Bulgarian Chemical Communications, Volume 57, Special Issue B (pp. 95-109) 2025 DOI: 10.34049/bcc.57.B.A0013

Integrating environmental justice principles into urban waste management in India through sustainable development goals

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Revised: February 06, 2025

Urban waste management in India is significantly challenging, as waste disposal lacks proper management and adequate infrastructure, leading to adverse environmental and health impacts on society. This paper examines the integration of environmental justice principles into urban waste management in India through Sustainable Development Goals (SGDs). This paper analyses the existing legal framework aimed at promoting equitable urban waste management practices, the provisions of the Indian Constitution, including Article 21 [1], Article 48A [2] and Article 51A(g) [3], and their alignment with SDGs (3, 6, & 11) [4]. Additionally, this research highlights the importance of incorporating environmental justice principles to achieve sustainable and inclusive urban waste management through a critical analysis of the "Municipal Solid Waste (Management and Handling) Rules, 2000", and its interpretation and implementation. It further identifies the loopholes in the current legal framework and aims to address them to ensure accountability among all stakeholders by adhering to the SDGs and constitutional mandates so that India can progress towards fairer and more sustainable urban waste management system.

Keywords: Environmental justice principles, urban waste management, sustainable development goals (SDG).

INTRODUCTION

Urbanization and industrial growth have greatly influenced the rapid economic progress of India, transformed its urban areas and opened up new avenues for development. These factors have presented significant challenges, especially when it comes to managing waste in urban cities. Because of the fast-growing urban population, unsustainable consumption, habits, and lack of proper waste management infrastructure the cities in India are dealing with the water crisis. It is quite challenging to manage urban waste due to various factors such as in adequate collection systems, limited treatment and disposal facilities, and a lack of public awareness and involvement. All these factors possess a threat to the well-being of both humans and environment. A lot of environmental problems are caused due to poor waste disposal practices like water, pollution, soil erosion, air contamination, and increased risk of diseases. And because of these issues, people of marginalized communities, living near waste disposal sites have been affected disproportionately.

The people of marginalized groups, informal waste collectors and sanitation workers, face, specially face higher risk of environmental and health hazards because of inadequate current waste management methods. The lack of fairness and inclusivity in waste management is a problem because it worse since social inequalities and makes it harder to achieve social justice and sustainable development goals. Therefore, there is a need for a holistic and impactful approach to achieve social and environmental justice and sustainable development goals to manage waste in urban cities. The environmental justice ensures that environmental benefits and burdens are distributed fairly among all the stakeholders, involving stakeholders in decision-making and held in institutions and policy makers, accountable for environmental governance.

The incorporation of environmental Justice principles into urban waste management aims to reduce environmental pollution, protect public health and encourage social equality, community resilience and sustainable urban development. There is a need to thoroughly assess the existing policies, methods, and systems to ensure inclusivity, promote participation and endorse environmental sustainability. This research discusses how environmental justice principles be incorporated into waste management in urban cities of India by using sustainable development goals framework. This people will thoroughly conduct a comprehensive analysis of the existing legal and policy framework, which include examining the provisions of Constitution, legislative measures and regulatory tools. It will identify the gaps contradictions or the areas that need to be addressed in order to achieve effective waste management. It further will examine how India's urban waste management strategies

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align with the sustainable development goals, specifically SDG 3 (good health, and well-being), SDG 6 (clean water and sanitation) and SDG 11 (sustainable citizen communities). This research will provide valuable insights and potential strategies to improve the efficiency inclusivity and sustainability of urban waste management in India by analyzing global business practices, case studies and innovative methods. The study involves identifying the main challenges, promising initiative and practical policy recommendations. It also aims to educate about significance of incorporating environmental justice principles into urban waste management system in order to deal with the intricate issues of urbanization, waste management and sustainable growth to the professionals, policymakers, civil society groups, and other stakeholders.

STATEMENT OF PROBLEM

Waste management in urban cities of India is a challenging issue due to lack of proper infrastructure, inadequate policies, limited involvement of stakeholders and the negative impact on the environment, society, economy and health caused by improper waste disposal, recycling and resource recovery practises. There are still major problems with how waste is managed in cities and regions across India, even though there are laws, policies and international agreements in place to encourage sustainable waste management. This leads to a major risk to environment, health, fairness, and economic losses. The current urban waste management in India is getting worse due to factors like rapid urbanization, population, growth, industrialization, consumption patterns, and lifestyle changes, causing an increase in waste generation, making it more complex and diverse issue to be dealt. As a result, waste management, systems, processes, and services are facing challenges in terms of capacity, efficiency, and effectiveness. Moreover, the lack of consideration for environmental justice principles involving stakeholders and engaging the community in waste management, decision-making, policy, creation and implementation has led to social injustice, inequality and marginalization. This leads to negative impact on the rights, dignity and well-being of waste because informal waste workers, vulnerable populations, and marginalized communities who are involved in waste collection, recycling and disposal activities. The lack of proper integration of principles of environmental justice, Sustainable Development Goals (SDGs) and constitutional provisions such as Article 51, Article 48A and Article 51A(g) into urban waste management laws along with the limited enforcement, regulations, tracking and accountability mechanisms and organizational capacities have been a barrier to progress, innovation and transformation in the urban waste management sector. This has impeded the achievement of sustainable development goals, environmental sustainability social equity and economic prosperity in the urban areas in India. Therefore, in order to transform urban waste management systems, practices and outcomes, create cleaner, healthier and more sustainable cities and communities and promote well-being, prosperity and resilience for all in India, there is an urgent need for comprehensive, integrated and inclusive approaches, strategies and interventions to address the systematic challenges, barriers and gaps in urban waste management.

LITERATURE REVIEW

The article *"Environmental Justice and Sustainable Development"* by B. Gebeyehu *et al.* [5] explores environmental justice, tracing its historical roots and focusing on racial and ethnic disparities in environmental risk exposure. It examines the evolution of the environmental justice movement to address broader issues like getting healthy food and impact of climate change on marginalized communities. The authors also underscore the interconnectedness between both, highlighting the need to meet the present needs without jeopardizing the ability of future generations to satisfy their own wants. However, this paper points outs several research gaps, including the need for a global analysis of environmental justice movements, a deeper exploration of intersectionality in the environmental impacts, more empirical studies on sustainable development and environmental justice, and concrete policy recommendations for integrating environmental justice into sustainable development initiatives.

