated with private sector participation.
Swachh Bharat Mission – Urban 2.0	2021	Swachh Bharat Mission (Urban) – 2.0 was launched in 2021, and it focuses on meaningful partnerships across all sectors with the primary goal of improving the state of sanitation in the country. It recommends the state governments to develop policies encouraging and supporting PSPs.
a) National Behaviour Change Communication Framework under SBM 2.0	2021	The Framework is a guiding document which provides for model strategies that include integration of businesses and commercial institutions for effective implementation of the mission. It also encourages private sector to participate in advocacy of implementation of SBM 2.0.
b) Swachhata Startup Challenge Initiative	2022	It was launched by MoHUA in collaboration with French Development Agency with focus on areas of SWM, social inclusion and socially impactful innovations in the digital space. The initiative also focuses on supporting and encouraging investment in cutting-edge solutions from small scale and private entrepreneurs and start-ups.
Waste to Wealth Mission	2021	The main objective of the mission is to encourage collaboration between public and private sector participants to develop technologies that convert waste into valuable resources.
Waste to Energy Mission – Biogas Programme	2022	The programme was implemented under the umbrella scheme of National Bioenergy Programme, sanctioned by the MNRE. It included providing central financial assistance to developers including WTE project generating biogas, CNG, etc. Developers under the program include private sector companies, joint ventures, firms, etc.

The various initiatives demonstrate the government's commitment to improving waste management and promoting PPPs in the sector. Presently, there are significant number of waste management companies working in India and providing infrastructure and technology to enhance waste

management. However, there is need for better regulatory framework and strategies to integrate private sector and develop a sustainable market for waste management in India to ensure effective waste management, mitigate environmental and health risks, and create a cleaner and more sustainable environment.

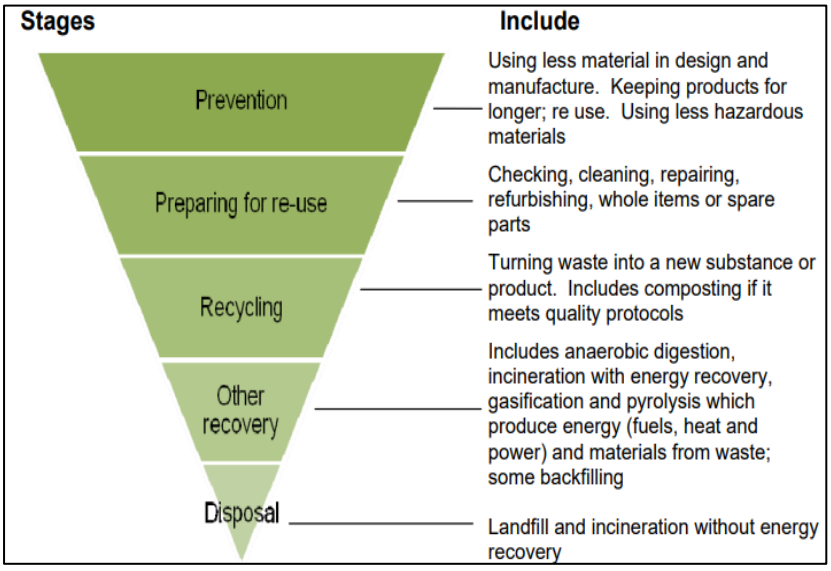
COUNTRY PROFILE: UNITED KINGDOM

1 Overview of the Ecosystem

The United Kingdom ("**UK**") is a country comprising England, Scotland, Wales, and Northern Ireland. The country has a well-developed waste management system focused on promoting sustainability and resource efficiency. The waste management ecosystem in the UK is guided by national legislation and regulations applicable across the different countries within the UK. The legal framework for MSW management in the UK is complex and multi-layered, with different levels of legislation and regulation at the national, regional, and local levels. At the national level, the key legislation governing waste regulation and environmental protection is the Environment Protection Act of 1990 ("**EPA 1990**"), which extends to every constituent nation within the UK. It was recently amended through Environment Act, 2021.

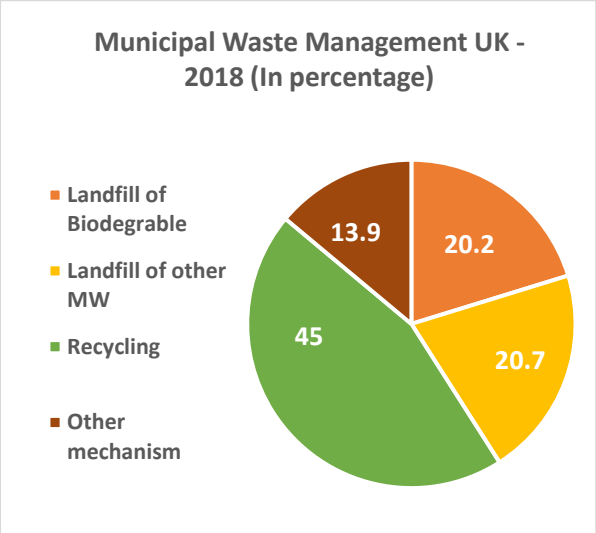
In addition, the Waste and Emissions Trading Act 2003 sets landfill targets for each constituent nation, strategies for reducing landfilling of biodegradable waste, and grants the UK government powers to regulate waste trade and greenhouse gas emissions. Furthermore, even though UK exited from the EU, the regulations followed within the country on waste applies EU Directives in the form of copy out (where the implementing legislation adopts the same wording as that of the Directive) within the national legislations and regulations.

Waste management is a devolved responsibility in the UK, with each nation in the UK having different waste strategies and objectives. Government agencies in different constituent parts of UK monitor and regulate waste management activities to ensure comprehensive waste management practices are followed. The waste management structure in the UK follows the waste hierarchy provisions under the EU Directives, starting with waste prevention, followed by reuse, recycling, energy generation through repurposing, and finally disposal.



Life Cycle Assessment ("LCA") is a crucial tool for waste management in the UK, quantifying the environmental impacts associated with specific products, supply chains, and waste management options. It helps to determine the most suitable method for handling waste products. For example, compositing, anaerobic digestion and incineration with energy recovery are

deemed suitable options for the recovery of food waste. Notably, the UK law allows for deviation from the waste hierarchy in cases where it is justified by life-cycle thinking, indicating that waste recovery depends on the environmental impacts of waste and its management.



In 2018, the UK generated approximately 222.2 million tons of waste, with around 84% of waste coming from England alone. The total municipal waste accounted for 35.6 million tons or 12% of the total waste generated in the country. Of the total municipal waste, approximately 41.12% was sent to landfills, 45% was recycled and 13.9% was treated with other recovery/disposal mechanisms. Data indicates that the UK has made significant progress in reducing landfilling of municipal waste, achieving a 41.5% reduction from 25,019 thousand tons in 2010 to 14,644 thousand tons in 2018. The UK also focuses on separately collecting biodegradable waste and aims to further reduce landfilling of municipal waste. It has achieved landfill reduction from 12,982 thousand tons in 2010 to 7201 thousand tons in 2018.

Within the UK, England has introduced a waste management plan which is focused on the elimination of all kinds of avoidable waste by 2050. The plan sets a target for the reduction of landfill of municipal waste in the country and increase the recycling percentage of municipal waste to 65% by 2030. By and large, the UK's waste management ecosystem is characterized by comprehensive regulations, a commitment to circular economy principles, devolved responsibility, and efforts to maximize resource efficiency and reduce environmental impact.

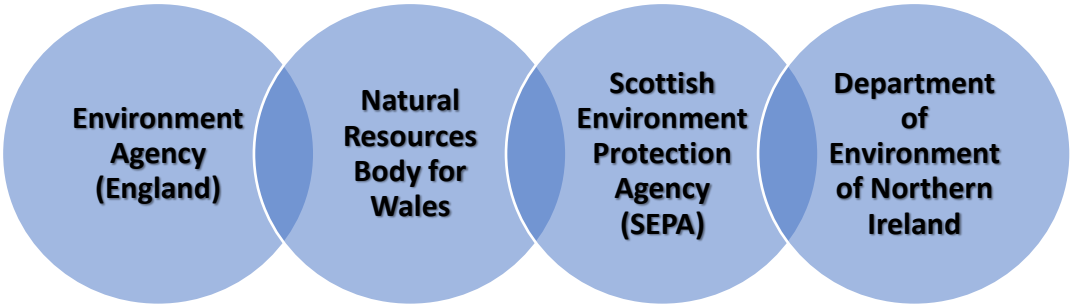
2 What is Waste?

In the UK, waste is classified as any material or object that is discarded or held by an individual or organization with the intention or obligation to dispose of it. The definition of waste is derived from EU Waste Framework Directive. The waste regulations defined under the EPA 1990 are applicable on controlled waste. Controlled waste includes all domestic, industrial, and commercial wastes or any such similar waste. The classification of controlled waste is based on premises/places from where the waste originated. Furthermore, the regulations on controlled waste are also applicable on municipal waste as municipal waste consists of household waste and any other waste that is similar to waste from households due to its nature and composition. The law defines household waste as waste from residential and domestic properties, premises forming part of schools, universities, nursing homes, garden waste, litter, etc.

3 Key Stakeholders

The key stakeholders involved in waste management include government authorities of the UK, authorities of each jurisdiction, private entities, and the public. Every stakeholder plays a vital role in maintaining effective waste management practices and is required to make sure that they are performing their part of the role in waste management. The EPA 1990 provides the overarching framework for waste management in the UK, and imposes responsibility of developing national plans and strategies on the government of each jurisdiction. It also introduces the concept of Duty of Care, which entrusts the waste producers with the duty to ensure proper disposal of their waste. Under this concept, all waste producers are legally obligated to take necessary measures to prevent the escape or unauthorized handling of their waste.

Further, each jurisdiction in UK has its own regulatory body responsible for framing and enforcing environmental laws and regulations, monitoring waste management activities, issuing permits for waste management facilities, and ensuring compliance with environmental standards. Therefore, the specific stakeholder and their roles vary. Following is the national regulatory body of each constituent nation in the UK:



The Environment Act 2021 has also established the Office of Environment Protection ("**OEP"**) as the environmental watchdog tasked with holding the national government and other public bodies accountable. It monitors the progress of environmental improvement plans and targets and supervises the enforcement of environmental laws by public authorities. Local authorities also play an important role in the implementation of waste management regulations. Local authorities, including city councils, county councils, and borough councils, are responsible for waste management at the local level. They develop waste management strategies as per national laws and policies, collect waste, and oversee recycling and disposal services.

In addition to the government, private waste management companies, both large and small, are also involved in waste collection, transportation, treatment, and recycling. These companies operate under contracts with local authorities or provide commercial waste management services. However, every

business offering waste management services in UK has to mandatorily register with the respective waste regulating authority.

Furthermore, every person involved in the waste management system, whether a natural person who produces or generates waste or any other legal person who carries out the waste management activities, is subject to regulation by the government. The EPA 1990 imposes the duty of care principle on everyone handling controlled waste to ensure waste is handled correctly. The roles defined under the law for various activities undertaken under the waste management framework are as follows:

Producer	Any person whose activities produce waste.
Carrier	Any person, who normally and regularly collects, carries or transports waste.
Broker	Any person who arranges recovery or disposal of waste on behalf of others.
Dealer	Any person that buys waste to sell it further.
Manager	Any person who collects, transports, recovers or dispose waste, and also includes person supervising waste activities, the after-care of disposal sites and actions taken as a dealer or broker.

It is pertinent to note that duty of care starts from the initial stage of waste production. The producer is required to transfer its waste to only registered waste carriers. Carriers may be appointed by the waste broker or dealer who has an authorized license. They are required to deliver waste to the licensed material recovery facility, where the waste undergoes treatment or incinerated facilities for recovery of energy production or registered landfill sites. Furthermore, every country within the UK requires a person to obtain a license in case they are involved in the business of waste deposit, recycling or disposal. Further, while transferring waste, the producer of waste is required to ensure that a transfer note is issued with a written description of the waste which is agreed upon and signed by transferor and transferee. Waste Transfer Note is a legal document and a written record that documents the transfer of waste from one party to another. It provides essential information about waste being transferred, including its type, quantity, and origin and includes details about the parties involved in the transfer, such as the waste producer and the waste carrier or recipient.

The Environment Agency provides a downloadable format of the waste transfer note to properly document information mandated under Section 35 of the Waste (England and Wales) Regulations 2011. The format prepared is provided below for reference:

Duty of care: waste transfer note Keep this page and copy it for future use. Please write as clearly as possible.

Section A – Description of waste

A1 Description of the waste being transferred

List of Waste Regulations code(s)

A2 How is the waste contained?
Loose ☐ Sacks ☐ Skip ☐ Drum ☐
Other ☐

A3 How much waste? For example, number of sacks, weight

Section B – Current holder of the waste – Transferor

By signing in Section D below I confirm that I have fulfilled my duty to apply the waste hierarchy as required by Regulation 12 of the Waste (England and Wales) Regulations 2011 Yes ☐

B1 Full name

Company name and address

Postcode SIC code (2007)

B2 Name of your unitary authority or council

B3 Are you:
The producer of the waste? ☐
The importer of the waste? ☐
The local authority? ☐
The holder of an environmental permit? ☐
Permit number
Issued by
Registered waste exemption? ☐
Details, including registration number
A registered waste carrier, broker or dealer? ☐
Registration number
Details (are you a carrier, broker or dealer?)

Section C – Person collecting the waste – Transferee

C1 Full name

Company name and address

Postcode

C2 Are you:
The local authority? ☐

C3 Are you:
The holder of an environmental permit? ☐
Permit number
Issued by
Registered waste exemption? ☐
Details, including registration number
A registered waste carrier, broker or dealer? ☐
Registration number
Details (are you a carrier, broker or dealer?)

Section D – The transfer

D1 Address of transfer or collection point

Postcode

Date of transfer (DD/MM/YYYY)

D2 Broker or dealer who arranged this transfer (if applicable)

Postcode

Registration number

Time(s)

Transferor's signature
Name
Representing

Transferee's signature
Name
Representing

WMC2A Version 3, August 2011 page 1 of 1

Source: Duty of care- Waste transfer note form, the Environment Agency

Furthermore, the duty of care is also imposed on every individual household or every occupier of the domestic property to ensure that their waste is transferred to a registered waste carrier, taken to a waste facility operated by a licensed individual, and handled appropriately. They also have to ensure that all waste management transaction records are retained. Hence, the UK has a waste management

system which involves the government authorities, private enterprises and practically every person dealing with waste whether in their individual capacity or professional capacity.

4 Models and Strategies for the Promotion of Private Sector Participation

In the UK, the legal framework plays a crucial role in facilitating the involvement of the private sector in waste management through various approaches. Following are certain measures and mechanisms implemented in the UK for promoting private sector involvement:

4.1 LEGAL STRUCTURING UNDER THE LOCAL GOVERNMENTS ACT

In 1988, the Local Government Act 1988 introduced compulsory competitive tendering ("**CCT**") for local government services, including waste management. It required local authorities to open up waste management contracts to competitive bidding from both public and private entities. The CCT was a policy aimed to introduce a broader privatization of services through competition among public organisations and the private market. It aimed to reduce the cost with improved waste management services. Furthermore, according to the law, the municipal authority could only participate in services if its own organisation participated and won the tender in an open competition The tender process was subject to national guidelines, which were imposed on everyone.[2] The implementation of CCT increased the participation of the private sector in waste management. The system of CCT was a turning point in the waste management framework of UK. It gave a fair chance to every entity whether public or private, to compete in the tendering process and participate in the waste management system as a business professional.

Later, the government implemented the Local Government Act 1999 ("**LGA 1999**") which introduced Best Value, replacing CCT. It emphasized efficiency and effectiveness in the delivery of local government services, including waste management. The new law required local authorities to continuously evaluate and improve the services they provide to ensure that they are obtaining the best value (in terms of cost as well as quality) for money. Additionally, when reviewing any services, the local government were under the duty of best value and was mandated to consider social value as an additional benefit to maximise by procuring services. The LGA 1999 also implemented audit and inspection provisions to assure operations of best value and introduced intervention power of the central government on authorities failing to meet the best value requirements. These laws had a significant impact on the promotion of private sector participation in waste sector.[3]

4.2 WASTE MANAGEMENT LICENSING AND PERMITS

In the UK, the regulatory authorities are empowered to issue licenses or registration for waste management in their respective countries. Waste management activities are regulated and hence,

every person involved in performing any of these activities is required under the law to obtain a license or registration. The regulation requires waste carriers to transfer waste from producers to treatment facilities whether for recovery or disposal of waste.

4.2.1. Registration for carrier, dealer and broker

Any business engaged in waste transportation, waste dealing (buying, selling, or disposing of waste), or waste brokering (arranging waste transactions on behalf of others) must obtain registration with the relevant regulatory authority. The process of waste management starts with collection, and different aspects of waste management from the stage of production till the stage of treatment/ disposal is undertaken by a carrier, dealer or broker. All of them have to specifically register to undertake the activity that falls within the ambit of their function. Furthermore, every registration has to be renewed every 3 years. Also, once a person is registered as a carrier, broker or dealer, their name shall be updated in the Register of Waste Carriers, Brokers and Dealers. Registers are maintained by every country in the UK. Besides, anyone who has registered in Wales and Scotland can also operate in England as well. It ensures transparency in terms of who all can undertake the waste management activity in a specific region.

4.2.2. License for waste treatment and disposal

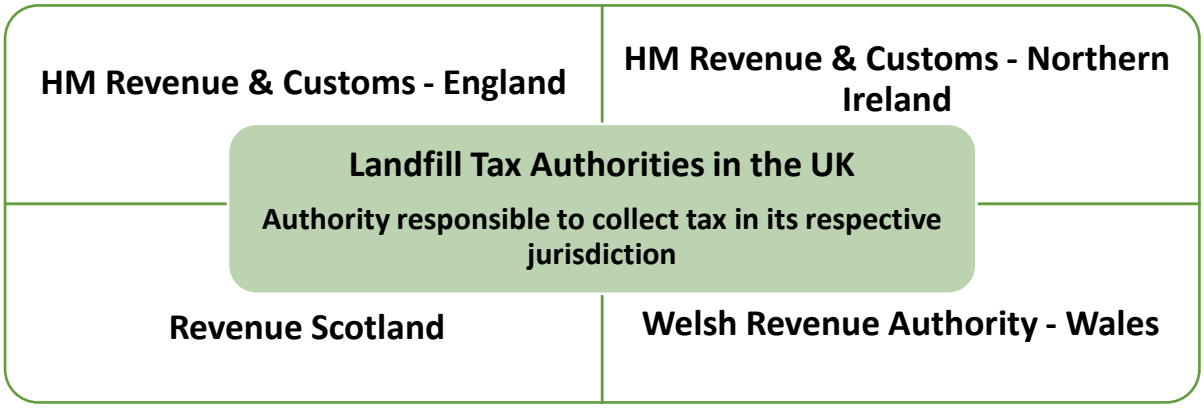
Similar to the registration system established for a carrier, broker or dealer, every business in the UK involved in either, treatment or disposal of waste is required by law to obtain the necessary license from their respective regulatory authorities. There are two categorisations of license under the law for carrying out these functions i.e., site license and mobile plant license. A site license authorizes businesses to undertake the treatment, possession, or disposal of controlled waste on a specific land site. On the other hand, a mobile plant license is intended for businesses that carry out waste treatment or disposal using a plant or equipment that is designed to be mobile and can be moved from one location to another. The license is given to the owner, lessee or occupier of the land, who uses the land for treatment, deposit or disposal or is granted to the operator of the mobile incinerator. The process for license differs in each constituent nation. Further, the system of registration for landfill, deposit and treatment sites also differs within the country.

By establishing licensing and registration systems at each level, the regulatory authorities have created a structured and controlled environment for waste management, which promotes private sector participation by providing clarity, accountability, and a level playing field for businesses.

4.3 ENVIRONMENTAL TAXES AND LEVIES

In UK, the landfill tax system was introduced in 1996 as a means to encourage waste prevention and promote alternative forms of waste management. Different set of landfill taxes is applicable to active wastes and inactive wastes. The differentiation reflects the environmental burden associated with each type of waste. Active waste consists of all biodegradable wastes, including biodegradable municipal waste. On the other hand, inactive waste, also known as inert waste, consists of naturally occurring materials like rocks, sand, and soils, as well as low-activity processed materials such as glass minerals, furnace slags, and ash.

Initially, the landfill tax rate introduced in 1996 was GBP 7 per tonne for active waste and GBP 2 per



tonne for inactive waste. Over time, as waste generation and its environmental impact increased, the tax rates were raised. As of 2023, the landfill tax rates stand at GBP 102.10 per tonne for active waste and GBP 3.25 per tonne for inactive waste.

The purpose of the landfill tax mechanism was to create a financial disincentive for landfilling. The increasing tax rates over the years have been associated with a decrease in the amount of municipal solid waste sent to landfill. It indicates that the landfill tax has played a significant role in incentivizing waste management practices that prioritize higher levels of the waste hierarchy, such as recycling and recovery, and generating revenue for recycling infrastructure.

4.4. PRIVATE SECTOR PARTICIPATION AND PUBLIC PROCUREMENT LAWS

Private sector participation in waste management is promoted through the regulatory framework and laws specific to the waste management system. In the UK, the EPA contains provisions that allow the regulatory authority to engage the private sector for waste management services through a tender process. The authority is empowered to enter into waste disposal contracts with private sector entities for the treatment or disposal of waste.

Furthermore, the UK has introduced the Public Contract Regulations 2015 ("**PCR**"), which establish procedures for procuring public contracts by government authorities or agencies. These regulations require all contracting authorities to follow the prescribed procedures and ensure compliance with the PCR when awarding any contract. PCR also requires public sector organizations to consider environmental and social factors when awarding public contracts for waste management services, which encourages the development of sustainable waste management practices.

Notably, a private company was awarded the contract for the operation of its countywide network of 11 Recycling Centres by Suffolk County Council for the period from 16 May 2019 to 30 September 2027 after a very rigorous and competitive procurement process. The contract is worth approximately 26 million pounds. The private company is one of the biggest waste management companies in Spain which provides its services in various countries. It has a large business in the UK with around 100 Household Recycling Centres and around 1.6 million tonnes of waste being recycled each year.

4.4 PRIVATE FINANCE INITIATIVE FOR WASTE MANAGEMENT INFRASTRUCTURE

The Private Finance Initiative ("**PFI**") is a contractual arrangement that resembles a PPP, wherein a public sector entity and a private sector provider enter into a long-term agreement. Under this arrangement, the private sector provider takes on responsibilities for designing, constructing, financing, maintaining, and operating infrastructure assets and associated services. It has been used to facilitate investment in waste management projects such as WTE plants in the UK. The UK government has implemented the Waste Infrastructure Delivery Programme ("**WIDP**") as part of the PFI to promote private sector involvement in waste management and support the development of waste management infrastructure projects.

WIDP, established in 2006, focuses on accelerating the delivery of residual waste treatment infrastructure and meeting landfill diversion targets. The WIDP, implemented under the PFI, introduced a contract format that allowed the private sector to finance public sector projects, covering the associated costs. The government initiated the program to fulfil commitments to the EU Landfill Directive, diverting biodegradable municipal waste from landfills. The primary goal of WIDP was to improve waste management practices, boost recycling rates, and reduce reliance on landfills. It provided financial assistance and guidance to local authorities and waste management companies for implementing infrastructure projects supporting sustainable waste management. The program focused on projects related to recycling facilities, waste treatment and recovery technologies. Through WIDP, the government provided funding to eligible projects through a competitive bidding process. It aimed to encourage the use of innovative technologies in waste management while promoting sustainability. The PFI system facilitated various contracts in the waste management sector. One example is the contract between Surrey County Council and a private contractor for the Charlton Lane Ecopark Waste Treatment Facility. This facility focuses on the treatment of household waste. WIDP also supported the contract with the Herefordshire Council and Worcestershire County Council. They entered into a contract for the EnviRecover Project, which developed an Energy from Waste facility which is owned and operated by a private company. Similarly, several other waste infrastructures are being developed or have already been developed under the PFI initiative.

4.6. STRATEGIC GOVERNMENT PLANS AND POLICIES

UK is actively promoting private sector participation in waste management through its Circular Economy Package and a range of strategic government initiatives. With a strong focus on sustainability and resource efficiency, the Circular Economy Package emphasizes reducing landfill and following the waste hierarchy. This approach provides a clear framework for businesses to prioritize reuse, recycling, and responsible waste management practices. For instance, the government has issued guidance notes which mandates businesses and local authorities to implement waste hierarchy in their respective regions Additionally, the National Anti-litter Campaign, in line with the Circular Economy Package, has established Litter Innovation Fund, which promotes businesses by providing grants to launch and evaluate innovative small-scale anti-litter interventions.

Further, under England's 25-Year Plan, significant efforts are being made to minimize waste generation and improve environmental outcomes. The plan sets ambitious targets for landfill reduction, increased recycling, and resource optimization. It also encourages innovation, investment, and collaboration between the public and private sectors to achieve these goals. The plan's emphasis on public-private funding partnerships creates opportunities for businesses to contribute to environmental protection while driving economic growth. As part of their commitment towards circular economy, the Government has also allocated GBP 99 million to invest in innovative technology and research across various sectors including waste management.

Further, the Scottish Zero Waste Plan is committed to achieving a zero-waste Scotland, focusing on resource efficiency, recycling, and sustainable procurement. The target is to achieve a recycling rate of 70% for all waste generated and limit the amount of waste sent to landfills to just 5% by the year 2025 in Scotland, showcasing a strong commitment to sustainable resource management.

Similarly, the Waste Prevention Programme in England promotes innovative projects and initiatives to foster a culture of waste reduction and sustainable practices. As part of the waste prevention program, the Innovation in Waste Prevention ("**IWP**") Fund was introduced in 2014 with the primary objective to encourage sustainable waste prevention practices and initiatives. The fund provides financial support to innovative repair and renewal projects, aiming to shift communities away from a disposable mindset. Also, the UK government's Net Zero Research and Innovation Framework reinforces private sector involvement in waste management by providing substantial investment to develop cutting-edge technologies aligned with net-zero targets. It aims to position UK businesses as leaders in the global green economy, attracting private investors and fostering innovation. Initiatives such as Smart Sustainable Plastic Packaging challenge with grants amounting GBP 60 million was established for research and innovation for tackling commercial and behavioural issues surrounding solid waste. Further, the UK government has also introduced the Smart Waste Tracking Digital Challenge as an economic incentive to enhance public participation in waste management. It serves as a comprehensive system for tracking waste and recording its movement throughout the UK's economy. The objective of the initiative is to stimulate the development of innovative technologies for waste tracking and management. The challenge was open to businesses of all sizes and provided financial support and assistance to selected participants who proposed viable solutions.

Altogether, the UK's comprehensive approach to waste management, backed by its Circular Economy Package and strategic government plans, offers a compelling environment for private sector engagement. These initiatives create opportunities for businesses to contribute to sustainability goals, benefit from funding support, and leverage innovation for creating responsible waste management system.

5 CONCLUSION

The waste management framework employed in UK is highly advanced and comprehensive. The country has a implemented stringent regulations and legislations to promote waste reduction and recycling at both individual and industrial levels. One significant aspect within the system is the

principle of duty of care which mandates that every person involved in the waste management process, from the initial waste generation to its final treatment or disposal, must ensure that waste is managed efficiently and in compliance with the law. The principle is applicable in varying levels of responsibility to individual households, local authorities, and industrial establishments.

Additionally, the UK government has embraced private sector involvement in waste management. This is evident in the regulatory structuring of waste management laws as well as the various initiatives undertaken by the government. The regulatory framework makes significant strides in terms of viewing waste management as a business operation. It mandates every entity dealing in the business of waste management to treat waste as a resource by ensuring there is proper licensing and authorisation framework in place. Legal documents such as Waste Transfer Notes and smart waste tracking technology further exemplify the outlook of waste as a resource.

Further, the UK has also introduced in the past and on ongoing basis certain policies to the like of CCT and PFI which has improved market entry options and funding channels for the private sector. The UK has also implemented a landfill tax based on the type of waste to reduce landfill usage and incentivize innovative solutions for waste recovery and recycling. Hence, the various legal interventions implemented in the last three decades by the Government of UK has helped foster an innovative and competitive market environment for waste management where multiple private companies operate under government oversight and regulation.

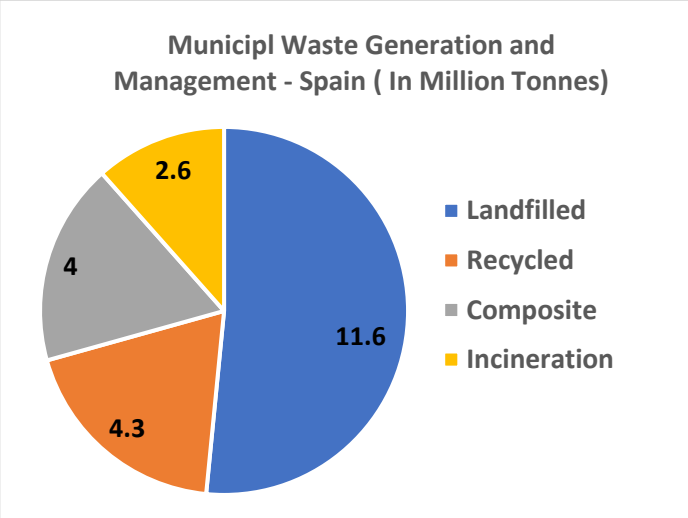
COUNTRY PROFILE: SPAIN

1 Overview of the Ecosystem

The waste management sector is a critical component of Spain's efforts to ensure sustainable development and environmental stewardship. With a population of around 47.4 million in 2021, Spain recognizes the importance of adopting circular economy principles in waste management. The sector is guided by national legislation and regulations, which establish a framework for waste prevention, management, and control that focuses on the principles of the circular economy.

The Waste Law 07/2022 ("**Waste Law 2022**") which is the main legislation governing waste management in the country, regulates and provides specific provisions for MSW practices in the country. The objectives of the Waste Law 2022 include reducing waste generation, managing its impact, and transitioning to a circular and low-carbon economy. Moreover, as a member of the EU, Spain has implemented regulations and directives, ensuring alignment with waste management standards set at the European level.

Municipal waste management in Spain involves a range of activities that have been carefully structured. The activities encompass waste collection including separate collection of bio waste, transportation, classification, surveillance of operations and maintenance after landfill closure. All of these activities are monitored and regulated by various government agencies in Spain, ensuring comprehensive waste management practices. Disposal is considered as the last resort in the waste management hierarchy when the recovered waste cannot be reused, recycled or repurposed for energy generation.



In 2021, the total amount of municipal waste generated in Spain amounted to 22.3 million tons, which was around 16.15% of the total waste generated in the country. Of the total municipal waste, approximately 52% was sent to landfills, 19.3% was recycled, 11.6% was incinerated for energy generation, and 17.9% was composted. Over the course of a decade, there has been a notable decrease in landfill usage in Spain. Specifically, the landfill figure has decreased by 3.2 million tons, going from 14.8 million tons in 2010, which accounted for 63% of the total municipal waste, to 11.6 million tons in 2021, representing 52% of the overall waste. Consequently, Spain has effectively reduced the volume of municipal waste disposed of and achieved in increasing waste recovery through diverse operational methods.

2 What is Waste?

In Spain, waste is defined as any material or item that an individual or entity disposes of or possesses the intention or responsibility to dispose of. In accordance with the Waste Law 2022, various classifications and specific guidelines for the appropriate management of different types of waste including municipal waste, hazardous waste, agricultural waste, among others have been established. Notably, the definition of municipal waste encompasses both mixed waste and waste collected separately from residential areas, as well as other sources, provided that such waste exhibits similar characteristics and composition to household waste. However, waste from production, agriculture, forestry, fishing, septic tanks and sewerage and wastewater treatment plants, including sewage sludge, end-of-life vehicles or construction and demolition waste is not included under the ambit of municipal waste. Public roads, green areas recreational, areas beaches, dead domestic animals and abandoned vehicles are included within the definition of municipal waste under the Spanish law.

3 Key Stakeholders

The waste management sector in Spain involves several key stakeholders who play vital roles in ensuring effective waste management practices. The key stakeholders involved include government authorities, private entities, and the public. The involvement of these key stakeholders was brought through a series of regulations and laws implemented by the Spanish government.

In Spain, the first law specifically addressing waste management was introduced in 1985. It emphasized the responsibility of municipalities in managing growing waste and implementing waste collection and treatment methods. However, the lack of specifications regarding the responsibilities of waste producers and parties involved in waste management in the initial law necessitated the government to introduce the waste law in 1998. The Waste Law 10/1998 **("Waste Law 1998")** introduced as well as regulated the involvement of the private sector in waste management operations. It aimed to prevent waste generation and establish a legal framework for waste production and management. However the Waste Law 1998 was later repealed with the introduction of the Waste Law 2011, which incorporated the EU Waste Directive 2008. The current Waste Law, known as Waste Law 2022, further builds upon previous legislation and integrates the concept of the circular economy into the legal framework of waste management.

Owing to the above, the municipal waste management in Spain operates within a highly regulated environment wherein every aspect of waste management, from its generation to final disposal, is subject to regulation. These regulated actions are managed by the government and are devolved from the government to individuals, public institutions as well as private entities. The responsibility for waste management in Spain rests primarily with the government at all levels, with the private sector also playing a significant role. Spanish laws underscore the government's obligation to manage waste effectively, while also incorporating the involvement and participation of private entities in waste management activities by way of authorization, wherein they can collaborate with the government or perform these activities independently. In addition, the Waste Law 2022 imposes various obligations and duties on all persons involved in implementing and performing waste management services.

The role and responsibility of the government for implementing the waste regulations in Spain is derived from the Spanish Constitution. The administration of waste legislation is handled by multiple authorities operating at various administrative levels. Spain is divided into 17 autonomous communities, which are political and administrative entities with their own government and legislative powers. At the national level, the Ministry for the Ecological Transition and the Demographic Challenge implements national regulations and plans after consulting the autonomous communities, local entities, and other affected ministries or in collaboration with other Member States. Whereas, the autonomous communities have the authority over their respective regions for implementing policies, regulations, plans, etc. They are responsible for implementing policies and regulations in their region, as well as developing their waste management plans in line with national laws and EU Directives. Further, they are also entrusted with the duty to develop a framework on division of responsibilities between public and private operators within the waste management plan. Within each autonomous community, there are provinces, which are smaller administrative divisions. Provincial councils are governing bodies that exist in most provinces of Spain. They are local entities resulting from the grouping of municipalities. Their primary role is to coordinate and provide waste management services to municipalities within the province. Municipalities are the most local level of government in Spain. While the provincial council is in charge of the waste management services in their respective areas, the responsibility for waste collection and disposal lies with the local municipalities within their jurisdictions.

Moreover, both the government and competent authorities have the responsibility of incorporating the waste hierarchy system into the waste management framework. The competent authority refers to any governing body entrusted with tasks outlined within their jurisdiction by the Waste Law 7/2022, operating under the government and public administration. It is accountable for granting authorizations, conducting monitoring and inspections, imposing sanctions, and disseminating information.

Further, there exists a Waste Coordination Committee ("**WCC**") that serves as a platform for coordinating efforts between the national ministry and the autonomous bodies. WCC has various functions including but not limited to promoting cooperation and collaboration between the competent authorities in the field of waste management, analysing the practical implementation of state waste regulations, examining the rationale behind any changes in the prioritization order of the waste hierarchy and other related tasks. WCC also possess the authority to establish specialized working groups, comprising of technicians or experts in the relevant subject matter, representing the public sector, private sector and civil society, that serve as support for the fulfilment of the functions entrusted to it by law.

The regulatory system in Spain allows a mixed system of waste management, where both public and private entities are involved in waste management services. The degree of privatization varies among the 17 autonomous regions of the country, as the allocation of responsibility lies within the purview of these regions. Therefore, each region has the autonomy to decide the extent of private involvement in waste management based on their specific needs and circumstances. As a result, some regions rely

more on private entities for waste management services than others. However, private participation in the sector has been present for over a century. The government has been involving the private sector in municipal waste management through tender and contract arrangements since 1911. As of 2016, around 75% to 80% of the waste collection and waste treatment in the country is provided by private companies. In contrast, less than 25% of waste collection and treatment activities is under municipal management. As a result, Spain is heavily reliant on the private sector to provide waste management services.

Furthermore, the law establishes various obligations and duties for persons involved in generating and performing waste management services. According to waste regulations, producers are categorized into two groups: waste producers and product producers. A waste producer refers to an individual or entity that generates waste as part of their activities. On the other hand, a product producer refers to a person or entity involved in the professional development, manufacturing, processing, treatment, filling, selling, or importing of products within the national market. The law places several obligations on waste producers, including the prevention of waste generation, the separation of waste at its source, and the requirement to transfer waste to a regulated entity. Within the regulatory framework, the local entities are required to set up a rate or fee based on "pay as you throw" principle, which would be imposed on the waste producer on the basis of waste generated at the source. The law also includes provisions for a system of incentives aimed at waste producers who take measures to reduce mixed waste and promote the separation of recyclable waste at the source. They are designed to encourage and reward waste producers for implementing practices that contribute to waste reduction and recycling efforts. On the other hand, it imposes obligation on product producers to bear the financial responsibility for the cost of waste management associated with the products they place on the market.