Another article is *"Role of Indian Regulatory Authorities in Integrating Environment Justice into Industrial Siting Decisions"* by Yashaswini Mittal [6]. In this paper, the author has discussed the role of regulatory authorities in ensuring environmental justice in industrial siting decisions. It emphasizes procedural components of environmental justice, such as public participation, transparency, and accountability, and their role in promoting social justice and equality of opportunity. The article also discusses the Indian philosophy of dharma and its similarity to Rawls' theory of social justice in the context of environmental justice. However, the article lacks discussion on the impact of industrial

siting decisions on marginalized communities, particularly those living in special areas like forest land and scheduled areas. The article could have also explored the role of civil society organizations and international frameworks in promoting environmental justice in industrial siting decisions and thus there is a need for further research.

Another article available is *"Waste as a Social Dilemma: Issues of Social and Environment Justice and the Role of Residents in Municipal Solid Waste Management, Delhi, India"* by Adriana Milea [7]. The author explores factors influencing waste decisions, drawing from theories on common-pool dilemma situations and environmental issues. It emphasizes the importance of understanding people's actions related to waste handling, as they are determined by historically built structures, values and knowledge. The author research aims to contribute to theories for problem-solving programs and interventions, emphasizing on the effective separation of hazardous waste from biodegradable and non-biodegradable materials. However, gaps exist, such as the lack of focus on hazardous waste and impact of social norms on trash segregation. The study employs mixed methods and is primarily deductive in its approach. The research's limitations may limit its generalizability to other contexts.

In the *paper "Innovations in Recycling for Sustainable Management of Solid Wastes"* by Nazia Parveen *et al.* [8] the authors have discussed the swift production and build-up of waste in developing is a significant issue because of urbanization, industry, inadequate government policies and population increase. The authors emphasize the need for strict laws, increased awareness, and innovative techniques to control solid waste in developing countries. They suggest waste-to-energy technologies for energy production and carbon emissions reduction. However, the review lacks comprehensive studies on waste impact, recycling and composting techniques, innovative technologies, public-private partnerships, waste management policies, and community engagement. Thus, further study can be carried out.

URBAN WASTE MANAGEMENT IN INDIA: CHALLENGES SND IMPACTS

Urban waste generation and management: an overview

India's cities are facing a growing waste management challenge due to swift urban expansion, population increase, and changing consumption habits. Current projections suggest that Indian urban areas, each year produce municipal solid waste which is more than 62 million tons, a number set to double by 2030 if the present trends persist. However, the existing waste management systems are largely insufficient to manage the rising volume and diversity of urban waste. In numerous Indian cities, the current waste management methods are largely linear and reactive, mainly concentrating on collection and disposal, rather than embracing proactive, sustainable, and circular methods that emphasize waste minimization, reuse, and recycling. The absence of holistic waste management plans, along with insufficient investment in infrastructure, technology, and manpower, has led to ineffective waste collection systems, widespread littering, open dumping, and unregulated landfill use, leading to environmental harm, health hazards, and social inequalities.

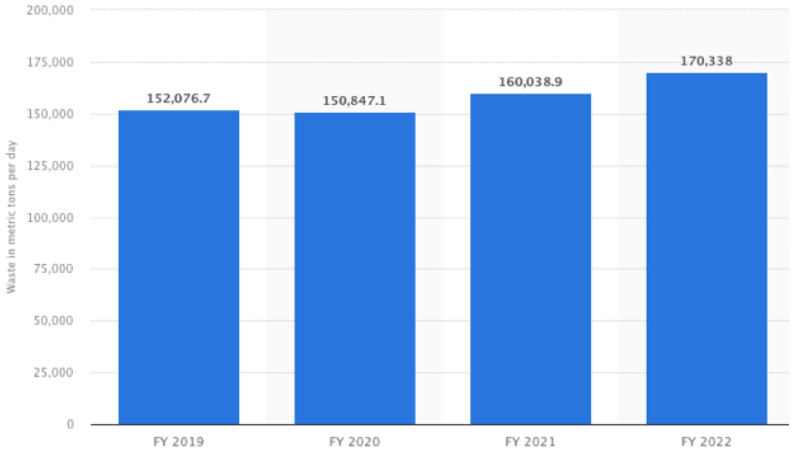

Figure 1. Total municipal solid waste generated per day in India from FY 2019 to FY 2022. [Source: India; Central Pollution Control Board; FY 2019 to FY 2022] (Open access doesn't require copyright permission)

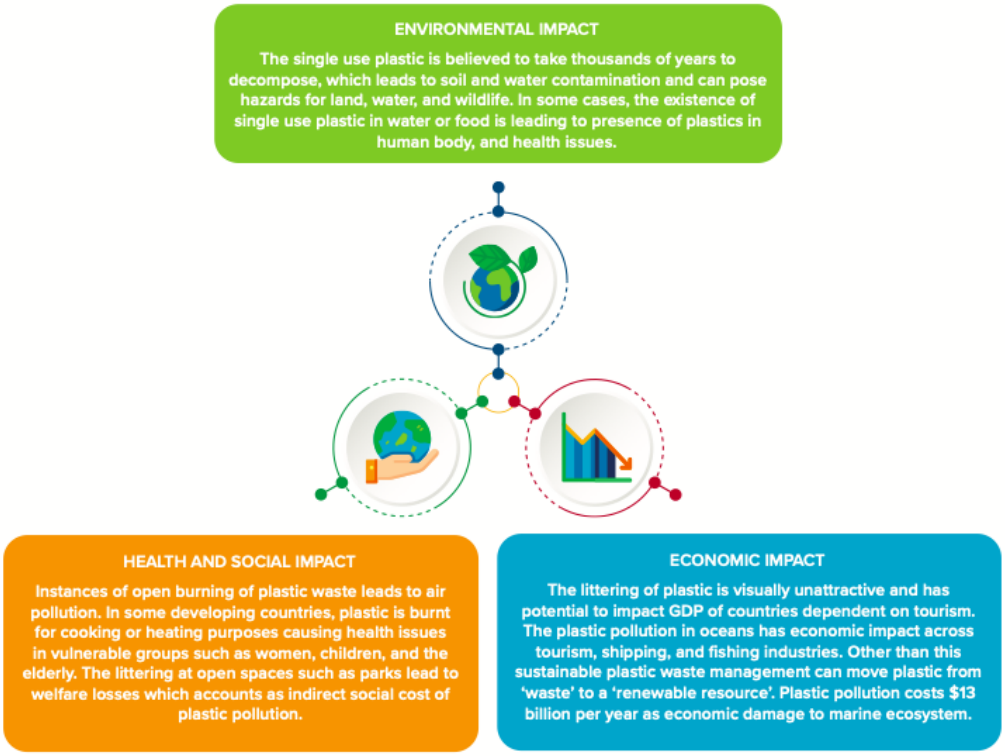

Figure 2. Environmental health and economic impact of municipal waste. [Source: https://www.unep.org/news-and-stories/story/plastic-planet-how-tiny-plastic-particles-are-polluting-our-soil] (Open access doesn't require copyright permission)