4 Models and Strategies for the Promotion of Private Sector Participation

Effective management of MSW is a crucial aspect of maintaining a sustainable and clean environment. Spain employs diverse approaches to MSWM, including municipal-owned and operated systems, PPPs, and fully privatized models. Further, various models and strategies have been implemented to encourage private sector participation in MSW management. The tools employed for enhancing private sector participation range from regulatory interventions, such as laws, policies and standards, to economic incentives. Some of the specific measures and mechanisms implemented in Spain to encourage private entities to play an active role in waste management activities are as follows:

4.1 AUTHORIZATION FRAMEWORK FOR WASTE MANAGEMENT ENTITIES

Since 1998, the Spanish Government has taken significant steps to promote independent private participation in waste management through an authorization framework. Under the existing law, both public and private entities are required to obtain specific authorizations from the competent authority to engage in waste production and management activities. By establishing a formal process for obtaining authorizations, both public and private entities are given equal opportunities to engage in these activities. Further, through specific authorizations, the government ensures that all entities,

regardless of their public or private status, meet the necessary criteria and standards for conducting waste-related operations. It serves as an administrative intervention to regulate and monitor access to waste-related operations. The Waste Law 2022 has different authorizations for different waste operations and they are as follows:

- Authorization for storage facilities for professional waste collection and waste treatment operations.
- Authorization for professional waste pick-up activities focused on waste recovery or disposal, excluding the need for associated installations.
- Authorization for mobile installations for waste treatment operated by waste management entities with established headquarters.

The authorization framework established under the law recognizes waste management activities as specialized and professional services that require specific qualifications, expertise, and adherence to standards. Further, all authorizations are registered by the autonomous communities in their respective register of waste production and management. It contains information on all legal persons, whether private or public, that are involved in waste management. Essentially, the Spanish government has established waste management laws that outline the roles and responsibilities of private entities in waste collection, transportation, treatment, and disposal and ensure compliance with environmental standards.

4.2 IMPLEMENTATION OF TAX

Implementation of tax is one form of economic incentive used in Spain to promote private sector participation. Previously, the implementation of taxation on disposal activities was primarily handled by autonomous communities within their respective regions. For example, Catalonia implemented a tax system in 2004 to encourage responsible waste management practices. The tax system involved charging Euro 10 for landfill disposal and Euro 5 for incineration of municipal waste. Additionally, if municipal waste was disposed without separating organic waste, an additional tax of Euro 20 for landfill and Euro 15 for incineration was applied. These taxes aimed to discourage landfilling and incineration without proper waste separation, thereby promoting recycling and waste reduction efforts.

However, with the enactment of the Waste Law 2022, the national government introduced taxation on disposal activities at the national level. It marked the first time that such taxation measures were implemented nationwide, bringing uniformity and consistency to waste management practices across the country. The specific taxes included within the regulatory framework are as follows:

1. Landfill Tax: The landfill tax imposes a requirement for any individual or entity utilizing landfill sites as a means of waste disposal to pay a tax. This tax is levied at the time when the waste is delivered

to the landfill, regardless of whether the landfill is privately or publicly owned. Presently, the tax amount for municipal waste is set at 40 euros per metric ton.

2. Incineration Tax: The incineration tax is applicable when waste is sent for disposal or energy recovery at authorized waste incineration facilities, whether privately or publicly owned. The tax amount for waste disposal through incineration is 20 euros per metric ton, while for energy recovery operations, it is 15 euros per metric ton.
3. Non-reusable Plastic Tax: Effective from January 1, 2023, this tax targets manufacturers or importers of non-reusable plastic packaging. The tax rate is fixed at Euro 0.45 per kilogram of plastic.

These above-mentioned taxes serve as financial incentives to promote responsible waste management practices, encourage recycling and waste reduction, and generate revenue to support environmental initiatives. They act as a catalyst and improve demand for alternative waste treatment options such as recycling, composting, or energy recovery and thereby, promote the development of recycling facilities, waste treatment plants, and other waste management infrastructure. These measures have indirect impact by motivating private sector companies to invest in technologies and infrastructure that enable them to divert waste from landfills and maximize resource recovery.

4.3 IMPLEMENTATION OF SOFT POLICY MEASURES

In order to enhance private sector participation in waste management services, Spain has implemented soft policy measures. One notable measure is the introduction of the Spanish Circular Economy Strategy 2030 (**"Strategy 2030"**). This strategy, launched in 2018, aims to facilitate Spain's transition to a circular economy and includes specific objectives to increase private sector involvement in waste management services. In consonance with Strategy 2030, the autonomous communities have also implemented independent strategies for their respective jurisdictions. The autonomous communities are also given the authority to formulate plans and programs for their regions in consonance with the National Plan and programs. Certain state governments have released aids and grants for improving private participation in the waste management sector.

The Community of Madrid has launched an aid program to finance waste management projects, endowed with more than 46 million euros. This aid would be given to any private or public entity that is involved in the waste management services under the waste law including municipal waste management. Additionally, the waste management plan of the Community of Madrid for the period 2017-2024 is focused on promoting waste recovery and implementing measures to support investment and innovation in businesses that develop new technologies and products for domestic waste management.

4.4 PRIVATE SECTOR PARTICIPATION MODELS

Inclusion of private sector participation in waste management system is motivated by several factors, such as cost reduction, efficiency improvements, and the introduction of new technologies. In Spain, the local government's decision to involve the private sector was driven by multiple factors such as cost concerns and budgetary constraints. To amplify private sector participation in the sector, the regulatory design also provides measures which allow local governments to give incentives to the private entities.

Among the various models employed in the country, contracting out and tendering are the most common models which has been subsisting since 1990s. Private sector participation in waste management services by entering into a contractual arrangement with the government where the private sector is responsible for delivering and managing the specified services, such as waste collection, transportation, treatment, or disposal has been in existence in Spain for several decades now. For example, the city of Madrid started contracting out solid waste collection to private companies in 1968. However, the municipalities and local governments have to be in compliance with the laws governing contracts when following these processes. These modes of outsourcing aids the municipalities to focus on their core responsibilities while relying on private companies to provide specialized services.

Barcelona is one of the provinces in Spain which started contracting out waste management services in 1974. The urban solid waste collection was contracted out for a period of 25 years. However, to further enhance the SWM system, the city was later divided into four zones with four different contracts being awarded to private entities. It may be noted that none of the private firms were permitted to acquire services of more than two zones. In 2009, a revision was made to the waste management contracting process allowing for the implementation of only a single contract with a single firm. The concept of exclusive zones for market was developed with an aim to enhance competition and reduce costs for services. Similar specification in the tender allowing market exclusivity in zones is also used by the province of Valencia.

In addition to the abovementioned, the local government through joint venture also uses the partial privatization method for waste management services. The government in the case, where it has cost and financial constraints would form a joint venture with a private entity. The reason for such collaboration is the private company would already have expertise in the waste management sector which gives private company exposure and a medium for revenue generation on the other hand the government can save money and get the management in a much more efficient manner. Under this model, private companies perform waste management activities and the government maintains control and supervision over activities.

In addition to the above-mentioned services provided to the government, the waste management companies authorized for waste operations also provide independent services to various business operations. The companies offer a range of services, including waste collection, transport, treatment, and disposal services to households, housing societies, and private entities such as hotels, factories, or businesses. For example, a private company in the year 2019-2020, had 1,098 environmental services management contracts, which were spread across a portfolio of 706 clients, which consists of 72 % public bodies and 28 % private clients.

Remarkably, a prominent private waste management company involved in waste management services in Spain as well as in other countries has indicated in the annual report of 2019 – 2020 that the revenue generated from waste activities in Spain was the highest among all countries. It is a company that has been providing urban sanitation and cleaning services since 1911 in Spain. The company's waste collection and treatment activities have generated 50.3 % of turnover, accounting for the bulk of the services provided by the organisation, followed by urban cleaning activities with 32.1 %. The remaining

17.6 % covers building cleaning, parks and gardens maintenance and upkeep, sewerage maintenance and other services such as beach and public fountain maintenance and energy management.

Through authorization frameworks, taxation measures, soft policy measures, and specific waste management plans, the government of Spain encourages collaboration between the public and private sectors, promotes responsible waste management practices, and supports the transition to a circular economy.

5 CONCLUSION

Waste management activities are highly regulated in Spain. All activities within the waste management framework have been carefully divided into specific roles and formalised through law. The regulatory framework in Spain does not distinguish waste operator on the basis of whether they are private or public in nature. Any organisation with specific standards is allowed to carry out waste management activities after obtaining necessary authorizations from the government. Various policy and regulatory interventions have led to an ecosystem where majority of the waste management services in Spain is provided by private organisations holding more than 75% of the total market.

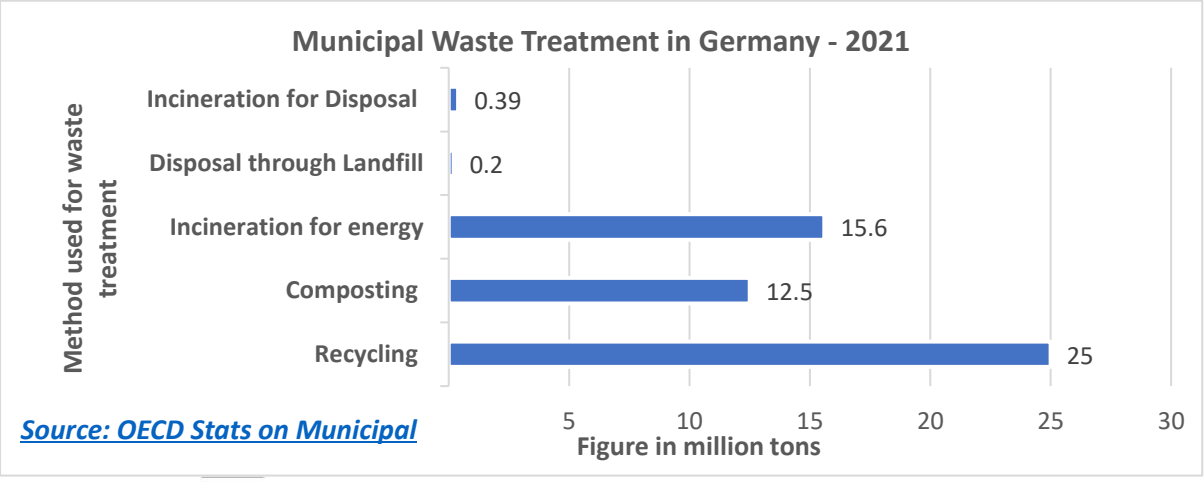
Spain also follows the waste hierarchy principle, which promotes resource efficiency and encourages sustainable waste management practices. Notably, like India, Spain relies heavily on landfill as a waste disposal method and recognizes the importance of reducing landfilling and promoting alternative waste treatment approaches. The primary legislation on waste management has incorporated tax structures like UK to improve recycling rates and reduce reliance on landfilling. Hence, unlike the UK, Spain has implemented incineration tax in addition to landfill tax to discourage the disposal of waste that could otherwise be recycled. Lastly, even though the autonomous authorities have the responsibility of implementing regulations and policies in line with the national laws, a separate authority known as Waste Coordination Committee has been created at the central level to ensure effective coordination and collaboration between national and local authorities in all matters relating to waste management.

COUNTRY PROFILE: GERMANY

1 Overview of the Ecosystem

Waste management in Germany is a highly prioritised and carefully monitored aspect, driven by the country's commitment to sustainability, resource efficiency, and environmental protection. The nation has already achieved the waste targets set by the European Union's Waste Directive 2008. With a well-developed and efficient ecosystem for municipal waste management, Germany focuses on minimal waste disposal and promoting a circular economy. Germany operates under a democratic and federal parliamentary republic system, where legislative power on waste management resides with the Bundestag (the German parliament), while enforcement of waste legislation is the responsibility of the federal states. The primary regulation governing municipal waste management in Germany is the Kreislaufwirtschaftsgesetz – KrWG ("**Circular Economy Act**"). As an EU member, Germany aligns its national legislation with the regulations and directives set by the EU. Hence, the Circular Economy Act has incorporated the EU's Waste Framework Directive of 2008, including subsequent amendments.

The Circular Economy Act highlights waste management principles, circular economy practices, obligations incumbent on waste producers and holders, along with the responsibilities of public waste management service providers. The law also imposes duties and obligations to utilise or dispose of waste from private households on the waste management authorities. Additionally, each federal state is empowered to implement its waste management plan in accordance with the Circular Economy Act. Waste management activities in Germany cover transfer, collection (including separate collection of biowaste), transportation, recovery, and disposal after waste sorting. Monitoring of all waste management activities, aftercare of disposal facilities and all functions carried out by waste dealers or brokers are also included within the ambit of waste management activities.The country's waste management practices adhere to the waste hierarchy. Germany has adopted a comprehensive approach, focusing on waste reduction, recycling, and environmentally friendly disposal methods. Further, the country has implemented a system of pre-treatment of waste in its waste management framework. Non-pre-treatment of garbage has been prohibited in the country since 2005. Pre-treatment is a method applied before sending the waste for disposal, like sorting, crushing, compacting, pelletising, drying, shredding, conditioning or separating.



Source: OECD Stats on Municipal

Further, according to statistical data, in 2021, Germany generated 53.7 million tons of total municipal waste. Approximately 47% of the total municipal waste treated in Germany was through recycling, with an additional 29.1% allocated to incineration for waste-to-energy purposes. Composting accounted for 23.23% of the waste treatment methods utilised. Remarkably, landfill disposal represented a mere 0.003% of the overall municipal waste management approach as of 2021. Through stringent regulations and comprehensive infrastructure, Germany has achieved high waste recycling rates and significantly reduced the amount of waste sent to landfills.

2 What is Waste?

In Germany, waste includes all substances and material that the holder no longer has a use for and is obligated or intends to dispose of. According to the law, municipal waste refers to mixed waste or waste that is collected separately from residential households, as well as waste that shares similar characteristics with household waste in terms of its nature and composition. It includes various types of waste such as bulky waste, bio-waste, separately collected recyclables like glass and paper, and so on. Moreover, household-like waste derived from locations similar to residential households, such as medical and legal practices, administrative buildings, schools, kindergartens, hospitals, care homes, and commercial establishments are also considered within this category.

3 Key Stakeholders

In Germany, the waste management sector comprises a range of stakeholders including government entities at different levels, municipal waste management companies, private waste management companies, including businesses involved as collectors, carriers, traders or brokers of waste, and environmental agencies. These stakeholders independently carry out their duties and responsibilities or collaborate to ensure effective waste management in Germany, promoting resource conservation, environmental protection, and a circular economy approach.

At the national level, the Federal Ministry of Environment is responsible for creating legislation that shapes the legal framework on environmental protection, nature conservation, and consumer protection policy. The Federal Government develops laws and regulations related to waste disposal and associated matters, as specified under the German Constitution, i.e., the Basic Law for the Federal Republic of Germany. Regional states in Germany are mandated to implement these national laws and, further, possess the authority to enact additional legislation, particularly in areas not governed by federal law. While the responsibility for enacting environmental legislation primarily lies with the federal government, the implementation and administration of German ecological laws are mainly delegated to the regional states and their respective authorities.

In addition to the aforementioned stakeholders, Germany has environmental agencies at both the national and regional levels that play a vital role in waste management. The federal environment agency, known as Umwelt Bundesamt, holds the responsibility of enforcing environmental regulations, offering policy advice to the Ministry of the Environment, and providing guidelines for waste reduction and recycling. Moreover, each federal state within Germany has its own state environmental agency tasked with regulating and monitoring waste management activities within its jurisdiction. These

agencies recommend measures for environmental standards to the Ministry, provide information to the public and take actions that promote sustainable waste management practices.

Besides, at the local level, waste management responsibilities lie with the local authorities. These authorities oversee a wide range of operations and activities related to waste treatment and disposal facilities. The regulations place specific obligations on local public waste management authorities, including collecting and transporting and implementing measures to promote waste prevention and recovery. They are also responsible for planning, constructing, and operating waste disposal facilities within their jurisdiction. Further, the competent authority within each regional state is responsible for the supervision of the certification process of waste management companies. The competent authority is typically an environmental department of the state government, representing the respective land. However, the competent authority delegates direct control over the certification process to Technical Supervisory Organizations or a Community of Certified Waste Management Companies through a supervision contract.

A Technical Supervisory Organisation ("**TSO**") is an association comprising experts who work collaboratively to ensure long-term cooperation in waste management supervision. On the other hand, a Community of Certified Waste Management Companies is an association of Certified Waste Management Companies. Both entities require recognition by the competent authority, either in the form of a supervisory contract or certification. The recognition ensures that these entities meet the necessary standards and requirements set by the competent authority and are authorised to perform their respective roles in waste management supervision. The TSOs or Community of Certified Waste Management Companies are responsible for overseeing and monitoring the waste management services provided by waste management companies, as required under the law.

From the abovementioned, it is evident that private individuals and companies have the opportunity to participate in the supervisory process in Germany. Moreover, waste management companies, whether public or private, can engage in a range of activities related to waste, such as waste collection, transportation, storage, treatment, recovery, disposal, trade, or commercial dealings after receiving the necessary certification from the TSO or Community of Certified Waste Management Companies. Essentially, waste management companies can be categorised as public, private, or public-private entities. These companies offer commercial waste collection, transportation, and disposal services. Their responsibilities encompass collecting waste from households, businesses, and industries and ensuring its appropriate handling and treatment. The critical roles defined within the waste management law for various waste management services are as follows:

Collector	Transporter	Trader	Broker
•Individuals or organizations engaged in the commercial collection of waste from various sources such as households, businesses, and other entities.	•Transporters are responsible for the commercial transportation of waste, ensuring its safe and efficient transfer from collection points to designated facilities or treatment sites.	•Traders are involved in the business of acquiring and reselling waste materials. They may purchase waste from collectors or other sources and sell it to recycling facilities or other buyers.	•Brokers arrange waste management services on behalf of third parties as a commercial activity. Their role involves connecting waste generators with appropriate waste treatment or disposal facilities.

Furthermore, waste management laws impose obligations on businesses that generate significant amounts of waste, mandating proper waste management practices. Private residences and individuals also play a crucial role by segregating their waste at the source, facilitating its transfer for treatment and disposal. Private households must also pay a fee for waste management services received. These various roles and responsibilities collectively contribute to effective waste management, ensuring the proper handling, transportation, and treatment of waste materials.

4 Models and Strategies for the Promotion of Private Sector Participation

Like several other nations, municipalities in Germany have traditionally held control over the provision of municipal waste management services. However, since the late 1900s, there has been increased participation of the private sector in waste management services. The increase in private sector participation in Germany may be attributed to different factors undertaken by the German government. They are as follows:

4.1 DUAL SYSTEM GERMANY UNDER THE PACKAGING ORDINANCE

The privatisation of waste management in Germany took a significant step forward with the implementation of the Packaging Ordinance in 1991. This ordinance introduced the concept of EPR, which made the private sector responsible for the collection, sorting, and recycling of packaging waste throughout the country. Packaging included items used for storing, handling, protecting, supplying or displaying products, whether used for raw material or final goods to pass on from distributor to end user. The packaging waste produced in private households also formed a part of the packaging waste regulated in the country. Germany was at the forefront of implementing EPR as a means to promote recycling and reduce the environmental impact of packaging materials. The motive behind the Packaging Ordinance was to shift away from landfilling as a disposal method, as many landfills at the time were reaching their capacity.

To facilitate the implementation of the ordinance, an association called Duales System Deutschland ("**DSD**") was established. The DSD consisted of corporations from the retail, packing and filling, packaging material production, and raw material supply industries. DSD operates through a network

of collection and recycling companies to ensure compliance with the packaging ordinance. The system was designed to collect, sort, and recycle packaging waste from private households, consumers, and nearby locations. The law established a privately organised system where packaging waste is returned and sent for recycling. Further, it ensured that producers and distributors are required to pay fees to the system based on the type and quantity of packaging they place on the market. The organisation contracts with the municipalities and waste management companies to collect and recycle the packaging waste from private households and municipalities to fulfil the EPR obligations.

The Packaging Ordinance also introduced the Green Dot symbol. This symbol is used on packaging to indicate that the producer has fulfilled their obligation to pay the DSD fee. In 2019, the Packaging Ordinance was replaced by the new Packaging Act (Verpackungsgesetz), which was adopted by the German parliament in 2017. The new packaging law increased the recycling percentage for packaging waste and implemented a more transparent and fairer economic competition. It also introduced incentives for producers to use more recyclable-friendly products, thereby enhancing the overall recyclability of packaging.

Until 2003, DSD was the only Producer Responsibility Organisation (**PRO**) in place. However, in 2003, multiple PROs were allowed in the country and under the recent Packaging Act 2017, each PRO has to be registered with the central authority and placed in the register. By establishing the dual system under the Packaging Ordinance, Germany took a significant step towards privatising waste management in the country, particularly in the realm of packaging waste. The involvement of the private sector through the DSD and the implementation of EPR principles have contributed to promoting recycling and reducing the environmental impact of packaging materials.

4.2 REGULATORY STRUCTURE FOR CERTIFICATION AND SUPERVISION OF WASTE MANAGEMENT ACTIVITIES

One factor that has been employed to promote private sector participation in waste management services in Germany is embedded within its regulatory structure. As stated earlier, under German law, every private or public company involved in waste management activities must obtain certification. This certification is granted by a TSO or a Community of Certified Waste Management Companies.

The certification process ensures that companies meet specific criteria for their organisation, staff, equipment, activity, and staff knowledge and expertise. It is a means to ensure that waste management services are carried out effectively and in compliance with regulations. By requiring certification, the German government promotes quality standards and accountability within the private sector. Importantly, the law allows all waste management activities to be carried out by private sector entities as long as they are certified. It means that private companies can be engaged in various aspects of waste management, including collection, sorting, recycling, and disposal, once they meet the necessary certification requirements.

Furthermore, the law provides an option for contracting supervisory functions in relation to waste management to an association or community comprising private companies. It means that private entities can collaborate and collectively undertake supervisory responsibilities in waste management.

This law encourages cooperation among private sector actors and fosters a more diverse and competitive waste management sector.

4.3 ECONOMIC INSTRUMENTS AND INCENTIVES UNDER THE CIRCULAR ECONOMY ACT

Under the framework of waste management in Germany, economic instruments and incentives play a crucial role in promoting private-sector participation. It aims to encourage waste management activities aligned with the principles of the circular economy. The Circular Economy Act, along with state-specific laws, outline several measures and incentives to drive private sector engagement in waste management. It mandates the implementation of waste preventive programs, which include various economic measures to incentivise sustainable waste management practices. These measures may consist of grants, financial aid, and funding assistance for projects focused on waste management, particularly those that emphasize waste prevention, minimization, and recycling.

Private companies involved in waste management benefit from these financial incentives when their activities align with the waste hierarchy principles. Imposition of fees and restrictions on the use of landfills and incineration as waste management methods and, the development of public procurement system for the promotion of better waste management and the use of recycled products are some examples of economic measures specified within Germany's waste management framework. The law also acknowledges the importance of research and development in achieving environmentally friendly and less waste-intensive products and technologies, which encourages private sector participation in research initiatives by promoting appropriate research and development activities.

Furthermore, every state implements their waste management laws in addition to the national laws. Specific state laws, such as the Bavarian Waste Management Act, exemplify the implementation of economic instruments and incentives at the regional level. The Bavarian Waste Management Act which governs the waste management regulation of the largest geographical region in Germany, places an obligation on public authorities, including municipalities and districts, to provide waste management services. These services can be delivered directly or through private companies' engagement via procurement or contract. Public authorities in Bavaria are also empowered to grant financial aid to private companies involved in waste management projects. Additionally, the State of Bavaria has the power to grant financial assistance for research or testing of new technologies for the treatment or disposal of waste. Municipalities in Bavaria are also duty-bound to provide financial support within their available budgets for private measures related to waste prevention, minimizing pollutants, and waste recycling. This financial support encourages private sector initiatives and participation in waste management activities.

Furthermore, the Circular Economy Act also supports the promotion of reuse or multiple uses of products. Local authorities are tasked with providing financial support, as well as technical and organizational assistance, to private entities engaged in activities promoting product reuse. It incentivizes the private sector to develop innovative solutions and business models that contribute to waste prevention and resource efficiency.

4.4 MODELS OF PRIVATE SECTOR PARTICIPATION IN GERMANY

In Germany, waste management is a collaborative effort between the public administration and the private sector, with various models of private sector participation in place to promote efficient waste management. These models include joint ventures, contracting out services, and independent waste management companies.

Joint ventures involve the collaboration of the government body and a private company, both having equity stakes and ownership in a waste management venture. The proportion of ownership tends to differ on a case-to-case basis.

For example, Die Abfallwirtschaft und Stadtreinigung Freiburg GmbH operates as a joint venture between the city of Freiburg and a private company. The city of Freiburg holds a majority stake of 53%, while the private company retains 47% ownership. This joint venture is responsible for waste collection and recycling services in Freiburg.

Another joint venture is Frankfurter Entsorgungsund Service GmbH (FES), in which the private entity has 49% stake, and the City of Frankfurt also has ownership. FES has been developed as a waste management company which focuses on cost-effective measures and high-quality waste management services, catering to private residents, small businesses, and commercial clients.

In addition to the existing partnership models with the government, private companies that meet the required legal certifications also offer independent waste management services. They adhere to the regulations and guidelines set by the government and provide various waste operations, including collection, transport, treatment, pre-treatment, and disposal of waste. The Recycling Center at Oberhausen GmbH (RZO) founded in 1990, is an example of private sector involvement through independent waste management. RZO specializes in the pre-treatment and preprocessing of different waste types. They enter into cooperation contracts with WTE facilities for the disposal of the remaining waste after pre-treatment. These models of private sector participation in waste management demonstrate how the collaboration between the public and private sectors is used to promote efficient waste collection, treatment, and disposal processes in Germany.

4.5 SUPPORTING POLICIES AND INITIATIVES

Germany has also developed supporting policies and initiatives to promote private sector participation in waste management. The KfW Environment loan program and the German RETech Partnership for the export initiative are two key examples.

The KfW Environment loan program, administered by the KfW bank, is dedicated towards supporting of sustainable development and environmental protection. It provides loans to various projects that have positive environmental impacts. It offers financial assistance to enterprises, including private companies, SMEs, joint ventures, and PPP models, both from Germany and other countries. It has specific funding schemes tailored to different types of projects. Under the KfW Environmental Protection Programme, loans are available for investments up to EUR 25 million per project as a supporting measure for projects working towards general environmental protection. It includes

financial investments in waste management, circular economy projects, and waste prevention, treatment, and recycling enterprises. Through loans and financial support, the KfW Environment loan program encourages private sector involvement in waste management practices.

Further, the German RETech Partnership, formed in collaboration with the Federal Environment Ministry in 2011, is an initiative that brings together companies, institutions, consultancies, and research organizations engaged in waste disposal, recycling, and other waste management activities. RETech serves as a platform for promoting German recycling and efficiency technologies in the global market. It aims to export environmental sector expertise and technologies.

In line with this objective, the Federal Ministry for the Environment has implemented an Export Initiative for Environmental Protection. The initiative offers grant support and funding to commercial companies, including SMEs, universities, and other organizations, to help them internationalize their green innovations, products, and services. The grant is available for projects across various fields, including waste management. These policies and initiatives demonstrate Germany's commitment to fostering private-sector participation in waste management. They provide financial assistance, encourage innovation, and promote the transfer of German expertise and technologies to the international market.

While the government has implemented several measures and policies to promote private sector participation in Germany, it is worth noting that there has been a shift from the privatization trend in Germany. Local governments have implemented the decision to de-privatize waste management services as a strategic choice. Although there is no specific rationale that can be attributed as the sole reason for this change, it has been observed that various factors, including the local context, the dynamics of the waste management market, cost considerations, and the desire for increased control over activities influence re-municipalization.

The focus on cost was a significant factor in opting for reverse privatization, particularly in densely populated areas. Furthermore, the dominance of large private companies in the market adversely affecting the competition is noted to have played a crucial role in driving the re-municipalization process. As a result, municipalities have decided to actively participate in the urban services market to regulate private firms' behaviour and ensure quality service delivery. Budget deficits have also compelled public authorities to refrain from outsourcing services and instead take on a more active role in managing waste management activities. However, it should be emphasized that the German government has so far not taken any regulatory action within the existing laws indicating a formal de-privatization policy.

5 CONCLUSION

The waste management system in Germany is of such high efficiency that less than 1% waste produced in the country is disposed of. The remaining is recycled, composted or repurposed in some manner. The country implements a strict waste hierarchy, prioritising waste prevention, recycling, and composting. It was one of the earliest to establish EPR programs under the Packaging Ordinance, placing the onus on manufacturers to manage and recycle the waste generated by their products. This

approach has helped divert waste from landfilling. Further, the country has mandated pre-treatment of waste prior to sending it to the disposal facilities within the regulatory framework through introduction of fines and penalties for non- compliance.

The openness towards privatisation of waste management sector can be gauged from the legal framework of Germany which allows private participation in waste management activity through certification as well as in the form of supervisory function that allows granting of certificate of license to waste management companies. Further, various economic and financial incentives have also been implemented in the legal framework to promote private participation in the waste management sector.

COUNTRY PROFILE: CHINA

1 Overview of the Ecosystem

China is one of the largest producers of MSW in the world. However, the official statistics does not provide statistics on the amount of waste generated in China. Rather, it provides data on the waste collected by the government. Therefore, according to the data released by the National Bureau of Statistics of China, the total MSW collected in China amounted to 235.1 million tons in 2020. Of this, approximately 77.8 million tons of waste were sent for sanitary landfilling, while 146 million tons were treated through incineration. It signifies that about 97% of the MSW collected was disposed of in a safe manner. The table below provides data on the collection, transportation, and disposal of MSW in China in 2020:

COLLECTION, TRANSPORTATION AND DISPOSAL OF MSW IN CHINA (2020)

Consumption Waste collected and transported (million tons)	235.1
Safe Disposal Amount (million tons)	234.5
- **Landfill**	77.7
- **Incineration**	146.1
- **Others**	10.7
Unaccounted waste (million tons)	0.6
Safe Disposal ratio	97.7%

Source: National Bureau of Statistics of China, 2020

Further, an analysis of waste collection and treatment datasets published by the Government of China indicates that China is realigning from landfilling as the primary method of disposal to incineration and other methods such as anaerobic digestion of MSW. Presently, only 33% of the waste collected is disposed of through landfilling, compared to 60% in 2013.

The regulatory and policy framework on waste management in China has implemented various measures to transition the economy towards a more sustainable and environment-friendly waste management system. The government's 13th five-year plan prioritizes the establishment of a circular economy, which promotes greener development through the recycling of household waste. Considerable investments have been made in WTE incineration plants, with a total of 583 facilities built as of 2021 for the treatment and disposal of waste through incineration.

Further, the growing awareness of environmental threats posed by waste pollution has led the country to focus on the 3Rs (i.e. reduce, reuse and recycle). Over the past decade, several initiatives such as the promotion of source separation of waste, compulsory waste sorting in 46 pilot cities, an improved waste classification system, and the Zero Waste Cities initiative have been implemented by the government to enhance the utilization and recycling of waste materials collected as MSW. Moreover, as per the Implementation Plan of the MSW Separation System published by the National Development and Reform commission ("**NDRC**") and Ministry of Housing and Urban-Rural

Development ("**MOHURD**"), the national recycling target for MSW was set to reach 35% by 2020 in cities where mandatory waste separation was implemented.

Notably, China's government has undertaken several projects through PPPs to scale up infrastructure, promote economic growth, and ensure sustainability through the adoption of new technologies. Around 2,854 PPP projects in sewage, waste treatment, heating, and environmental protection have been developed by the government to enhance the quality of basic public services.

2 What is Waste?

The legal framework for solid waste management in China has evolved over time. Until the 1980s, there was no specific law for solid waste management, and it was addressed under the broader Environmental Protection Law. However, in 1996, China implemented its first dedicated law for solid waste management, known as the Law on Prevention and Control of Environmental Pollution Caused by Solid Waste of People's Republic of China. This law was revised in 2020 to strengthen waste management practices.

Under the law, solid waste includes various materials generated from residential, commercial, industrial, agricultural, and construction activities. It encompasses materials such as organic waste, paper, plastics, glass, metals, textiles, and other items that have lost their original use values or are no longer needed. Further, it is classified into consumer waste, industrial solid waste, hazardous waste, and agricultural waste.

Although the law does not offer a precise definition of municipal solid waste, it is commonly interpreted as consumer waste as defined by the law. Consumer waste, also referred to as household garbage, encompasses solid waste that originates from everyday life activities or services provided to support daily life. Additionally, it also includes solid waste that is classified as such based on existing laws and administrative regulations. Hence MSW comprises a range of waste sources such as residential, institutional, commercial, street cleaning, and non-process waste generated by industries.

3 Key Stakeholders

The primary responsibility for waste management in China rests with its government. The government authorities, entrusted with combating waste and protecting the environment as mandated by the Constitution, formulate and implement waste management policies. The government in order to fulfill its constitutional duties develops implementation plans from time to time. These plans are prepared by the NDRC in coordination with the relevant department.

At the central level, various ministries play key roles in waste management. These ministries have distinct responsibilities and collaborate amongst each other to ensure effective waste management practices. The Ministry of Housing and Urban-Rural Development takes charge of municipal solid waste collection, transportation, and treatment/disposal. The Ministry of Ecology and Environment ("**MEE**") assumes responsibilities including assessing the environmental impact of waste treatment facilities and formulating pollution control standards for proper waste management and disposal. They also oversee the handling and treatment of hazardous waste. On the other hand, the Ministry of

Commerce ("**MOC**") oversees the recovery and circulation of recyclable waste materials in China. Lastly, the Ministry of Finance is the central department that is responsible for developing taxation policy which supports the disposal of municipal solid waste.

Moreover, the local government bears the responsibility of enacting the waste management system mandated by the central legislation. At the municipal level, the task of MSW collection, transportation, and disposal falls under the purview of the Urban Management Bureau ("**UMB**") or the Bureau of Housing and Urban-Rural Development. The UMB is also entrusted with the construction and management of waste disposal facilities such as landfills and incineration plants. Further, the local Bureau of Commerce serves as a regulatory authority for material recycling facilities by issuing permits to these industries, thereby ensuring their compliance with relevant regulations and guidelines.

Alongside government involvement, private entities also play a role in waste management. The law permits private sector engagement in waste management activities, and the government promotes private participation through the PPP model. Enterprises seeking to participate in waste management activities must obtain service permits/licenses from the environmental and sanitation department of municipalities, cities, and counties. The waste is classified, segregated, and collected by qualified entities, and dumping of municipal solid waste is strictly forbidden, with fines imposed for violations. Private enterprises are involved in collection, transportation, and treatment of municipal waste. Moreover, material recycling facilities in China are funded, built, and operated by industries, with limited involvement from local departments under the Ministry of Commerce, who primarily grant permits to these industries. Hence, recyclable components within the MSW system are mostly managed by private sector enterprises in the country.

Further, the Ministry of Finance and the Ministry of Housing and Urban Development have also emphasized the importance of inclusion of private enterprises through PPP for MSW treatment to enhance the quality and efficiency of public service. To facilitate waste management through PPP, various guidelines and regulations are in place in China. Therefore, waste management in China is primarily a government-led effort, with responsibilities divided among various ministries at the national level and local level. Private sector involvement is encouraged through the PPP model as well as licensing mode. The role of individuals in the waste management system is rather minimal with the duty to ensure that waste is minimized at source and disposed of in accordance with the sorting system implemented by the government agencies.

4 Models and Strategies for the promotion of private sector participation

In China, waste management is a critical issue that requires the participation of both the public and private sectors. While the government holds the primary responsibility for waste management, various models and strategies have been implemented to promote private sector participation in this crucial sector. These models and strategies aim to leverage the expertise and resources of private enterprises to improve waste management practices, enhance service quality, and achieve sustainable

waste management goals. The various models and strategies in place to promote private sector participation in waste management are as follows:

4.1 PUBLIC–PRIVATE PARTNERSHIP PROJECTS IN WASTE MANAGEMENT

In China, the government encourages private sector involvement through the PPP model. PPPs are collaborative arrangements between government entities and private enterprises, aimed at jointly undertaking projects and delivering public services. In the context of waste management, PPPs enable the government to leverage the expertise, technology, and financial resources of private companies to enhance the efficiency and effectiveness of waste management practices. In order to foster the development of PPPs in waste management, the Chinese central government has implemented a range of policies and initiatives which states that the local governments should adopt PPP in solid waste management. One such policy emphasizes the significance of PPPs in promoting environmental sustainability and encourages social investment under the Guiding Opinions of the State Council on Innovating Investment and Financing Mechanisms in Key Areas. This policy sets the objective of involving social capital in the construction and operation of municipal infrastructure, recognizing the crucial role of PPPs in achieving this goal. Further, specific provinces in China, such as Fujian in the east and Yunnan in the west, have mandated the use of PPPs as the sole method for treating rural solid waste in line with the policies published by the government.