Inadequate waste management: environment and health impacts

There can be various reasons for inadequate waste management. There are a few main reasons for this, such as not having enough infrastructure, having weak legislation, and a lack of public awareness. It can be difficult for municipal authorities to implement effective waste management programs because they often have limited resources. Furthermore, in many developing countries, there is a lack of resources to set up a dependable waste management system. As a result, residents have limited choices when it comes to safely disposing of their waste. Improper waste management can cause significant harm to the environment, for example, if waste is not disposed of properly, it can result in the release of harmful chemicals and pollutants that can contaminate our environment. This contamination can lead to pollution of the soil and water. These issues lead to damaged ecosystems, loss of biodiversity, and climate change. In addition, waste disposal sites like landfills and incineration facilities release greenhouse gases that contribute to the problem of global warming. Waste management problems can have a significant impact on public health. Being exposed to hazardous waste can lead to various health problems, including respiratory issues, skin irritations, and infections. Furthermore, waste has the potential to attract and host disease-carrying insects and pests. This can result in the transmission of diseases such as dengue fever, malaria, West Nile virus, and Zika. Moreover, when waste is dumped into our waterways and oceans, it causes pollution that endangers both human and animal life.

Social inequalities in waste management

Social justice is to achieve equitable distribution of social, environmental, and economic benefits and drawbacks. Vulnerable populations worldwide still face unequal access to rights and opportunities, and bear a disproportionate weight of environmental issues, such as insufficient waste management and its consequences. The pursuit of justice for both humanity and the planet is not a separate matter, but rather intricately interconnected. The environment is constantly influencing our life, while human activity has a huge impact on it. Environmental justice is a crucial aspect of social justice that focuses on addressing inequalities related to activities such as waste disposal and resource exploitation, which lead to environmental deterioration and disproportionately affect the most vulnerable people. Most incinerators, dumps, landfills, and burn factories are situated in close proximity to low-income neighborhoods, communities of color, and marginalized populations. Residents have everyday

challenges due to insufficient noise control, litter accumulation, heightened vehicular congestion, unpleasant odors, and air pollution. Incinerator emissions result in health-related problems caused by excessive exposure to particles and hazardous contaminants, hence elevating the likelihood of cardiovascular and respiratory ailments, with youngsters and the elderly being the most vulnerable. In India, waste pickers are the sole means of solid waste collection, offering numerous advantages including elevated recycling rates, improved public health and safety, and enhanced environmental sustainability. However, waste pickers persist in facing significant vulnerability, laboring under hazardous and detrimental circumstances. For many years, the environmental and social justice movement has worked to bring attention to the difficulties faced by underprivileged communities. Their goal is to address the unequal distribution of environmental benefits, such as access to nature, green spaces, clean air and water, and landscape improvements. They also aim to address the disadvantages faced by these communities, such as the risks of hazards from industrial, transport-generated, and municipal pollution. Both social and environmental justice focus on power dynamics, namely on identifying the individuals or entities responsible for pollution or waste, as well as those who are negatively impacted by it. Environmental rights are situated at the point where human rights and environmental preservation converge.

Legal framework for urban waste management system in India

During early times, the disposal of human and other garbage was not a major concern because of the limited population and ample acreage accessible for waste assimilation. However, the escalating and varied waste generated by the rapid economic expansion and overpopulation has made the management of urban waste a significant concern for many Municipal Authorities and Urban Local Bodies. This responsibility includes overseeing public health and sanitation, as improper disposal of solid waste contributes to serious health, environmental, and aesthetic issues. The situation in developing countries has become increasingly complex and challenging due to inadequate infrastructure and financing, lack of clear responsibilities and functions of the authorities, insufficient norms, legal framework, and poor enforcement. In India, the uncontrolled and rapid expansion of cities and the spread of slums, resulting from both a desired quick industrialization and an undesired population boom, have led to a significant rise in public concern regarding sanitation and environmental issues. Hence, let's review the legal frameworks and profiles that exist for urban waste management in India.

Constitutional provisions: Articles 21, Article 48A & Article 51A(g)

The Indian Constitution serves as the supreme legal document, providing a comprehensive framework for the preservation of the environment, promotion of sustainable development, and improvement of public health and welfare. The clauses of the constitution lay the groundwork for environmental conservation, waste disposal, and sustainable development. The *Article 21 of the Constitution* ensures that every individual has the fundamental right to life and personal freedom. The Supreme Court has interpreted this right to include the right to live in a clean and healthy environment. This understanding places an obligation on the government to guarantee environmental protection and sustainable development, highlighting the crucial role of environmental quality in upholding citizens' fundamental rights and dignity. The *Article 48A of the Constitution* requires the state to conserve and enhance the environment and protect forests and wildlife. It recognizes the value of nature, biodiversity, and ecological balance, emphasizing the importance of sustainable environmental care and conservation efforts for the well-being of present and future generations. The *Article 51A(g) of the Constitution* states that every citizen has a fundamental duty to protect and improve the natural environment, which includes forests, lakes, rivers, and wildlife. This emphasizes the importance of individuals in preserving the environment, promoting awareness, education, and civic participation to foster a culture of environmental responsibility and sustainable lifestyles. These constitutional clauses provide a solid legal foundation for integrating environmental considerations, such as waste management, policy development, planning, governance, and decision-making at all levels of government and society. They enhance the legal and the ethical responsibilities for protecting the environment, promoting conservation, and fostering sustainable development.

The Municipal Solid Waste (Management and Handling) Rules, 2000

The Municipal Solid Waste (Management and Handling) Rules of 2000 are the primary legislative guidelines governing the handling, management, and disposal of municipal solid waste in India.