Additionally, specific departments such as China Public Private Partnerships Center and PPP Projects Promotion Office were set up by the central government under various ministries and departments to expedite the approval and implementation process of PPP projects. Soft measures such as high performance by government officials in PPP project implementation have also been considered as a factor for internal promotion within government by various municipalities and autonomous provinces. The use of PPP models, especially in the waste disposal/ treatment stage has been given impetus by the Government of China through incentives in the form of economic and reputational benefits.

Notably, PPP model is very commonly seen in China in WTE facility development. The promotion of WTE plants through PPP model was achieved by implementation of various policies and regulations that create a conducive environment for the development and operation of WTE facilities. These include:

- Introduction of a fee collection mechanism for MSW treatment, which helps offset some of the investment costs and ensures the financial sustainability of the facilities.
- Encouragement of private sector participation through financing and operating MSW treatment facilities with concession agreements.
- Granting preferential electricity tariffs for power generated from WTE facilities.
- Promotion of third-party treatment of environmental pollution, which includes the application of the PPP model in WTE projects.

WTE projects in China receive sector subsidies in the form of feed-in tariffs and subsidies from provincial and central governments. The power grid enterprises were mandated by the government to purchase the electricity from renewable power generation projects such as WTE. Additionally,

companies engaged in energy conservation and environmental protection, including WTE, benefit from preferential taxation policies such as income tax exemptions and reductions.

Also, the implementation of the "Notice on the Comprehensive Utilization of Resources and Other Products VAT Policies" included a measure to promote the advancement of WTE projects through a tax incentive. Under this policy, the government guaranteed an immediate refund of Value Added Tax (VAT) collected from the sale of electricity or heat generated by using MSW as fuel, provided that MSW constitutes more than 80% of the total fuel utilized. Similarly, the PPP model is also used for other waste management activities such as commercial collection, operation of transfer stations, transportation, treatment and disposal facilities, material separation and recycling.

4.2 SERVICE PERMITS/LICENSES FOR WASTE MANAGEMENT ENTITIES

As discussed earlier, private sector involvement in waste management is facilitated through the issuance of service permits/licenses to waste management entities. The legal regulations and measures established for the purpose of waste management enable private enterprises to actively participate in activities related to waste collection, cleaning, transportation, processing/treatment, and disposal, thereby contributing to the municipal solid waste management system. In addition to their operational roles, these entities also play a crucial role in promoting public awareness of environmental protection.

According to the regulations, enterprises seeking to engage in commercial cleaning, collection, transportation, and disposal of waste must obtain a service permit. These permits are granted by the environmental and sanitation departments of municipalities, cities, and counties. To be eligible for obtaining a permit for engaging in cleaning, collection, and transportation activities, the entity must meet certain requirements. The entity should be a legal person, meaning it must be a registered business entity recognized by the law and the registered capital of the company should be in specific thresholds provided under the law. The process of issuing service licenses follows fair methods, typically involving a bidding process where the successful bidder is awarded the license.

Through the framework of service permits/licenses, the private sector is encouraged to actively participate in waste management activities, ensuring efficient and responsible handling of waste while raising public consciousness about environmental preservation.

4.3 GOVERNMENT INCENTIVES AND SUPPORT

The Chinese government is actively encouraging the involvement of the private sector in waste management activities by implementing various incentives and measures. One such measure is the facilitation of green financing and increased credit for projects aimed at preventing and controlling environmental pollution caused by solid waste.

Under the 1995 regulation, the government offers tax incentives to businesses that are involved in preventing environmental pollution caused by solid waste. Further, enterprises engaged in pollution prevention and control are granted preferential tax incentives, with a reduced income tax rate of 15% as mentioned in the Climate Change Action policy of 2022. Moreover, waste-to-energy plant operators

are also granted an exemption from environmental protection tax as long as their pollutant discharge adheres to both national and local standards.

Another incentive offered by the government is in the form of subsidies. Enterprises that generate electricity from waste-to-energy projects are eligible to receive government grant subsidies. These subsidies are granted to power generation project enterprises that have been engaged in WTE for approximately 15 years since their first production. Additionally, China has recently implemented a ban on the import of waste. With the implementation of the ban, the government aims to strengthen domestic recycling and reduce reliance on imported waste. It also creates opportunities for the private sector to develop and invest in local waste management infrastructure, technologies, and recycling facilities.

The abovementioned measures collectively contribute to fostering private sector participation in waste management and driving the development of a more sustainable waste management system in China.

4.4 SOFT POLICY MEASURES IMPLEMENTED THROUGH FIVE-YEAR PLANS

Through its five-year plans, the Chinese government has made significant investments in environmental protection activities. In the 12th five-year plan, a budget of 3.2 trillion yuan was allocated for initiatives, including infrastructure projects for the construction of facilities to treat and dispose of urban garbage. It demonstrated the government's commitment to MSW management.

In the 13th five-year plan, the focus shifted towards PPPs, franchise operations, and government procurement of services. It stated the goal to encourage non-governmental capital to participate through investments, construction, and operations. The plan also addressed the urban-rural divide by extending urban public services to rural areas, aiming for consistent public service systems and standards across both urban and rural regions. Within the waste management framework, the government aims to implement a pilot plan for "zero-waste cities" to minimize waste generation, , promote recycling and reduce environmental impact of solid waste. The plan emphasizes green development and highlights the importance of waste recycling.

China recognizes the need for collaboration among all stakeholders to create a waste-free nation. To achieve this vision, China has launched the program "Being a Contributor to Beautiful China," which encourages active participation from the entire society in building an ecological and positive environment for all residents.

5 CONCLUSION

Both China and India are highly populated countries, and both, with their large population and rapid urbanisation, generate a large amount of waste and face immense challenges in solid waste management. Like India, China has also implemented various strategies to address these issues, including waste sorting programs, and investment in waste treatment infrastructure. China has

advanced its waste management infrastructure by creating incineration facilities and developing WTE plants to manage its increasing waste generation.

The country encourages private participation in the sector and PPP model is one of the most common employed for the same. To achieve timely approval and implementation of PPP projects, the Chinese government has developed dedicated departments such as China Public Private Partnerships Center and PPP Projects Promotion Office. The Chinese government has also established reward system for high performing bureaucrats to promote private sector participation in the waste management. It has also implemented regulatory framework that promotes private participation through licensing method.

Additionally, preferential electricity tariffs and other tax incentives are provided to businesses that are involved in preventing environmental pollution caused by solid waste. Not only that, enterprises engaged in pollution prevention and control are granted preferential tax incentives, with a reduced income tax rate of 15%. China's implementation of WTE plants and incentivizing measures has contributed to significant progress in solid waste management.

INFORMAL SECTOR WORKERS IN WASTE MANAGEMENT

1 Overview of Informal Waste Workers in India

Informal sector workers are key stakeholders in the waste management ecosystem of India. The informal sector consists of units operating at a low level of organisation with little or no division between labour and capital, as factors of production and on a small scale. Therefore, rather than contractual agreements with formal guarantees and proper labour relations, informal workers are those they are dependent on casual employment, kinship, and personal or social connections. In the Indian context, as per the National Commission for Enterprises in the Unorganised Sector (NCEUS), informal workers are those employed in unorganised enterprises or households, excluding regular workers with social security benefits and workers within the formal sector without any employment or social security benefits provided by employers. Reportedly, approximately 93% of the total workforce in India comes from the informal sector. However, there is no comprehensive data identifying the number or the percentage of waste workers employed in the informal sector workspace. Globally, on the other hand approximated 80% of the 24 million waste workers in the world are informal workers. In this chapter, we have endeavoured to the identify the proportion of population engaged in informal SWM work, the different types of waste workers, their social – economic conditions, various challenges they face on a day-to-day basis and the kind of support they require to improve their living conditions.

1.1 POPULATION OF WASTE WORKERS

Informal sector plays a vital role in waste management in India. The nature of the job and fragmented mode of engagement of informal sector workers in waste management creates difficulty in having accurate data regarding waste workers in the informal space. As stated earlier, there is no official data on how many people in India are employed as waste workers. However, the MoHUA in 2016 estimated that India constitutes approximately 10% of the global waste picker community, which comprises about 1.5 million persons. Further, as per 2017-2018 estimates, 0.5% of the total employed population in India is engaged in informal waste picking. It is pertinent to note that the community of waste pickers forms only a part of the informal sector workforce engaged in waste management. India's informal waste workforce comprises a community of waste collectors who play an integral role in collecting waste and delivering it to recycle. However, the datasets collected by national and international organisations on waste pickers do not distinguish between the two types of waste workers within the informal sector, leading to a scarcity of data regarding this community of workers.

1.2 INFORMAL WASTE WORKER GROUPS AND THEIR ACTIVITIES

Generally, there are two broad classifications of informal waste workers: **waste pickers** and **collectors.** This distinction between informal waste pickers and waste collectors have also been incorporated with the SWM Rules 2016. SWM Rules define a waste picker as a person or group informally engaged in the collection and recovery of reusable and recyclable solid waste. They operate at various location including streets, , material recovery facilities, processing and waste disposal facilities to earn income for their subsistence. Waste pickers can be further classified into different waste worker groups such

as street waste pickers, waste picking from collection vehicles, dumpsites and landfills, and fixed waste pickers based on their activities.

The **first typology** of waste pickers is street waste pickers. They recover recyclable material from mixed waste discarded in the community bins before formal waste collectors collect it. Street pickers tend to collect either moderately soiled or unsoiled material that can be cleaned. They focus on material that has high recycling value. Waste pickers usually sort the material and sell each category separately to obtain better rates. Traditional waste pickers or generally referred to as kudahwallahas, do not own any mode of transport. They recover recyclable materials from mixed waste, bus terminals and train stations, street markets, and around municipal waste collection points. The **second typology** consists of waste picking from collection vehicles. They collect recyclable materials that are recovered from vehicles transporting MSW to landfills and dumpsites. Waste picking from dumpsites and landfills constitutes the **third typology** of waste pickers. They often sift through garbage at dumpsites and landfills before treating it. Communities that live near dumpsites carry forward this work to support their livelihood. The **fourth classification** of waste pickers includes fixed waste pickers collecting organic refuse and other recyclable materials. In cities, fixed waste pickers are formally integrated as service providers for refuse collection, and they are authorised by the municipal authority to collect user fees for household waste collection.

The second grouping of informal waste workers other than waste pickers is **waste collectors.** They include individuals, associations, or waste traders sorting, selling and purchasing recyclable materials. Among informal waste collectors, there exist itinerant waste buyers (raddiwalas, as locally addressed in India). They come to doorsteps, usually in their vehicles, and purchase high-value recyclable material and sell in large quantities of well-sorted clean material at a higher price to the specialised waste traders (kabadiwallahs) who accumulate a particular material and sell it to recyclable plants. Further, Kabadiwalas engage in fine sorting and cleaning recyclables at a higher level of the waste chain. As a result, kabadiwalas earn more than waste pickers. They collect plastic, cardboard, glass and plastic bottles, PVC, glass, paper, shoes, wood, tyres, white paper, iron, files and thermacol. Scrap dealers or the kabaddi system act as a vital link in the overall waste management in India. They can be compared to micro-entrepreneurs who buy reusable and recyclable materials. This system purchases 70-75% of recyclable materials from households and commercial establishments.

Lastly, the solid waste management system consists of **waste processors**. They purchase specific grades of post-consumer scrap material from kabadiwalas and scrap dealers. Further, they convert the bought material into secondary raw materials for the manufacturing industry.

2 Socio-Economic Conditions of Informal Waste Workers

The economic and social status of informal waste workers tend to vary significantly on the basis several factors such as the type of activity, the region of operation, type of equipment in their possession etc. Informal waste workers are reported to have a low-quality standard of living. They often develop health conditions like malnutrition, anaemia, and tuberculosis as they live close to dumpsites and landfills, and work under unhygienic and unhealthy conditions without public toilets, clean drinking water, and

Personal Protective Equipment ("**PPE**"). They are also prone to diseases like asthma, cholera, hepatitis, and eye and skin infection due to unsanitary community waste bins and dumpsites being breeding grounds for viral and bacterial diseases. They're also exposed to chemical hazards as harmful gases such as ammonia, methane, and other hazardous gases may be present due to waste biodegradation.

Additionally, they earn significantly less compared to kabadiwalas, small and big junk dealers, leaving them financially vulnerable. Studies have shown that the income generated by waste pickers is below the poverty line set by the Planning Commission of India. Furthermore, waste pickers are also vulnerable to harassment. Various studies have highlighted that waste pickers in India have undergone police custody at least once in their lifetime, especially in Kolkata resulting in payment of hefty fines and bribes. However, due to the sector's informal nature, waste workers don't have any anti-harassment policies and penalisation.

Unfortunately, waste picking is not viewed as a decent and dignified occupation. Dalits and other marginalised castes primarily collect waste, and consequently, still struggle for their fundamental right to decent and respectable living. According to a study in Andhra Pradesh, 723 Dalit Bahujan workers pick up street waste, and 77 workers pick up garbage from dump yards. Additionally, their socio-economic conditions leave them susceptible to exploitation by traders. Most women waste pickers have not learned what price trader resells the products and therefore, have little to no bargaining power. Another vulnerable section of waste pickers are children. Despite waste picking being included in the Schedule for Hazardous Occupations in 2001, child labour continues to be employed in the informal waste management sector. Migrant workers from inter-district and inter-state are another disadvantaged group living without any support in new cities. Their identity as a migrant also affects their capability to enforce their rights. It is estimated that among 3 lakh to 6 lakhs ragpickers in Delhi, 80% are migrant labourers from the Muslim community of West Bengal.

Owing to the reasons mentioned above, informal waste workers are often marginalised community deprived of basic necessities. The Secretary–in-charge of Urban Development in the States and Union territories has been entrusted with the duty to create a scheme for the registration of waste pickers and waste dealers by virtue of Rule 11(M) of the SWM Rules of 2016. However, the policy does not provide a mechanism for the identification of targeted beneficiaries. Hence, UNDP in its 2021 report, recommended establishing concrete steps for identifying beneficiaries through Aadhar cards, ration cards, and Jan Dhan accounts, which will help them enrol into schemes developed for their well-being. Based on secondary research, the following profile of informal waste workers in India have been developed:

Socio-Economic Profile of Informal Waste Workers in Solid Waste Management in India		
WASTE PICKERS		
Waste pickers from households		
	Age profile	• Less than 20 years: 5% of the informal waste pickers.

		• Between 20 and 40 years: 64% of the informal waste pickers. • Between 40 and 60 years: 26% of the informal waste pickers • Above 60 years: 5% of the informal waste pickers
	Type of waste collected	Data is bifurcated based on waste pickers with vehicles and without vehicles.
	Revenue from the waste collected per kg	Bifurcated based on waste pickers with vehicles and without vehicles.
	The total quantity of waste collected in a day	60-90kgs per day
Waste pickers with vehicles		
	Age profile	No furnished data is available.
	Type of waste collected	Food items, hair, and thermocol
	Revenue earned from the waste collected per day	Rs, 1,200 -1,500 per day
	The total quantity of waste collected in a day	No furnished data is available.
Waste pickers without vehicles		
	Age profile	No furnished data is available.
	Type of waste collected	Either moderately soiled or unsoiled material that can be cleaned. Focus on material that has high recycling value.
	Revenue earned from the waste collected per kg	No furnished data is available.
	The total quantity of waste collected in a day	No furnished data is available.
Waste pickers from landfills		
	Age profile	No furnished data is available.
	Type of waste collected	No furnished data is available.
	Revenue earned from the waste collected in a day	No furnished data is available.
	The total quantity of waste collected in a day	No furnished data is available.
Iterant waste buyers		
	Age profile	No furnished data is available.
	Type of waste collected	High-value recyclable material and sell in large quantities of well-sorted clean material at a higher price to specialised waste traders.
	Revenue earned from the waste collected	No furnished data is available.
	The total quantity of waste collected in a day	No furnished data is available.

Kabadiwalas		
	Age profile	No furnished data is available.
	Type of waste collected	plastic, cardboard, glass and plastic bottles, PVC, glass, paper, shoes, wood, tyres, white paper, iron, files and thermacol
	Price at which Kabadiwallahs take materials from waste pickers per kg	Subjected to change depending upon the quantity and type of material collected. For example: • Cardboard: Rs. 5/kg • Plastic bottles: Rs. 15-16/kg • PVC: Rs. 8/kg • White paper: Rs. 3/kg • Glass bottles: Rs.1/per bottle • Files: Rs.6/kg
	The total quantity of waste collected in a day	No furnished data is available
Small junk dealers		
	Age profile	No furnished data is available.
	Type of waste collected	Coloured, milky and natural polypropylene, panni (plastic bag), dabbas in high density, plastic bottles, milk packets, black plastic, kadak, red bottles, and HM (mixed high density)
	Price at which small junk dealers take material from Kabadiwallahs	Subjected to change depending upon the quantity and type of material bought. For example: • Coloured polypropylene: Rs. 32-33/kg • Milky polypropylene: Rs. 40-42/kg • Natural polypropylene: Rs. 50-51/kg • Panni: Rs. 31/kg • Milk packets: Rs.22-23/kg
	The total quantity of waste collected in a day	No furnished data is available

Note: Figures are subject to change depending on the municipality.

3 Other Challenges and Barriers

Even though the informal sector plays a significant role and contributes to waste management, it encounters numerous challenges. Their activities are often unregulated and operate outside the formal waste management system, leading to issues in monitoring and coordination. The SWM Rules emphasize the importance of inclusion of the informal sector in waste management. Although several duties and responsibilities in relation to it informal workers are entrusted to the local authorities and panchayats under the SWM Rules, it is not given adequate priority under the local authority's agenda. Furthermore, the current policy framework does not cover aspects that recognises their legal protection and proper integration into the sector. There is need to improve the existing legal framework to clearly outline the necessary steps required to sufficiently acknowledge their crucial role

in addressing waste issues. It could incorporate actionable steps that may be undertaken by the municipalities to improve their living conditions, safety and health.

In addition, one of the biggest challenges in their integration is the limitation in terms of support from stakeholders, as the authorities and people often mistreat them. Furthermore, the mode of waste collection often involves searching for various sources of waste generation, which can be a challenging task. It is not uncommon that the informal sector faces restrictions and is not granted access to public places and private properties, leading to difficulties in collecting waste. They often face harassment and obstacles while performing their work. In addition to access issues, the informal waste workers are vulnerable to exploitation. Reports and studies indicate that some contractors and authorities take advantage of these workers and fail to provide them with fair compensation for their services. Moreover, the informal waste sector often operates under hazardous conditions at dumping sites and other unsanitary locations without proper safety precautions. As this sector mainly comprises marginalized and economically disadvantaged individuals, they lack the means and capital to ensure their safety through protective measures. Hence, they are exposed to various health and safety issues making them prone to health hazards. Owing to lack of adequate awareness regarding the importance of segregation and insufficient segregation of household waste, they also end up spending a large amount of time at waste dump yard which are potentially hazardous environments.

4 Legal Framework

The implementation of the SWM Rules by the government marked a significant step in recognizing and legally acknowledging the informal sector's role in waste management which was absent in the previous MSWM Rules. The SWM Rules played a pivotal role in integrating the informal waste sector into the formal waste management system. The law demonstrated that the government intent to acknowledge and appreciate the contribution made by the informal sector workers in the waste management framework of the country.

SWM Rules imposes a duty on the State Government to implement and introduce state policies and strategies that acknowledge the primary role played by the informal sector in reducing waste and provide broad guidelines for their integration into the waste management system. The state Governments are also entrusted with the responsibility for implementing a scheme for the registration of waste pickers and waste collectors. The law obligates the municipal authorities to establish a system recognising the informal sector and their integration to promote and facilitate their participation in SWM. Further, it imposes a duty on the ULBs to take steps in waste management training and provide incentives for recycling services done by the informal sector. Furthermore, the Plastic Waste Management Rules 2016 have also recognised the roles of waste pickers. It imposes a duty on the ULBs to set up, operate and coordinate the waste management system for effectively engaging with civil societies and groups working with waste pickers.

While the SWM Rules 2016 gives direct recognition for informal workers in the waste sector, other laws and policies have been implemented which is applicable on the unorganised sector at large. In India, the terms unorganised sector and informal sector are used interchangeably. The Government of

India introduced the Unorganised Workers' Social Security Act 2008 ("**UWSSA 2008**"), which provides social benefits and recognition to the unorganised sector. According to the UWSSA 2008, an unorganised sector includes enterprises owned by individuals or self-employed workers, where the number of workers is less than ten and are producing or selling goods or providing services of some kind. This legislation aims to provide social security and welfare benefits to workers in the unorganised sector. Under the UWSSA 2008, the central government at the national level has implemented the scheme Pradhan Mantri Shram Yogi Maan-dhan (PM-SYM) to improve the status of the unorganised sector. The scheme also covers unorganised workers working as waste pickers.

Further, even though the national law specifying the informal sector in waste came in 2016, few states had taken initiatives prior to SWM Rules to include informal sector workers in SWM framework through their power and duty laid under the Constitution. In 1999, the Maharashtra state government issued an order to municipalities to provide identification cards to waste pickers. Subsequently, in 2002, another order was issued, mandating municipalities to assign the task of collecting waste from households, shops, and markets to organisations and co-operatives of waste pickers. Furthermore, certain municipalities have also implemented laws and introduced initiatives for integrating the informal sector into waste management services:

*In **2006**, the **Municipal General Body of Mumbai** enacted a bye-law called **the Greater Mumbai Cleanliness and Sanitation**, which aimed to enforce waste segregation and enable the allocation of dry waste sorting to registered co-operative societies of waste pickers or other relevant agents.*
*Similarly, **Pune Municipal Corporation** passed General Body Resolution No. 476 in 2007 to **establish and endorse the creation of a central co-operative**. The co-operative was intended to integrate waste pickers into door-to-door solid waste collection.*
*Since **1992**, waste disposal schemes have been implemented by the **Municipal Corporation Hyderabad**, which provides a system for the integration of formal and informal sectors in waste management. The model was developed with the help of NGOs and Community-based Organisations and involves a collaboration between **UNICEF**, the **UK's Department for International Development (DFID)**, and city-based voluntary organisations to rehabilitate waste pickers. The scheme introduced a door-to-door collection scheme with the help of waste pickers and other informal recycling sectors.*
*In **Spain**, a waste co-operative comprising waste pickers, was established in **2015** through the efforts of **Labcoop**, a City Council organisation. Labcoop provided a three-year grant to support the collection of home appliances, scrap metal, and other household waste. The **government of Barcelona offered around 75% of the funding** to the waste cooperative, while the remaining **25% came from sponsors**.*
***Nanjing, China,** also focused on recognising waste pickers' role in enhancing MSW recycling and proposed similar solutions as that for India. The scholars proposed establishing a **community-based semi-official waste picker organisational framework**. The case suggested that the government must pass managerial authority over urban solid waste to commercial companies to organize pickers and improve their economic contribution. Some cities in China have passed managerial authority over urban solid waste to commercial companies. These companies directly recruit waste pickets for **MSW-related activities**. However, only a small share of waste pickers can be hired by these companies, and the resulting activities of these companies are hindered by the conflict of interest with the rest of the waste*

pickers. Therefore, considering the vast number of WPs, the city government will have to manage waste pickers properly to reduce social risks and realise their inclusive growth. Thus, scholars have proposed a pilot structure to develop a new semi-official waste picker organizational framework based on community participation.

In addition, the Indian States, as per the requirement laid under the SWM 2016, have implemented policies within their jurisdiction for SWM activities, including policies for improving the living conditions and other social aspects of informal sectors working in waste management. For example, the State of Karnataka implemented Karnataka State Urban Solid Waste Management Policy 2020 adopting social principles for recognising and involving the informal sector workers in waste management services. It provides various guiding principles that are to be followed in the Karnataka while carrying out waste management activities. The policy focuses on ensuring health, welfare and dignity, promoting and protecting the safe and decent livelihoods of waste pickers, waste collectors and aggregators. It states that the ULBs should ensure safety and make sure PPE is used by the waste workers when employed by a third party or by themselves. Additionally, ULBs must take steps towards medical check-ups of occupational diseases and treatment of injuries resulting from SWM activities under applicable welfare schemes. The policy also highlights the role played by the informal sector and the need for implementing provisions to integrate informal waste sector into the SWM system by ULBs.

5 Role of the Private Sector

A collaboration between the public and private sector offers cost-saving solutions and the introduction of new technologies. It can enable Indian cities and urban authorities to effectively and efficiently address significant needs like improving and increasing access to SWM services. Thus, greater participation from private sector and commercial orientation can help marginalised communities avail more benefits.

Integrating the informal sector within the formal system is highly beneficial for the private and informal sectors. The private sector participation could use the inclusion of the informal sector through direct collaboration. Private companies involved in recycling can reduce transportation and collection costs with the help of the informal sector. The informal sector can economically help them by delivering recyclable items. Notably, a private company in India utilised the services of informal sector workers as part of the CSR initiative. The entity took significant strides to support women employed in the informal sector by involving them in tasks such as picking, segregation, and recycling of waste. This proactive approach has resulted in the diversion of more than 25 metric tons of waste per day from landfills at each location. It led to an improvement in the living conditions of the informal workers in terms of safe working conditions and better earnings. Further, in countries like Brazil, municipal government of City of Curtiba is promoting integration of private sector with informal sector by engaging private waste management company to collaborate with waste pickers' co-operatives. The mechanism employed is such that the private company undertaking the waste management project shall be obligated to provide recyclable materials to waste picker cooperatives. The government of Brazil has also uplifted the waste picking community by granting them legal recognition and incentives.

The case study of Curtiba highlights the significant positive impact collaborations can have on waste diversion, environmental sustainability, and socio-economic development. An arrangement between formal and informal sectors can enhance the recycling system and help in diversion from landfill and reduce illegal dump yards leading to the overall achievement of waste management.

Following is a list of case studies form India where informal workers were integrated into the formal system of SWM:	
Chennai City	
Under the Clean and Green Madras City Project, the Municipal Corporation of Chennai innovatively forged a novel alliance encompassing the public, community, informal, and private sectors. This initiative focused on the rehabilitation of children engaged in street waste picking. The project's strategy involved compensating these children through NGOs and subsequently engaging them to contribute to street maintenance efforts. A community-based voluntary organization under this scheme created a community-private alliance by integrating local rag pickers for sweeping and collecting waste.	
Presence of various interventions	
Policy interventions	Yes, but they were not specific to support this model.
Economic or Financial instruments employed	No economic or financial instruments were employed.
Institutional or organisational intervention	Yes, partially, but the local government was not involved.
Social interventions	Not mentioned
Characteristics	
Technical	Yes
Initiator	CBO Exnora
Externally financed	No
Hiring scheme	Recyclers were employed as individual workers.
Achievements and Limitations	
Achievement	This resulted in high community involvement and reduced household waste tariffs. It also resulted in financial viability and an increase in the quality of employment for street beautifiers.
Limitation	There needed to be more coordination among the stakeholders.
Mumbai City (eastern and western parts of Vikhroli)	
A successful collaboration between the private sector and informal waste pickers was achieved through their Good Green Policy of Godrej. Godrej employed 45 women waste pickers from Self Help Groups to manage residential waste, promoting sustainable practices while providing fair wages and employment benefits.	
Presence of interventions	
Policy interventions	Godrej (private actor) focused on sustainable initiatives under the 'Good and Green Policy'. The policy mandated look into two goals, specifically environmental and social sustainability.

Economic or Financial instruments employed	Yes, in establishing STPs and ETPs.
Institutional or organisational intervention	Not mentioned
Social interventions	Not mentioned
Characteristics	
Technical	Yes
Initiator	Godrej Society
Externally financed	No
Hiring Scheme	45 women waste pickers from Deonar Dumping Ground were employed to manage the waste of the residential colonies
Achievements and Limitations	
Success	Forty-five women were employed, and they were also made part of a self-help group (SHG), which ensured that they would get their minimum wages and other employment benefits such as ESIC, EPF (Employee Provident Fund), and safety gear (gloves, jackets and closed shoes). Further, the industrial complex extended its waste management to the residential colony that houses its employees in 4500 apartments.
Limitations	The limitation faced was that the municipal truck started mixing their waste because segregation was not the work of residents. However, the SHG helped with the segregation and managed to segregate the organic from the inorganic. Recyclekaro.com comes to pick up the recyclables, and electronic waste is collected periodically (not as often as the recyclables).
Pune City	
SWACH waste pickers were integrated in an initiative of Pune municipality along with a private organisation for effective waste segregation in Pune.	
Presence of interventions	
Policy interventions	Yes, in late 2007, the Pune municipality mandated the implementation of Municipal Solid Waste Laws 2000 across all cities, catalysing the initiative's growth.
Economic or Financial instruments employed	Not mentioned
Institutional or organisational intervention	Pune Municipal Cooperation
Social interventions	Not mentioned
Characteristics	
Technical	No

Initiator	BCG Foundation
Externally financed	No
Hiring Scheme	The 3,000 SWaCH waste pickers were integrated into the door-to-door waste collection. The collected recyclable items were segregated manually by the waste pickers on the premises of a waste generator, in sorting sheds, in the open or wherever they could find a space. The SWaCH waste pickers earn income from the user fee payment from households and the recyclable materials they sell to itinerant buyers and scrap shops.
Achievements and Limitations	
Success	The model attained significant success in improving the SWM system in Pune while also uplifting and protecting the livelihoods of its 3500+ informal waste worker members. The model saved an estimated 740 million rupees yearly in labour costs at statutory wage rates and 160 million rupees in reduced waste transportation and processing costs 3,000 rupees. The total estimated annual savings of 900 million rupees, when compared against the entire capital budget of Pune's solid waste management system, which, between 2018-2020, was approximately 5.9 billion rupees, shows the estimated financial savings during this period to be 2.7 billion rupees - an amount that the PMC would have had to budget for in the absence of the waste picker driven SWaCH Model. The savings from SWaCH waste pickers allow the PMC to undertake developmental activities to 2.7 billion rupees in 3 years.
Limitations	The model was vulnerable to external changes in the waste economy (price volatile) and shifts in national and local priorities. The core principle of user fee-based collection is politically volatile, with the PMC only enforcing the user fee through an administrative directive instead of a legally enforceable regulation.
Mumbai City	
The Municipal Corporation of Greater Mumbai spearheaded this initiative in collaboration with Community-Based Organizations (CBOs) and Non-Governmental Organizations (NGOs). The scheme was designed to facilitate the segregation of waste at its source, differentiating between biodegradable and recyclable materials. The program encompassed the organization of rag pickers and their training for efficient waste collection and composting practices	
Presence of interventions	
Policy interventions	Yes
Economic or Financial instruments employed	No

Institutional or organisational intervention	Yes
Social interventions	No
Characteristics	
Technical	Yes
Initiator	Non-government organisation (NGO)
Externally financed	Yes
Hiring Scheme	Association members
Achievements and Limitations	
Success	The system contributes to the decentralisation of waste service delivery (for increasing coverage rate); the user pays principle; the municipality monitors instead of delivering waste.
Limitations	CBOs and NGOs face problems due to non-participation from some community members. There were also problems with the revenue recovery from compost.

6 Framework and Strategies

In SWM sector, the informal sector comprises individuals, families, and small and medium private-sector enterprises working in waste management. The inclusion of the informal sector in waste management activities provides social, economic and environmental benefits to the waste management framework. They play significant role in reducing plastic waste, implementing better recycling figures, reduce costs, as well as lower disposal activities.

- *In Delhi and Bangalore , the informal sector has helped reduce waste landfilling by 15%, which helped municipalities save collection and disposal costs, accounting for approximately USD 13,700 per day.*
- *Similarly, SWaCH, a co-operative integrating informal waste workers in solid waste management, has helped the Pune municipality corporation save costs of approximately 12 crores per year and achieve efficient waste management. The co-operative workers are involved in door-to-door waste collection from various parts of the city. The municipality does not pay them a salary, but PMC pays for Equipment and Management Costs. Further, these workers earn money from user fees and the sale of recyclables. Therefore, municipalities could gain from integrating the informal sector into the waste management system.*

Further, the work of the informal sector is considered a green job. Thus, integrating their role in the waste management supply chain shall promote corporate social responsibility and sustainable development. Also, to effectively utilise their services and enhance their participation in the formal sector, there is a need to create local co-operatives or bodies for informal waste workers. This shall assist in bringing them together, creating a platform for the identification, registration and

disbursement of social benefits. Legal recognition beyond the existing level is also essential to guarantee their financial and social well-being. Such recognition shall also help corporates who wish to integrate their system with informal workers to bring value to their supply chain. To achieve this, there is a need for policies at national and state levels to promote their formal inclusion. The policies should provide measures for protecting livelihoods, establishing social security, healthcare, safety, insurance, while also improving the efficiency through training programs. Further, municipalities may have to undertake the duty of issuing identity cards for waste pickers, and facilitating the formation of co-operatives or small and medium-sized enterprises (SMEs).

Further policies must be adopted that encourages the municipality authorities and the private sector to collaborate with NGOs and co-operatives working for informal sectors in waste management sectors. In addition, the government can take measures to establish a system of formal contracts and agreements between waste management companies and informal waste workers by defining clear roles, responsibilities, and payment mechanisms to ensure fair treatment and accountability for all parties involved similar to the mechanism employed in Brazil.

Additionally, digitization can formalise the informal sector in a phased manner. For instance, the Kabadiwalla Connect incorporates technology on different levels to formalise the informal waste management services, and further, classify and integrate the informal sector workers into the formal waste-collection and recycling supply chain. Further details of their operation are elucidated below under “Case Study 1: the Kabadiwalla Connect”.

Case Study 1: the Kabadiwalla Connect

The Kabadiwalla Connect has undertaken revolutionary steps to digitise informal workers in its pilot project in Chennai. Developed as a point of sale (PoS) device, it help a scrap shop located in Chennai, which enables the registration of waste pickers as suppliers and facilitate authorised transactions. This help recognise and integrate the decentralised informal sector service by leveraging technology, such as Information and Communications Technology, as well as IoT, to establish a network, including that of physical objects. The integrated digital platform initiative benefits informal waste pickers as well as government schemes. The classification of waste picker as level one aggregator and further tracking the volume and quality of waste collected is an innovative method that helps integrate the informal workers into the formal waste-collection and recycling supply chain. The system also works towards bridging the disconnect between informal sector workers municipalities, waste management companies, and other formal sector stakeholders.

In order to form and strengthen mutual partnerships between the formal and informal sector, Kabadiwalla Connect provides services of different types which includes :

***(1) Mapping:** Through mapping, it collects, processes, and analyses data, which helps classify and integrate the informal sector stakeholders based on their role and functions in the chain. The ISWMTrak (Integrated Solid Waste Management Track), which is Kabadiwalla Connect’s open-standard platform for its mapping services, provides ULBs, PROs, and Development Agencies with local data regarding waste generation and flow, infrastructure, illegal dumpsites, etc. It acts as integral tool for key decision-making and deploying practical solutions.*

(2) Digitisation: *It also provides for engagement across stakeholder lines by enabling KYC and transaction-based material tracking and traceability in both, formal and informal sectors.*
(3) Sourcing: *It enables procurement of secondary raw materials through the informal sector, to PROs and processors.*

In addition, initiatives have also been implemented by the government to improve the living conditions of informal sector while integrating their skillset to address issues in waste management. National Safai Karamcharis Finance & Development Corporation is one such government undertaking established as not for profit company to uplift the Safai Karamcharis and scavengers as well as their dependents.

In addition, initiatives have also been implemented by the government to improve the living conditions of informal sector while integrating their skillset to address issues in waste management. National Safai Karamcharis Finance & Development Corporation is one such government undertaking established as not-for-profit company to uplift the Safai Karamcharis and scavengers as well as their dependents. It provides Government-backed support to informal workers by way of schemes and programs. Workers can avail loans under various schemes, such as Mahila Samridhi Yojana (MSY), Micro Credit Finance (MCF), Education loan (EL), etc. offered at significantly reduced interest rates and favourable terms. Additionally, awareness programmes, job fairs, skill development and training programs, and workshops are also offered as non-loan-based schemes.

WOMEN'S PARTICIPATION IN THE WASTE MANAGEMENT SECTOR

1 Gender Composition and Representation

The gender composition and representation within the waste management sector play a crucial role in promoting inclusivity, diversity, and equal opportunities. Waste as a product and its value as a resource is heavily dependent on who has control and access to it. Therefore, gender roles and their dynamics have a significant impact on the value of resources disposed of as waste. Understanding the role of women and their contributions is crucial in identifying disparities and developing strategies to enhance their participation in the solid waste management sector.