"These regulations aim to standardize waste management practices, promote waste reduction, segregation, collection, treatment, and disposal, while mitigating the adverse environmental impacts and health hazards associated with inadequate waste management." The main provisions of the rules include:

- *Waste segregation:* The rules require waste to be classified into biodegradable, non-biodegradable, and hazardous types at the household, institutional, and commercial levels to facilitate recycling, composting, and proper disposal. This promotes the adoption of waste segregation methods, waste reduction strategies, and sustainable consumption habits to minimize waste generation and promote resource reuse.
- *Waste collection and transportation:* The standards set for waste collection, transportation, and disposal emphasize the importance of effective and eco-friendly waste management practices, infrastructure improvement, and stakeholder engagement. The objective is to enhance waste collection efficiency, reduce littering, illegal dumping, and open waste burning, and improve the overall cleanliness and hygiene of urban areas.
- *Waste processing and treatment:* Promoting the use of waste processing technologies, composting, recycling, and converting waste to energy to reduce waste production, reclaim resources, and decrease the amount of waste sent to landfills. It advocates for the creation of sustainable waste management facilities, the adoption of cutting-edge technologies, and the incorporation of circular economy principles into waste management strategies to boost resource efficiency and environmental sustainability.
- *Landfill management:* Establishing criteria for landfill design, construction, operation, and closure to reduce environmental pollution, soil and groundwater pollution, and public health hazards linked with open dumping and unregulated landfilling. It underscores the significance of landfill gas control, leachate treatment, landfill site cleanup, and closure strategies to lessen environmental effects and guarantee the safe and sustainable handling of landfill locations.
- *Public awareness and capacity building:* Encouraging public awareness, education, and skill-building programs to stimulate community involvement, encourage behavioral shifts, and boost stakeholder participation in waste management and environmental preservation initiatives. It advocates for the active engagement of civil society, community groups, educational bodies, and the private sector in waste management projects, advocacy drives, and outreach efforts to elevate consciousness, develop capabilities, and rally backing for sustainable waste management practices.

Despite the comprehensive regulatory framework provided by the Municipal Solid Waste Rules, the successful implementation, enforcement, and oversight encounter significant obstacles due to limited resources, institutional capacity constraints, and insufficient stakeholder involvement. There is a need to strengthen regulatory compliance, enhance institutional collaboration, increase investments in waste management infrastructure, and promote collaborative efforts among various stakeholders to effectively address the complex issues of urban waste management.

Urban waste management and sustainable development goals (SDGs)

India's efforts in urban waste management are increasingly in line with the Sustainable Development Goals (SDGs), demonstrating the nation's commitment to achieving inclusive, fair, and sustainable growth. Aligning with the SDGs provides a strategic framework for integrating environmental sustainability, social inclusivity, and economic well-being into urban waste management plans and endeavors.

- *SDG 3 "Ensure healthy lives and promote well-being for people of all ages"* emphasizes the importance of providing access to secure and cost-effective healthcare services, minimizing environmental hazards, and preventing diseases associated with inadequate waste management. It advocates for integrating health perspectives into waste management policies and actions. Additionally, it stresses the need to enhance public health monitoring, surveillance, and response mechanisms to detect, counteract, and prevent health threats and disease outbreaks related to environmental contamination, water pollution, and waste-associated risks.
- **S***DG 6 "Ensure availability and sustainable management of water and sanitation for all."* highlights the significance of providing everyone with access to clean water and proper sanitation. It underscores the need for sustainable water management, wastewater treatment, and measures to prevent pollution to safeguard both water sources and public health. The goal promotes the use of comprehensive water resource management methods, water-saving techniques, and water quality checks to strengthen water safety, improve sanitation facilities, and reduce waterborne illnesses associated with poor sanitation and wastewater practices.

- *SDG 11 "Make cities and human settlements inclusive, safe, resilient, and sustainable."* underscores the necessity of building inclusive, safe, resilient, and sustainable cities and communities. It calls for thoughtful urban planning, the development of robust infrastructure, wise waste management, and effective environmental governance to enhance living standards, minimize environmental harm, and support sustainable urban growth. The goal encourages the adoption of eco-friendly building methods, sustainable transportation options, green urban areas, waste minimization efforts, and infrastructure resilient to climate challenges to advance environmental health, social equity, and economic progress in cities.

By "integrating urban waste management plans with the SDGs, India aims to address the interconnected issues of environmental harm, health hazards, and social inequalities."

Figure 3. State wise per capita solid waste generation. [Source: Annual Report on Solid Waste Management 2020-21, CPCB, Delhi] (Open access doesn't require copyright permission)

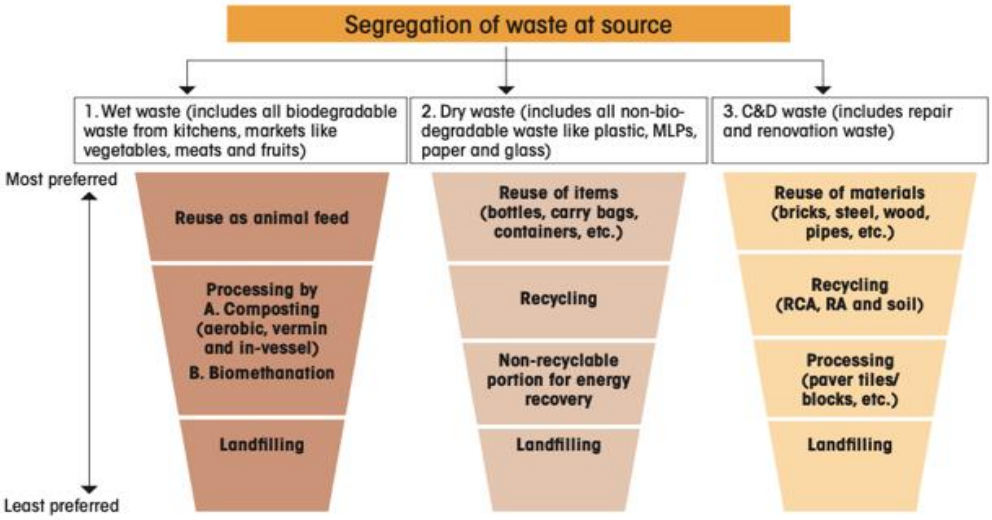

Figure 4. SDGs linkages through effective plastic waste management in a city. [Source: https://www.corpseed.com/knowledge-centre/plastic-waste-management-amendment-rules-2022] (Open access doesn't require copyright permission)

This approach establishes a connection between safeguarding the environment, enhancing public health, and striving for sustainable development goals". It calls for comprehensive, united, and community-focused approaches that consider the complex interrelations among environmental, social, economic, and institutional elements influencing waste management practices and outcomes in India

ENVIRONMENTAL JUSTICE PRINCIPLES AND SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Environmental justice is the fair distribution of environmental benefits and burdens, ensuring that everyone, regardless of social status, race, gender, or location, has equal access to a clean and safe environment. "Equity ensures that everyone receives a fair share of environmental benefits and doesn't bear an unequal burden of environmental problems. It involves addressing social inequalities and systemic injustices to narrow environmental gaps and achieve the goals of environmental justice." Participation emphasizes the need for inclusive decision-making regarding the environment, involving local communities, non-profit groups, and indigenous communities. Accountability ensures that all parties involved take responsibility for their actions, following environmental laws and rules, thus preventing harm to the environment and promoting sustainable living.