In India, a substantial portion of MSW is generated from households where women are actively involved in domestic services. Recognizing and understanding women's role in waste management is essential to establish the interlinkage of waste from the household level to the municipal level, and thereafter to disposal, recycling and processing facilities. This interlinkage supports the system of a circular economy within waste management, which focuses on resource recovery and reuse.

Although waste management is a field that affects the entire population, the participation of women has often been overlooked or restricted to specific roles. Presently, there is limited gender-disaggregated data on women employed in the waste management sector. Further, studies have indicated that more than half of the 15-20 million workforces engaged in informal waste collection globally is women. Gender gap of 64.3 % and parity of less than 40% in economic participation and opportunity also suggests that the status of women in the India is far from ideal.

Women's participation in the waste management sector occurs at various levels and activities and their involvement has shown to yield better results. However, there are significant gender dynamics with women's participation in the formal sector with higher positions being limited and largely male-dominated.

The extent of women's participation in waste management activities also varies across countries. In the United States, waste collection is predominantly carried out by men, while in India, women play a significant role in waste picking, with 49% of waste picking being handled by females. The women's participation also differs within India as, according to a study conducted in Pune, it was observed that 90% of street recycling pickers in the city is performed by women. In upper-middle and high-income countries, women hold high management profiles, including project managers and directors, and are part of diverse teams. Conversely, in countries like India, women's participation is more concentrated in collection, cleaning, and other initial stages.

The gender imbalance in waste management, with men predominantly occupying technical and managerial positions, is attributed to various factors such as societal norms, cultural biases, and stereotypes associated with waste collection and disposal. It has been noted that when waste management is institutionalised as a medium of earning and labour-intensive, men are given more

opportunities than female. The institutional waste management sector is typically male-dominated, while women participate at the household level or in unorganized paid labour systems.

However, women are increasingly becoming established female entrepreneurs and innovators in the sector. There are numerous women-led initiatives that have provided creative solutions and economic opportunities, benefiting both the community and the environment. For instance, companies like Daily Dump and Orbin, founded and run by women, offer innovative products for composting waste at home and in institutions.

Recognizing the contributions and potential of women in waste management is essential for promoting inclusivity, sustainability and maximizing the value of waste as a resource. By addressing gender disparities and implementing strategies that empower women, an equitable and effective waste management sector that harnesses the full potential of all individuals involved can be developed.

2 Importance of Women's Inclusion and Empowerment

Integration of women in waste management is integral not only for their upliftment in the society but also for the overall improvement of solid waste management system. Studies have indicated that the term 'waste' has different meanings for women and men. It is now internationally accepted that the concept of waste is not gender-neutral. For example, items that may appear as old and disposable clothes to men could be kitchen cloth or cleaning cloth for women.

Separation of waste which is a key concern for optimizing value of waste as a resource is often done in the households where the task of cleaning and dealing with solid waste is allocated to women. The responsibility of keeping households clean and devoid of waste is either the duty of the woman of the household or domestic services employed for the purpose which largely comprises of women. In such scenarios, the way women handle waste plays a larger role in the classification of waste and its potential for recycling or reuse. Therefore, involving women in waste management processes is crucial for effective waste segregation and maximizing resource recovery.

Women's diverse perspectives based on their unique experiences and knowledge of household waste streams can contribute to a more comprehensive understanding of waste management challenges and promote sustainable consumption patterns. Additionally, by including women in the sector and providing them with equal opportunities, gender roles and stereotypes can be challenged and broken. Women's inclusion in higher positions, formalised activities and decision-making roles within the waste management system helps dismantle gender-related barriers and promotes a more inclusive and diverse workforce.

For instance, Sanju Devi, an e-rickshaw driver trained by the Patna Municipal Corporation for door-to-door collection of refuse, defied societal norms and paved the way for other women to follow suit. The initiative taken by the Patna Municipal Corporation to train several women as drivers not only challenged societal norms but also created opportunities for women in the waste management sector. Through their roles as e-rickshaw drivers, these women have gained access to steady salaries and financial stability, thus promoting social security and economic independence.

Furthermore, women's inclusion in waste management has a direct impact on the health and sanitation of communities. They contribute to the design and implementation of effective waste collection systems, ensuring proper waste disposal and reducing the risk of environmental pollution and associated health hazards. Women's involvement can also help address specific needs related to menstrual waste management and hygiene, promoting dignity and well-being.

Integrating women in solid waste management systems also add immensely to infrastructural development. For example, the Mission Shakti Self-Help Groups (SHGs) in Odisha, empowered by the Housing and Urban Development Department, have played a pivotal role in both waste management and infrastructure development. Around 2,378 SHGs in Odisha are presently employed in waste management services. In addition to activities such as collection, transportation, operation of treatment facilities etc, they are also involved in entrepreneurial pursuits of sale of manure prepared through solid waste. By actively participating in waste management and generating value from the waste stream, these SHGs contribute not only to a cleaner and more sustainable environment but also to public infrastructural development. Their efforts in solid waste management and the sale of manure demonstrate their entrepreneurial spirit and ability to generate economic opportunities within the waste sector.

Women entrepreneurs create employment opportunities for waste workers, especially women, leading to financial independence and improved living standards. Initiatives such as reCharkha, a social enterprise focusing on upcycling plastic waste, have provided livelihood to their workforce, 80% of which are women. Women's self-help groups and cooperatives, such as Stree Mukti Sanghatana also help uplift women waste workers by providing employment opportunities, literacy programs, access to microcredits, healthcare, and hygiene through initiatives such as Parisar Vikas.

Additionally, women's inclusion in waste management aligns with the Sustainable Development Goals ("**SDG**"), particularly SDG-5 on gender equality. By recognizing the gendered aspects of waste management and empowering women in this sector, progress can be made towards achieving gender equality, decent work and economic growth (SDG 8), sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12), and climate action (SDG 13). Overall, women's inclusion and empowerment in waste management not only contribute to environmental sustainability but also promote social security, safety, infrastructural development, and economic independence.

3 Barriers to Women's Participation in Waste Management

The barriers to women's participation in waste management are multi-faceted and deeply rooted in systemic factors that perpetuate gender inequality. Women constitute roughly half of the global population and contribute significantly to the workforce, devoting approximately 75% of the total work hours, including both paid and unpaid labor compared to men. However, when it comes to income distribution, women around the world receive a disproportionately smaller share. Globally, data reveals that only 35% of the total share of labour income belongs to women. Further, the share of total income attributable to women in India is merely 18%. These systemic issues and entrenched

inequalities that persist in society spills over into the waste management sector, impacting women's participation and opportunities within this field.

A major barrier within the waste management framework is the lack of meaningful involvement and participation of women throughout the decision-making processes related to solid waste management. Women often struggle to receive support and opportunities for decision-making roles and higher positions, relegating them to low-level waste management activities. Their work is frequently undervalued and invisible, reinforcing gender inequalities in the sector.

Furthermore, women encounter difficulties in accessing finance, technical resources, and market opportunities, which hampers their entrepreneurial endeavours in waste management. The percentage of women having property rights in India amount to 35% and 40% for land ownership and house ownership respectively. Moreover, although women actively engage in unpaid or informal waste management activities within their households and communities, they are often excluded once waste management activities become institutionalized and formalized, being replaced by men. As a result, men benefit from increased employment opportunities, while women remain in the informal sector or engage in voluntary work.

Income disparity between men and women also poses a significant barrier. Despite women's substantial contributions, they experience greater income instability and are paid less than men in the waste management sector. Studies reveal that although 49% of waste pickers in India are women, men earn around 33% more than women in this field, perpetuating economic disparities. Studies have also found that women are employed more in sorting process while men are allocated the duty to pick up materials and thereby creating gender segregation within the waste management network.

Further, there also exists problems of inadequate consideration of gender-specific needs and priorities and a lack of inclusion of gender-specific designs and gender-sensitive approaches in the waste management system. Work timings, isolated workplaces, poorly lit areas, etc. can pose safety risks for women, as it increases the likelihood of harassment or violence. Furthermore, women in waste management face significant infrastructure-related barriers like sanitation facilities, adequate toilets, and washing facilities. These shortcomings in infrastructure exacerbate the already existing barriers, further impeding their active engagement and contributing to an unsafe work environment. Women's health is also often affected due to waste picking and household waste management. Lack of proper infrastructure and sanitation exposes them to higher health risks, including diseases like hepatitis, diarrhea, and eye/skin infections. Addressing these barriers requires addressing gender inequalities and creating an inclusive waste management sector that values and supports the active participation of women.

4 Case Studies and Best Practices

In this section, we have highlighted certain successful examples of women-led waste management enterprises and innovative initiatives promoting women's participation in the waste solutions sector.

4.1 SUCCESSFUL EXAMPLES OF WOMEN-LED WASTE MANAGEMENT ENTERPRISES

A private enterprise led by a woman entrepreneur that has created substantial impact in the life of informal sector workers in waste management is HasiruDala of Bangalore. A brief on the organisation and the activities undertaken by them is provided in the table below:

Enterprise: *HasiruDala (Green Force in the Kannada language)*
Founded by: *Nalini Shekhar*
Location: *Bangalore*
Waste management activities: *Empanelled Service Provider for Bangalore's Municipal Corporation for bulk waste generators, and undertakes all waste management services including event waste management for hosting eco-friendly events.*
Revenue generated for the year 2020: *Rs. 4.77 crores*
HasiruDala, led by women entrepreneur Nalini Shekhar, is an organization at the forefront of waste management solutions in Bangalore, India. This innovative enterprise has successfully integrated informal waste pickers into a formal system, providing them with occupational identity cards and opening doors to various central social security benefits.

One of the key achievements of HasiruDala is its instrumental role in advocating for a change in the law to allow waste pickers to obtain identity cards. As a result of their efforts, Bengaluru became the first city in India to issue occupational identity cards to waste pickers from the unorganized sector. These identity cards have transformed the lives of waste pickers, granting them social entitlements and benefits from the city, state, and government.
By providing waste pickers with occupational identity cards, HasiruDala has not only brought them into the formal system but has also empowered them with a recognized occupational identity.

In addition to its impact on waste pickers, HasiruDala plays a pivotal role in the waste management sector itself. The enterprise offers comprehensive waste management services for bulk waste generators and specializes in eco-friendly event waste management. Through their sustainable practices, HasiruDala has emerged as a leader in promoting responsible waste management.

The success of HasiruDala is evident not only in its social impact but also in its financial achievements. With a revenue of approximately INR 4.77 crores in the year 2020, the enterprise has demonstrated that environmentally conscious waste management solutions can be both socially impactful and financially sustainable. HasiruDala serves as an inspiring example of how woman entrepreneurship can drive positive change in waste management, empowering informal waste pickers and creating a more inclusive and sustainable society.

Apart from HasiruDala, there are several women entrepreneurs in India who have made a meaningful contribution to the waste management sector. These enterprises have not only implemented innovative solutions but also integrated women into their initiatives, promoting gender equality and empowering women in waste management.

Saahas Zero Waste Organization

- Founded by **Wilma Rodrigues** in **Bangalore**
- Over **20 years** of experience
- Women make up **59%** of the workforce
- Contributing to **SDG 5**
- Programs such as **'Creating Decentralised Solutions'** and **'EPR Plastic Impact'**

reCharkha: The Eco-Social Tribe

- Founded by **Amita Deshpande** in **Hyderabad**
- Rural livelihood opportunities while **conserving the environment** and **local heritage**
- Upcycling plastic waste through traditional handlooms
- Livelihood for over **80%** of their workforce, primarily women
- Weaving and tailoring units in **Bhor village** and **Pune city**

Oorvi Sustainable Concepts

- Founded by **Maya Vivek** and **Minal** in **Hyderabad**
- Rejuvenates **floral waste** to reduce **environmental harm**
- Established a system for collecting floral waste from village temples
- Provide **employment opportunities to women** and also extend **educational and health benefits** to women and children

These women-led enterprises exemplify the entrepreneurial spirit and commitment to sustainable waste management practices in India. By integrating women into their initiatives, they have not only created economic opportunities but also fostered gender equality and made significant contributions to the waste management sector.

4.2 INNOVATIVE INITIATIVES PROMOTING WOMEN'S PARTICIPATION

In addition to above, cooperatives and self-help groups have also been set up in different parts of the country to mobilise the potential of women waste workers in the country. Two notable examples of such SHGs and cooperatives are as follows:

Gitanjali Cooperative – Ahmedabad

Cooperative: *Gitanjali Cooperative*
Established in: *1995*
Initiated by: *SEWA Cooperative*
Location: *Ahmedabad*

Gitanjali Cooperative *provides quality employment opportunities to waste pickers associated with its network. In response to the 2008 financial crisis that led to the crash of waste recycling industry, the cooperative established a production unit to manufacture value-added products from recyclable*

waste to improve the livelihood of waste pickers who were adversely affected. The led to the the growth and evolution of an informal producer unit into a women-owned and run social enterprise. With a group of 50 women collectively owning and managing the cooperative, they produce a range of stationery products from fully recycled paper, catering to multinational corporations such as Stables, IBM and Goldman Sachs. This cooperative has not only provided a secure source of income but also improved the working conditions of its members.

Gitanjali Cooperative is an example of how women can achieve sustainable social impact with their collective efforts in waste management. By empowering waste pickers and transforming them into active participants in the formal sector, Gitanjali Cooperative has contributed to their socio-economic well-being. In addition to promoting environment sustainability, they have played a vital role in promoting the adoption of eco-friendly practices by multinational corporations.

Swachh Ambikapur Mission Sahakari Samiti Maryadit - Ambikapur

Self-Help Group: *Swachh Ambikapur Mission Sahakari Samiti Maryadit*
Location: *Chhattisgarh*
Established in: *2015*

Swachh Ambikapur Mission Sahakari Samiti Maryadit *is a women's self-help group that has made significant strides in waste management. Through an agreement with the Ambikapur Municipal Corporation, the group plays a vital role in cleaning Ambikapur city. Their work includes door-to-door solid waste collection, scientific disposal, and maintaining cleanliness in the city. The self-help group operates based on a community structure, predominantly led by women.*

By integrating women waste workers into the self-help group, Swachh Ambikapur Mission provided them a source of livelihood and empowered them to participate in waste management. Women involved in the group earn a steady income, receive necessary gear and uniforms for their safety, and benefit from improved working conditions. The Solid and Liquid Resource Management (SLRM) Centres for municipal solid waste management has been built with convenient work spaces so that secondary segregation of organic/ inorganic waste of all refuse generated in domestic and commercial areas in town is managed effectively. Additionally, the SLRM Centers are equipped with CCTV cameras, enabling centralized oversight of operations. The data related to the inflow of refuse, sale of recyclable products, and other operations are digitized, ensuring efficient management and transparency. The project has boosted the confidence and social status of women waste workers in Ambikapur, leading to a positive transformation in their lives.

Through these examples of cooperatives and self-help groups, it becomes evident that empowering women waste workers and involving them in waste management initiatives can lead to social, economic, and environmental benefits. These initiatives contribute to the overall development and well-being of women, while also promoting sustainable waste management practices in communities.

5 Building an Inclusion and Empowerment Framework

To address the various barriers and promote women's inclusion in waste management, it is necessary to build an inclusive and empowering framework that can promote women's active participation and empowerment in the waste management sector. However, in order to construct such a framework, it is essential to establish a strong foundation consisting of key pillars that uphold its success and effectiveness. These pillars each represent a strategic area of focus designed to address specific challenges and empower women in their waste management endeavours

1. Capacity Building and Training Programmes

Training and capacity building are crucial components of women's empowerment in waste

management. By offering tailored training programs, fostering leadership skills, and creating platforms for knowledge exchange, women can enhance their capabilities, improve the efficiency of their waste management activities, and contribute to sustainable practices in the sector.

Therefore, to enhance the capacity and skills of women in waste management, it is pertinent to develop support mechanisms that design and implement training programs tailored to address the specific needs and challenges faced by women in waste management. These programs should go beyond technical skills' development, and should encompass leadership and entrepreneurship training, empowering women to take on managerial and decision-making roles.

Conducting training on technical aspects of waste management, such as waste segregation, recycling techniques, and sustainable waste management practices shall equip women with the necessary expertise to perform their tasks efficiently and contribute to environmental sustainability. Additionally, developing dedicated workshops, conferences, and networking events specifically for women in the waste management sector can help foster collaboration, and provide valuable networking opportunities, which would improve the overall efficiency of waste management activities, and promote gender equality and inclusivity in the sector.

2. Development of Gender Disaggregated Data

Presently, there is substantial lacunae of gender segregated data of workers employed in the waste management sector. Collecting and analyzing data that is disaggregated by gender allows for a comprehensive understanding of the existing disparities, challenges, and opportunities faced by women in the sector. It provides valuable insights into the representation, roles, and working conditions of women waste workers, enabling a comparison with their male counterparts.

Gender-disaggregated data shall enable policymakers and stakeholders to identify areas where women encounter barriers and inequalities, and can help development gender-sensitive policies and interventions in the waste management framework. Systematic gathering of information on the participation of women at various levels of waste management, their roles, wages, working conditions, and access to resources and benefits can be beneficial in providing targeted interventions to address gender disparities and promote women's inclusion and empowerment. It also provides evidence to support the need for gender mainstreaming in waste management policies and in addressing gender-specific challenges.

3. Policy and Regulatory Interventions

Policy and regulatory interventions are essential for promoting gender equality and women's empowerment in waste management. The present legislative framework may be amended to further support women in the waste sector. The Municipal Solid Waste Management Manual of the Ministry of Urban Development endorses the engagement of women in solid waste management by urban local bodies. This commitment by the Government can be taken a step further by way of the creation of a mandatory framework that has to be employed for assuring an inclusive and supportive environment for women in the sector. Gender-responsive policies and frameworks can be developed to ensure that safe and fair working conditions are available to all individuals in this sector. It can promote representation, meaningful participation, and greater opportunities for women in waste management, for a more diverse, equitable, and sustainable waste management industry.

4. Access to Resources and Opportunity

Access to financial and technical support systems is essential for promoting women's inclusion and empowerment in waste management. To promote entrepreneurial spirits and improve self -sufficiency among women in the industry, it is important to develop avenues for women to access financial resources, such as microfinance initiatives or small business loans, which can help them establish and expand their waste management enterprises. This may involve establishing partnerships with financial institutions, government agencies, and NGOs to create tailored financial programs and certifications that target women waste workers. By strengthening financial and technical support systems, women in waste management can overcome barriers related to resource limitations and gain the necessary tools and resources to thrive in their roles.