- *Equity:* Environmental fairness ensures that everyone receives their fair share of environmental benefits and does not bear an unequal burden of environmental problems. It involves preventing marginalized groups and those most at risk from being unfairly exposed to pollution or denied access to clean air, water, land, and natural resources. This requires addressing social inequalities and systemic injustices that contribute to environmental damage, health problems, and economic disparities in society. "Prioritizing fairness in how we make environmental decisions, set policies, and distribute resources is crucial for promoting inclusivity, narrowing environmental gaps, and achieving the goals of environmental justice."
- *Participation:* Environmental involvement emphasizes the importance of allowing everyone to have a say in decisions that affect our environment. This includes local communities, non-profit groups, indigenous communities, and those who are often excluded from these discussions. "It's about fostering a democratic approach where decisions are made openly, with clear accountability, and where the public plays a real role in shaping environmental policies and actions." By encouraging people and communities to share their insights and concerns, we can better shape policies that truly reflect their needs and priorities, promoting both environmental care and community empowerment.*Accountability:* Environmental account-ability ensures that everyone involved takes responsibility for their actions. This means that our leaders, companies, and organizations should adhere to environmental laws and regulations, with mechanisms in place to verify compliance. It's about being transparent and honest in how we manage our environment, building trust, and ensuring that everyone abides by the same rules. By enhancing these accountability measures and encouraging businesses to fulfil their role, we can prevent harm to our environment, address any concerns people might have, and work towards a future where we all live sustainably.

INTEGRATING ENVIRONMENTAL JUSTICE PRINCIPLES INTO URBAN WASTE MANAGEMENT

- *By addressing gaps in legal framework* India is working to sync up its waste management efforts with the SDGs to tackle the intertwined issues of environmental harm, health concerns, and social disparities. "This means weaving together efforts to protect the environment, boost public health, and promote sustainable growth. It calls for a comprehensive, unified approach that considers the intricate mix of environmental, social, economic, and institutional elements that influence how waste is managed in urban areas in India."
- *Strengthening the regulatory framework:* Improving the laws and policies guiding how we manage waste in cities is vital for tackling the deep-seated issues and shortcomings in waste management practices. This involves reviewing and refreshing current laws, rules, and recommendations to embrace fairness in the environment, encourage sustainable waste management methods, and strengthen how we ensure rules are followed, complied with, and overseen.
- *Promoting policy integration and coherence*: Making sure policies work well together across various areas like city planning, protecting the environment, public health, water and sanitation, and social support is key to creating harmony, cutting down on redundant efforts, and making urban waste management projects more effective, efficient, and sustainable. This means bringing everyone together, encouraging teamwork between different agencies, and supporting a joint approach to planning, carrying out, and assessing waste management efforts.

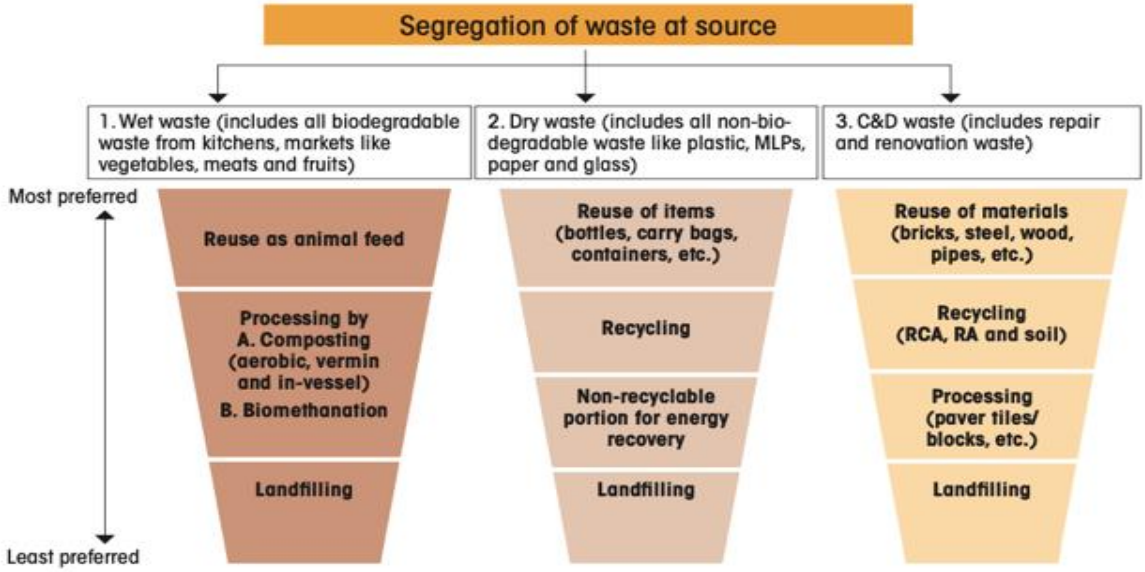

Figure 5. Hierarchy to Effective Municipal Waste Management. [Source: Guidelines for Swachh Bharat Mission (Urban) 2.0, 2021] (Open access doesn't require copyright permission)

- *Enhancing legal enforcement and compliance:* Boosting the ways we enforce the law, increasing penalties for breaking them, and stepping up oversight are crucial for making sure people follow environmental rules and standards. This means giving more power to the agencies in charge, equipping them with what they need like resources, tools, and training and working closely with the police, courts, community groups, and others to make sure environmental wrong doings are dealt with effectively and fairly.
- *Facilitating access to justice:* Making sure everyone affected by environmental issues has a fair shot at justice and access to legal solutions is key to protecting environmental rights and holding those responsible accountable. This means improving legal support for those affected, backing community efforts, supporting public interest cases, and encouraging judges to take an active role in environmental cases, making sure justice is accessible and fair for everyone.

Enhancing stakeholder participation and accountability

Getting everyone (stakeholder participation) involved and holding each other accountable in urban waste management helps make the process more transparent, inclusive, and democratic. This way, people and communities can have a say in decisions, share their insights, and make sure those in charge are doing their part responsibly and effectively.

- *Promoting public engagement and participation:* Encouraging people to get involved, share their thoughts, and work together with local authorities in planning and managing waste helps build a sense of ownership and strengthens our communities. This means spreading awareness, educating the public, organizing discussions, and setting up spaces for cooperation and partnership among government bodies, community organizations, schools, and businesses. Together, we can take collective action and find collaborative solutions to waste management challenges.
- *Promoting transparency and accountability:* Making decision-making, policy creation, and the evaluation of urban waste management more open and transparent is key to gaining trust and building credibility in these efforts. This means sharing information openly, making data accessible, and reporting on performance. It also involves giving citizens a way to oversee actions, provide feedback, and voice concerns, while also holding those responsible for waste management accountable for their actions and the effects they have on the environment, society, and economy.
- *Empowering vulnerable groups/ communities:* It's crucial to empower marginalized communities, vulnerable groups, and those often left out of the conversation, like informal waste pickers, sanitation workers, indigenous peoples, women, children, the elderly, people with disabilities, and others. This helps promote fairness, reduce disparities, and support environmental justice in managing urban waste. This means including them

in decisions, policies, and actions, addressing their unique challenges and needs, and standing up for their rights and well-being. Through focused efforts and support, we can ensure they have better access to resources, opportunities, and protection.

Developing inclusive and sustainable waste management practices

Encouraging waste management that cares for the environment, public health, fairness, and economic health is key to building sustainable cities, resilience, and ensuring everyone benefits equally from waste management decisions.

- *Adoption of circular economy approaches:* **"**Adopting circular economy ideas that focus on cutting waste, reusing resources, recycling, and turning waste into energy is vital. This approach helps us use resources better, cut down on pollution, and encourage more sustainable ways of making and using things." It means supporting green products, smart technologies, and new ways of doing business that help both the planet and our communities thrive.
- *Investment in technology and infrastructure:* Putting money into up-to-date, effective, and eco-friendly waste management systems and technologies is key. This means improving how we collect, recycle, compost, and manage waste, as well as how we turn it into energy. By doing this, we can boost our waste management abilities, offer better services, lessen our environmental footprint, and encourage greener waste practices. It's about getting both public and private sectors involved, using "creative ways to fund projects, and teaming up to bring about sustainable waste solutions, spur tech advancements, and make waste management more efficient."
- *Promotion of education, awareness and behavioral change:* Encouraging people, communities, businesses, and organizations to learn about the environment and change their behaviors is key to creating a mindset of caring for our planet. It's about promoting ways of living that are sustainable and getting everyone involved and excited about making waste management better. This means creating programs, campaigns, workshops, and outreach efforts that help people and communities understand and take action.

CASE STUDIES ON INCLUSIVE URBAN WASTE MANAGEMENT SYSTEM

Many cities and communities globally are tackling urban waste challenges in different ways. These range from creative local programs and community-driven efforts to technological breakthroughs and policy changes. Here are some successful case studies that prove sustainable, inclusive and robust waste management systems are possible and by drawing lessons from these effective approaches and adopting a comprehensive strategy that includes environmental justice, involving everyone and using innovative ideas, the cities can lead the path towards a sustainable future where waste is reduced, resources are used wisely and communities live in balance with their surroundings.

- *Curitiba, Brazil: Green Exchange Program*

Curitiba, Brazil's waste management system is well recognized globally for its innovative and inclusive strategy, which emphasizes on waste reduction, recycling, composting and public participation using the various methods. The Green Exchange Program in Curitiba attempts to incentivize individuals to contribute in waste sorting and recycling by providing rewards such as bus tokens, fresh produce and other things in place of recyclable materials. The campaign encourages for recycling, promotes waste segregation and cultivates stronger environmental consciousness and involvement from the community. The integrated waste management facilities have been established including composting sites, recycling centers and waste-to-energy plants. It facilitates the sorting, processing and treatment of many kinds of garbage, fostering reuse of resources and lowering the quantity of waste dumped in landfills. Curitiba emphasizes on promoting education and public awareness regarding waste management programs like extensive public awareness campaigns, initiatives like community involvement and special environmental education programs. These campaigns and programs aim to educate people, promote sustainable practices and motivating individuals to take an active part in reduction of waste and preservation of environment.

- *Fukuoka, Japan: Hydrogen from Sewage*

From its sewage, the City of Fukuoka has produced hydrogen to run fuel-cell cars. It is imperative to use cutting edge technology while striving for a low-carbon civilization. Already becoming more and more common in the city are electric vehicles; yet, Fukuoka has certain difficulties, such as charging times and relatively small driving ranges. As so, a different course of action was taken. At the specialized fueling station the city constructed, hydrogen produced by the processing of the sewage produced everyday by Fukuoka's 1.58 million residents may be injected into fuel-cell cars. In the area of hydrogen research, Fukuoka is working with several universities and businesses. Since the project's beginning, normal cars as well as motorcycles and logistical trucks in the city center

have been powered by hydrogen energy produced from domestic sewage. Fukuoka plans to establish a range of energy supplies across the city in addition to using it for mobility purposes. Since the energy can be used as a reserve in case of need, the city thinks the project will facilitate resilient, disaster-resistant urban development.

- *Barcelona, Spain: IoT sensors, smart waste collection system:* Barcelona implemented a city-wide smart waste collection system using IoT sensors. Real-time monitoring allowed for optimized collection routes, leading to a significant reduction in operational costs and environmental impact.
- *Singapore: Semakau Landfill and Waste-to-Energy Plants:* Singapore, facing land scarcity, combines intelligent landfill management at Semakau Landfill with waste-to-energy plants. This comprehensive approach minimizes landfill usage while generating clean energy for the city.
- *San Francisco, USA: Zero Waste Program:* The Zero Waste Program in San Francisco focuses on getting citizens involved and using a three-bin sorting system. The city's excellent work with composting and recycling demonstrates how successfully their waste reduction plan is operating. Creating resilient, sustainable and delightful to live in cities depends critically on smart waste management.
- *Pune, India: SWaCH:* The "Solid Waste Collection and Handling (SWaCH) Cooperative is a pro-poor partnership aimed at establishing itself as a self-sustaining social enterprise of waste workers, focussed on sustainable solid waste management (SWM) and waste worker rights". The operational costs of running the initiative (equipment, vehicles) are covered by the PMC, while waste workers are paid by customers and scrap recyclers. Initially only focused on uplifting the lives of waste workers, the SWaCH Cooperative has since diversified its actions to also provide SWM services such as composting, responsible disposal of e-waste, cleaning up the city's water bodies through organized activities etc. "By late 2007, the State Government mandated the implementation of Municipal Solid Waste Laws 2000, across all cities, which acted as a catalyst for the growth of the SWaCH Cooperative"[1]. "Through SWaCH initiatives, 60 metric tons of waste is diverted away from landfills every day, with 80-85% of the waste generated in the city being recycled/processed, resulting in annual GHG emission savings of approximately 50,000 tons of CO_2"[2]. The SWaCH Cooperative's door-to-door collection model has helped PMC save INR 900M rupees (USD 12.5M) per year in labour, processing and transportation costs, which is 46 percent of the capital budget for Pune's SWM system. SWaCH Cooperative's efforts also helped with socio-economic upliftment of its 3500+ waste worker members, from formalizing their work contracts and getting them access to health and welfare protections to supporting their families and children access loans, scholarships, vocational skills training etc. "The SWaCH Cooperative has influenced policy decisions on SWM beyond Pune, and elements of the SWaCH model are being implemented across other Indian cities."[3]