5. Establishment of Gender- Smart Infrastructures

Infrastructure and safety measures are crucial for women in the waste management sector. While their participation has a positive influence on waste management system at large, women often face various safety and health issues. Thus, there is need of proper equipment and dedicated infrastructure for

sanitation facilities for women in public space adds to the woes of women employed in waste management system. Creches as well as Mother's feeding rooms need to be built in greater numbers to ensure that public spaces are more accessible to women. Gender-sensitive sanitation infrastructure (such as public latrines) needs to be incorporated at a larger scale to ensure greater participation by women in India. There also exists several recounts of stories of waste pickers carrying their children on their back when going for collection. In lieu of this, providing a safe working environment through proper infrastructure is essential to ensure their physical well-being and long-term health effects. The infrastructure can create a conducive environment for women's participation through incorporation of gender-sensitive design principles and safety features, such as well-lit areas, separate and secure restrooms, ergonomic equipment and proper waste handling systems.

6. Advocacy and Awareness for Behavioral Change

To develop an inclusive framework, it is necessary raise awareness about the importance of women's participation and leadership in creating sustainable waste management practices. In India, waste management faces the issue of caste and class discrimination, with women experiencing additional challenges due to gender bias. The Swachh Bharat Mission by the Government of India has achieved a certain level of behavioural change. This success can be replicated and improved upon by way of targeted advocacy and awareness campaigns to address gender issues and empower women.

Advocacy efforts should focus on recognising and valuing women's contributions, advocating for gender-responsive policies, and eliminating discriminatory practices. Awareness campaigns should highlight the positive impacts of gender diversity, raise awareness about challenges faced by women, and disseminate information through various channels to reach a wide audience. Through targeted campaigns, community engagement, and partnerships, a culture of respect and empowerment may be built within the waste management ecosystem. Bringing gender awareness to the forefront of discussion among waste pickers can also help women waste pickers push for equality.

ANALYSIS AND RECOMMENDATIONS

Waste is a global issue and its impact continues to grow as the population becomes more consumerist, leading to increased production and waste generation. Inadequate waste management practices can have severe effects on public health and the environment, as demonstrated by the 1994 plague outbreak in the City of Surat, Gujarat, India. Recognizing the need for a proper regulatory framework to address solid waste management issues, most countries, including the nations studied in this research have developed specific laws on waste management.

Although waste management approaches may vary among countries, there are notable similarities in the strategies employed by India, Germany, Spain, the UK, and China. All these nations have implemented waste management laws and have established regulatory frameworks to tackle solid waste issues and reduce waste disposal. The regulatory frameworks enable the adoption of practical waste management practices tailored to each country's needs.

One common feature observed in all countries, including India, is the decentralized nature of waste management. Local public authorities bear the responsibility for waste collection, transportation, and the implementation of measures to promote waste prevention and recovery. The waste hierarchy, which prioritizes waste prevention, recycling, and resource recovery, is also universally recognized and followed. Additionally, there is a consistent trend among nations to restrict use of certain types of plastic products, either through use, import, or production restrictions. EPR is another aspect incorporated into the regulatory framework, wherein producers are held accountable for managing the waste generated from their products.

Further, private sector participation has been acknowledged in waste management across all countries. Governments have involved private companies in municipal waste management to play a significant role in waste management activities. The extent of private sector involvement varies, but PPP models are commonly adopted in different cities of these countries in different forms. Moreover, outsourcing of waste management activities to private entities is a prevalent practice undertaken by governments to achieve cost reduction and improve waste management practices.

Nevertheless, there also exists substantial differences in the way policy and regulatory framework is structured in each of these countries. It is revealed that each nation strives to implement a waste management mechanism that is feasible for its specific circumstances, aiming to reduce waste and improve waste practices. While there are shared waste management practices among the countries studied, the systems in place differ from those followed in India starkly in terms of the regulatory framework applicable on the waste management companies.

The UK, Germany, and Spain have well-established and heavily regulated waste management legal frameworks that prioritize environmental protection, public health, and proper waste management. These countries set high standards in terms of household waste separation, collection, reuse, recycling, and treatment. China has also implemented a comprehensive set of regulations at the national level

governing waste management activities. In contrast, Indian law does not have a comprehensive waste management law, which covers all aspects of waste management services.

Further, each of the countries anlaysed and studied have well-developed systems for private sector participation in waste management. Their laws provide a clear framework for private companies to engage in waste management activities. Private companies are involved in waste collection, sorting, recycling, and treatment through various contractual and legal arrangements. In India, although the solid waste law allows private participation, it is only permitted in the capacity of an agent of the local authority. There isn't a clearly laid out framework that is applicable on waste management companies whether as an independent service provider or as an organization working on behalf of the local authority.

Furthermore, Germany, Spain, and the UK maintain registers and databases to track waste generation, management facilities, and recycling rates. These registers act as valuable tools for monitoring compliance, enforcing regulations, and evaluating waste management performance. In India, there is currently no comprehensive system for maintaining registers of companies and individuals in the waste management sector.

In comparing these countries, it is evident that the UK, Germany, and Spain have made significant progress in waste management, with well-established systems focusing on waste reduction, recycling, and resource recovery. They have robust infrastructure, effective waste collection, and strong regulatory frameworks. China, despite generating a significant amount of waste, manages waste effectively through various strategies. In contrast, India faces greater challenges due to its large population and limited resources. Although the per capita waste generation in India is lower compared to other studied countries, India's waste management system has not effectively capitalized on waste and its potential as a resource. However, the government has made significant efforts to improve waste management, with initiatives aimed at waste segregation, waste treatment, producers' liability, infrastructure development, and public awareness.

Based on a comprehensive study of municipal solid waste management and practices followed in various countries, the following measures are proposed to enhance private participation and strengthen the municipal waste management framework in India:

(1) Implementation of landfill and Incineration Tax

It is recommended that the government should consider implementing taxes on waste disposal through landfill and incineration as a means to discourage waste disposal and promote waste recycling practices. The best practice may be derived from countries like the UK and Spain, where the implementation of landfill taxes has shown positive impacts on the waste management system.

In India, despite the adoption of a waste hierarchical system that prioritizes waste reduction and recycling, landfilling remains a prevalent trend, including illegal dumping in unauthorized sites. To address this issue, a landfill tax can be introduced, which would require companies, local authorities, and other entities disposing waste in landfills to pay a tax based on the quantity of waste disposed. The tax would discourage landfilling and encourage the exploration of alternative waste treatment

methods. Separate tax/ fee bracket must be introduced for landfilling of active waste, inactive waste and unseparated waste. It will act as a deterrent to landfilling practice.

Additionally, the government may consider implementing an incineration tax to discourage the use of incineration as an alternative to landfill disposal. Tax may be imposed for incineration of unsegregated waste. However, if incineration is used for energy recovery purposes, it could be exempt from this tax. By imposing these taxes, the different waste management activities shall become more financial sustainable and the private sector shall be incentivized to adopt innovative and sustainable solutions for the waste management industry.

(2) Development of open competition policy to promote private sector participation

To ensure the most effective waste management services are provided to the public, it is recommended to implement an open competition policy in municipal waste management. It would require all entities, whether public or private, to compete in the tender process for waste management services. The evaluation of tenders should be conducted independently to ensure the selection of the best possible service providers and facilities for waste management. Implementing a system of open competition shall promote transparency, accountability, and efficiency in waste management practices. Drawing from examples like the Compulsory Competitive Tendering and Best Value system implemented in the UK, this method encourages private sector participation and fosters healthy competition in the outsourcing of waste management activities. It can also help ensure that the waste management sector benefits from a diverse range of service providers, including private companies promoting innovation, improved service quality, and cost-effective waste management solutions for the public.

(3) Amendment in the existing law to develop a regulated environment for waste management companies

Currently, there is a need within the Indian solid waste management rules to introduce specific provisions that address waste management operators, as current system involves companies in MSWM as agencies of the local authority. This is in stark contrast to the practices followed in countries like the UK, Spain, Germany, and China, where individuals and businesses working in the waste management sector are granted licenses for their specific functions within the waste management framework. To effectively improve and regulate waste management activities and promote waste management as a business operation, it is recommended to develop a regulatory framework in the waste management law that defines the roles and responsibilities of various entities within the waste management sector.

The regulatory framework should outline the licensing and authorization process for waste management companies, specifying the functions they are permitted to carry out. It will provide clarity and legitimacy to waste management operators, enabling them to operate within a regulated environment. Drawing inspiration from the practices followed in other countries, India can establish a system that encourages private participation in waste management while ensuring compliance with environmental standards and regulations.

(4) Creation of a National Register of all Authorised Waste Operators in India

To provide legitimacy and promote waste management as a recognized business activity, it is recommended to establish a National Register of Authorized Waste Operators in India. It should would serve as a centralized database containing information about all authorized entities involved in waste management. It should contain information on waste management companies, service providers, recyclers, treatment facilities, and other relevant stakeholders. The areas in which the waste operators are providing services should also be included in the register. The aim is to develop a comprehensive directory that showcases the capabilities, expertise, and track record of authorized waste operators.

The government can establish a well-regulated environment for waste management operations by creating such register. It would enable transparency and accountability by ensuring that only authorized and qualified operators are engaged in waste management activities by public or private entities. It can also facilitate better coordination and collaboration among waste management stakeholders. Further, the register shall also serve as a valuable resource for government agencies, local authorities, and businesses looking to partner with authorized waste operators for waste collection, recycling, treatment, and disposal.

(5) Monitoring System for Waste Management with Standardized Reporting

To improve waste management practices and monitoring nationwide, the central government should establish a monitoring system with standardized reporting. Data on waste generation, collection, treatment and disposal is crucial to effectively assess the status of improvement and identify areas that require interventions. Further, the monitoring system should establish standardized reporting standards that all waste management entities, including municipal authorities, private waste operators, and other stakeholders, must adhere to so as to ensure consistency and comparability of data. The authority must also define the key performance indicators that reflect the desired outcomes and goals of waste management such as recycling rates, landfill capacity utilization, etc.

(6) Establishment of a Central Coordination Committee for Waste Management

There is need to implement a system which promotes transparency and coordination in waste management framework of India. Therefore, it is recommended that a Central Coordination Committee for Waste Management should be established. Currently, different aspects of waste management are handled by various authorities such as the Central Pollution Control Board, Ministry of Housing and Urban Affairs, local authorities, and several other ministries leading to fragmented approach when dealing with the responsibilities of each authority and the authorized waste management entities.

The Central Coordination Committee for Waste Management should serve as a dedicated authority responsible for overseeing and regulating waste management activities. Its primary role may be to consolidate information and ensure transparency in waste management processes. It shall also be responsible for setting up specialized working groups to support the implementation of law. It shall be entrusted with the duty of developing a centralized repository of waste management companies, authorized recyclers, and other relevant stakeholders operating within specific postal codes or

geographic areas. By creating a centralized platform, residents and stakeholders can easily access information about the waste management system in their locality. For example, a resident in Delhi should be able to determine which waste management actors among those available in the area are legally permitted to handle the waste collected from their household.

The Coordination Committee for Waste Management should also work closely with local authorities to streamline waste collection, transportation, and disposal processes. The Committee may be equipped to provide necessary assistance for development of waste management plans, ensuring compliance with environmental regulations and promoting sustainable approaches. It can also play a vital role in empower residents, waste management companies, and authorized recyclers to collaborate effectively and contribute to a cleaner and more sustainable environment.

(7) Develop independent notified bodies for supervision of waste management companies

It is suggested that every state should notify certain independent organisations with the power to supervise waste management companies in the state. The notified organisation should be entrusted with supervisory duty after empanelment of the organisation as independent monitoring authority. The duty entrusted to them should include the responsibility to monitor, evaluate, and certify waste management companies based on predetermined standards and criteria. A fixed amount of fee may be charged from each waste management institution for certification of a specific waste management activity. The fees charged may be made uniform throughout a single state for each type of waste management activity. Lastly, the findings of the independent notified bodies must be made public to enhance transparency and accountability. The standards and requirements required of notified independent bodies can follow the requirements sought from TSO or Community of Certified Waste Management Companies in Germany.

(8) Support mechanism for repair and renewal of waste infrastructural facilities/ Copayment of premium for waste infrastructure insurance

It is suggested that the government should design a support mechanism for alleviating the financial burden of waste management companies that are operating in India. One innovative approach to provide financial security and risk mitigation for waste infrastructure is by introducing co-payment of premiums for waste infrastructure insurance. The government can develop a dedicated insurance for critical/essential waste infrastructure operating in the country and help with a percentage of the insurance premium for those availing the insurance policy. Secondly, in order to accelerate the adoption of low-carbon solid waste management solutions and support entrepreneurs in SWM sector, it is recommended that a system of risk sharing facility may be implemented. Risk sharing facility shall aim to mitigate financial risks associated with innovative waste management projects that prioritize carbon reduction. The mechanism has been employed by other nations such as UK and Germany in promoting innovative technology. Through Risk Sharing contracts the government can encourage entrepreneurs to develop and implement low-carbon waste management initiatives, contributing to both environmental sustainability and economic growth.

(9) Implementation of Waste Tracking Systems

With increasing urbanisation, there is a need to adopt innovative strategies for management of waste. In countries like UK, the environment law contains provisions to implement regulations that allow tracking of waste through electronic system. Private sector companies can act as vehicle for implementation of waste tracking systems in India. The government can utilise their services to effectively implement waste tracking systems across the waste management value chain. Further financial incentives, and tax holidays may be provided for companies that develop innovative waste tracking technologies and systems similar to the innovation funds implemented in UK. The government should also explore the adoption of green finance mechanisms to fund environmentally sustainable projects in the waste management sector.

(10) Rebates to companies achieving 100% source segregation

Source segregation is a critical aspect of effective waste management as it involves separating different types of waste at the point of generation. Private companies achieving 100% source segregation of waste must be offered rebates or financial incentives for their role in promoting sustainable waste management.

(11) Integration of women and informal workers in the procurement framework for waste management services

It is recommended that urban planning initiatives by local, regional, and central governments, in relation to solid waste management and other areas, should create a criterion for providing additional points in the bidding process when outsourcing the construction of public infrastructural facilities or waste management services by the government. To translate this recommendation into action, the government should update the existing urban planning policies to incorporate the requirement for gender-inclusive plans and informal sector integration criteria within bidding processes . There should be a transparent and standardized scoring system to ensure effective implementation of the suggestion.

(12) Mapping of Informal Sector Workers through Digital Platform

Incorporating technology into waste management practices holds the potential to transform operations and inclusivity in a country like India with high internet penetration. It suggested that the government should carry out digital mapping of informal sector workers engaged in waste management activities through a dedicated digital platform. It should be tailored to map the locations and activities of informal waste workers. The platform may be utilised as a network by the informal sector workers to identify opportunities with private enterprises or households and viceversa. Furthermore, the digital platform can also serve as a catalyst for the legal recognition of informal waste picker activity as a profession, mirroring successful implementations in countries such as Brazil

(13) Gender Inclusive Decision-Making for Effective Waste Management Strategies

State waste management plans should incorporate a minimum percentage of female participation, such as 30%, at the preparation stage of the plan to ensure that women's perspectives and expertise are included in the decision-making process for inclusive and effective waste management strategies.

(14) Professional Network for Women in Waste Management

Creating a professional network specifically for women in the waste management sector can play a pivotal role in fostering collaboration, knowledge sharing, and mutual support. It is suggested that the platform or network serve as a hub for connecting women professionals, entrepreneurs, and practitioners, allowing them to share experiences, exchange best practices, and access resources. By coming together, women can collectively contribute to advancing the sector and empowering each other. Additionally, assigning a representative from the Government of India to support and assist women in waste management further reinforces the government's commitment to their empowerment.

(15) Develop a system of partial formalisation through private companies

Implementing a system of partial formalisation within the waste management sector can be a significant step towards women's empowerment. This strategy involves recognizing and supporting informal waste management workers, particularly women, by providing them with access to social security benefits, training opportunities, and avenues for skill development. Waste enterprises may be requested to document the waste collectors/ pickers from whom waste is received and provide company identification for their regular services. Specific incentives may be given to private organisations promoting inclusion of informal sector workers especially women into formal channels.

(16) Fostering Women's Representation and Entrepreneurship through Inclusive Procurement Practices

Promoting procurement policies that prioritize the inclusion of women-owned businesses in waste management projects and contracts can significantly contribute to women's economic empowerment. It is recommended that specific criteria and incentives that encourage the participation of women-owned and women-led enterprises in procurement processes must be established. This may include preferential procurement, reserved quotas, or financial incentives specifically designed to support and promote women entrepreneurs and workers in the waste management sector. The objective is to enhance women's representation, leadership, and economic opportunities within the waste management industry through creation of a supportive environment that fosters the growth of women-owned and women-majority businesses.

(17) Development of Informal Workers' Collectives/ Cooperatives for Participation in Waste Management Services Tenders

Informal waste workers play a crucial role in waste management, contributing to recycling and environmental sustainability. To address this issue of formal recognition and support system for informal sectors, a collaborative effort may be made between the government, informal worker collectives, and the private sector. It is recommended that the government facilitate the development of formal collectives or cooperatives of informal waste workers. These entities should be encouraged to actively participate in waste management services tenders. Further, trainings and workshops must be conducted regularly to improve their understanding on accounts, business management which can aid them to be self-sustainable and further, effectively participate in waste management services.

(18) Encourage Home Composting through Financial Incentives and Tax Benefits

To further promote and incentivize the practice of home composting, the following recommendations are suggested:

a. **Introduction of Loan Facilities**: The government should establish a dedicated loan facility to provide financial support to individuals and households interested in setting up home composting systems. The facility could offer low-interest loans or grants to help cover the initial costs of purchasing composting equipment, such as compost bins or tumblers. By making these resources more accessible, more people would be encouraged to adopt home composting as a sustainable waste management solution.

b. **Reduction in Property Tax Rates:** To acknowledge and appreciate the efforts of individuals who actively engage in home composting, the government should consider offering property tax reductions or exemptions. Homeowners or residential welfare areas who demonstrate their commitment to composting organic waste on their premises may be deemed eligible for reduced property tax rates as a form of incentive. The scheme shall reward responsible waste management practices and help raise awareness about the benefits of home composting within communities. The funding for these property tax incentives may be allocated by the central government to ensure that the financial burden of reduction does not fall on the state governments and thereby affect the coverage of the scheme. Further, by doing so, the central government can ensure consistent implementation of the incentives across different states and regions, regardless of their financial capacities.

For instance, Pimpri Chinchwad Municipal Corporation (PCMC) offered housing societies with sewage treatment plans and on-site composting 30%, and housing societies with only on-site composting 20% waiver on cleanliness tax. This is because housing societies in civic limits are bulk waste generators, and composting would significantly reduce the amount of garbage to be processed in an environmentally-sustainable way.

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