Periodically, the SWaCH Cooperative organizes events that unite city dwellers, NGOs, and waste workers on a single platform in order to increase awareness and facilitate dialogue and debates on waste management problems and policies. Red dot campaign was one important effort started to raise awareness of sanitary waste disposal methods that are safe and hygienic. Waste workers initially brought up the necessity for this kind of project during one of their frequent meetings with the Board. The SWaCH staff picks up 20,000 kg of sanitary pads and soiled diapers every day. Workers who have to separate sanitary waste from other trash are at risk for health problems from exposure to it. For thirty thousand city dwellers, door-to-door initiatives were planned to spread knowledge about the need of wrapping and red-dotting sanitary trash. The SWaCh workers themselves also created paper bags with red dots on them, which they sold for a little money while they were out and about. A daily reminder of the program was provided by the red-dot-marked compartments on waste pickup vans. Public areas had posters up, and t-shirts, mugs, and other gifts with comparable messages were also widely distributed. Menstrual health and sanitary disposal are other subjects covered in the workshops offered by the SWaCH Cooperative. The "Send it back" campaign, which the SWaCH Cooperative also started in 2013, involved sending sanitary pads back to the manufacturers of these products (Kimberly-Clark and Procter & Gamble) to encourage them to consider packaging waste and disposal more carefully when creating their product strategy. Thanks to the publicity this action

[1] Ibid at 22.

[2] Waste Management Cooperative: Pune, India, https://www.centreforpublicimpact.org/case-study/waste-management-cooperative-pune-india, Accessed 25 April, 2024.

[3] SWaCH Cooperative Pune, https://swachcoop.com/ , Accessed 26 April 2024.

generated, SWaCH employees are now actively working with Procter & Gamble to identify solutions for repurposing product packaging as biodegradable red-dot trash bags. A further project is the Recycling Trail, a shadowing field exercise run by the SWaCH Cooperative in which volunteers follow SWaCH's trash workers on their door-to-door rounds to get first-hand knowledge of Pune's waste management value chain.

The procedure of community involvement focused actions at the systems, community, and individual levels. The rights of informal trash workers in the city were to be protected, and SWaCH worked closely with the PMC to handle SWM in Pune. Raising public and other communities of informal waste workers nationwide knowledge of the problems of SWM and waste worker rights was their secondary goal.

POLICY RECOMMENDATIONS

Managing urban waste is a big problem all over the world, especially in fast-growing countries like India. We need strict and efficient rules and plans to handle waste better. The suggestions below aim to make waste management better by:

- *Making stricter laws:* We need stronger rules to manage waste properly. For example, every urban housing society should be penalized in case the Solid waste is not bifurcated as per law in dry, wet, biodegradable and non-biodegradable waste.
- *Involving more people:* We need to get more people involved in managing waste by encouraging building of community centers in local areas which educate people regarding the harmful effects of irresponsible waste management.
- *Building better facilities:* In this regard, Technology companies can be involved by setting up Public-Private Partnerships to deal with urban waste and build better facilities to recycle and reuse waste.
- *Training more people:* We need to teach more people how to manage waste properly. This can be done by conducting workshops in schools, colleges, government and private office spaces, and with the help of partnership with various NGOs in all districts across the nation.
- *Developing new waste management technologies:* We need to invent new ways to manage waste. This can be done by providing Research Fellowships in the field of waste management technologies and encouraging the topic in various research institutions and technological institutions.

Strengthening legal and regulatory frameworks

- *Enforcement and Compliance*: It is important that all the individuals strictly adhere to the waste management regulations. This can be done by enhancing rule enforcement, imposing stricter fines and penalties on the individuals not complying, monitoring major waste generating industries and sectors to mitigate pollution and promote responsible waste management.
- *Harmonization and Integration:* To ensure consistency across all the regions, it is important that we have uniform waste management rules and regulations. It is also important to integrate waste management strategies with other areas like urban planning, public health and protection of environment. Coordinating with other authorities is essential for efficient implementation of waste management rules, preventing repetition of efforts and enhancing the effectiveness of waste management initiatives.

Enhancing stakeholder engagement and public participation

- *Effective Stakeholder: Engagement* In order to achieve effective decision-making with regard to waste management in cities, it is crucial to ensure active engagement and involvement of all the individuals and encourage public participation.
- *Empowerment and Involvement of Communities:* It is imperative for the communities to be engaged, given power at local level, foster collaboration with other community groups, organizations an d local businesses. This fosters increased awareness, engagement and endorsement of enhanced waste management practices among individuals.
- *Stakeholder Consultation and Collaboration:* Every individual must be involved with all the stakeholders in waste management encompassing waste pickers, informal waste workers, local businesses and corporations. Exchange of knowledge, different perspectives and varied resources can be facilitated to collaboratively address waste management challenges, through engaging individuals in policy making, implementing strategies and monitoring progress.
- *Transparency and Accountability:* It is important to adopt transparency in decision making processes, making information accessible to everyone and developing ways for individuals to obtain feedback or complains. This ensures that the individuals are responsible for making choices and delivering services in waste management and held accountable for what they do and what impact they

create. It enhances trust and ensures credibility and acceptance of waste management efforts.

Investing in infrastructure and capacity building

- *Investment in modern waste management:* To build superior, highly efficient and environmentally sustainable waste management technologies, infrastructures and abilities, there is a need of allocating funds towards it. The growth in solar panels is an example of this. Various households are now bringing in solar powered grids thereby decreasing electronic waste generation.
- *Infrastructure Development:* We should invest in waste collection systems, recycling plants, composting facilities, waste-to-energy plants, and managing landfills. These need to meet environmental and safety standards, and be efficient, to expand waste management, cover more areas with waste collection, reduce waste, and promote recycling.
- *Capacity Building and Training:* We need to improve the skills of waste management professionals, policymakers, regulators, and service providers through training programs and knowledge-sharing platforms. This will enhance their knowledge of waste management practices, technology and innovations, therefore, optimising waste management operations and advocating for the most effective approaches.
- *Public and Private Investment:* In order to speed up the implementation of sustainable waste management solutions, stimulate innovation and enhance the efficiency of waste management, it is important to secure investments from both the public and private sectors, explore new financing methods and establish partnership between two entities. This will help in addressing budgetary challenges, enhancing infrastructure and expanding sustainable waste management programs.

Promoting research and innovation in waste management technologies

- *Research and Development:* In order to investigate and evaluate novel waste management technologies, techniques and solutions it is important to allocate resources towards research and development. This will allow to address emerging difficulties and develop strategies to enhance trash collection, segregation, recycling, composting and waste-to-energy conversion. Allocating resources to research endeavors facilitates the advancement of new ideas and enables informed decision making rooted in empirical data.
- *Technology Transfer and Adoption:* It is imperative to enhance the accessibility of information and utilization of emerging technology for individuals involved in trash management. This entails offering assistance and guidance to specialists in waste management, policymakers and service providers, adding them in the adoption of the most effective technologies and methods. It is imperative to promote collaboration among many stakeholders in waste management to expedite the adoption of novel technologies and innovations.

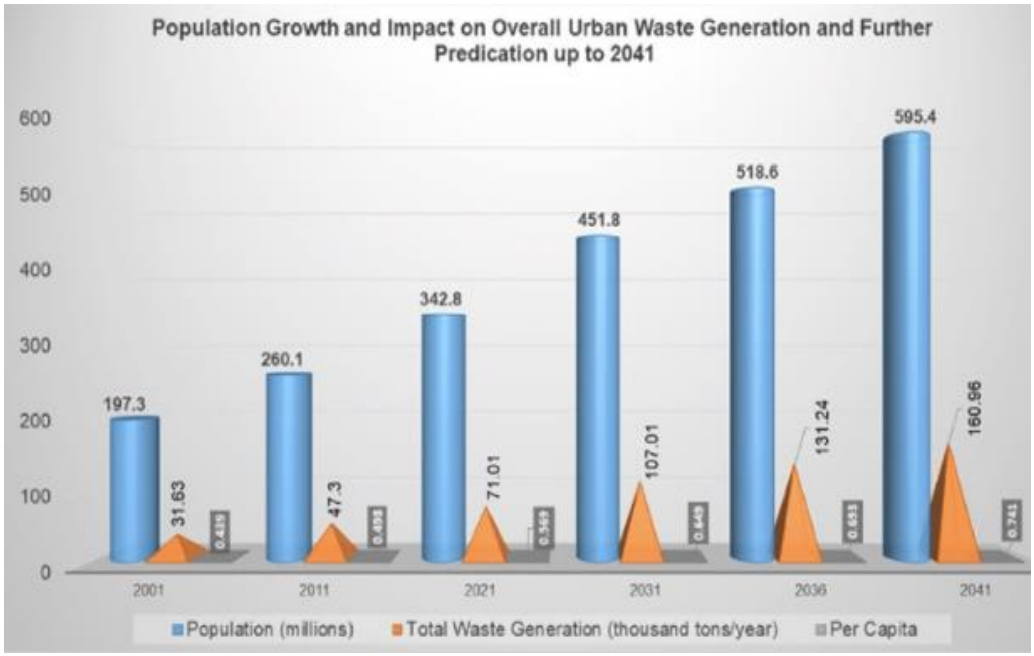

Figure 6. Population growth and impact on overall urban waste management generation and further predication up to 2041. [Source: Data by Centre for Science and Environment and NITI Aayog (2021)] (Open access doesn't require copyright permission).

- *Innovation Incentives and Support:* We need to establish a system of incentives, funding opportunities, grants, prizes and recognition programs with the purpose of stimulating and acknowledging incentive concepts in waste management. This will facilitate the development of a culture that promotes innovation, entrepreneurship and ongoing advancement in waste management. Promoting and assisting entrepreneurs and enterprises that create and apply new waste management solutions is crucial for fostering an environment favorable to innovation and enabling positive transformation in the waste management sector.

CONCLUSION

The management of waste in urban cities of India is a significant concern that requires urgent attention, proper planning and innovative approaches to mitigate environmental damage, health hazards and social disparities. This paper examines the challenges, impacts, legal aspects, gaps in policies and possible approaches and ideas to manage urban waste management in India. It emphasizes on the importance of integrating environment justice and the Sustainable Development Goals in order to create waste management systems that are fair and inclusive both, while also promoting sustainability. Upon analyzing existing legislations, including constitutional provisions such as Article 21, Article 48A and Article 51A(g), and assessing their alignment with the Sustainable Development Goals 3, 6 and 11, it becomes evident that urban waste management policies, practices and outcomes are influenced by constitutional mandates, global commitments and policy coherence. However, digging into the Municipal Solid Waste (Management and Handling) Rules, 2000, showed problems, shortcomings, and gaps in the current laws. This points to the need to make the rules stronger, have better enforcement, and make sure everyone involved is accountable. This is to make sure waste management works well, is clear, and treats everyone fairly. Looking at successful models of waste management, community projects to cut waste and recycle, and the role of technology and new ideas in sustainable waste management shows us what works best, what lessons we've learned and what new approaches cities, communities, and organizations use around the world. It helps address the challenges of city waste management, cut down on waste, recycle, and recover resources to support sustainable development.

The recommendations in this study stress the need to make laws and rules stronger, involve and listen to the public more, invest in better infrastructure and training, and encourage research and new ideas in waste management. This will move us towards fair, sustainable, and inclusive waste management practices, promote new ideas, and speed up progress in achieving the SDGs, constitutional orders, and global goals for sustainable development in the city waste management sector. In conclusion, incorporating environmental justice principles into urban waste management in India through sustainable development goals offers a complete, unified, and collaborative way to deal with the challenges of city waste management. It promotes environmental sustainability, social fairness, and economic growth, and moves India closer to fairer, more sustainable, and stronger city waste management systems that protect health, save resources, and improve life for everyone, now and in the future. By taking a team-based, shared, and creative approach that uses legal, policy, technological, institutional, and community resources, India can get over current hurdles, use new chances, and change its city waste management to create cleaner, healthier, and more sustainable cities and communities for all. This needs everyone to act together, be determined, commit to action, engage the public, and always improve waste management practices, policies, and technologies. This way, we can build an economy that recycles, cut down on waste, save resources, and achieve sustainable development goals, constitutional orders, and fairness in city waste management in India.

Authors' contributions: *Methodology and original draft preparation by Shweta Choudhary, Supervision and formal analysis by Yogesh Dharangutti and Abhijit Vasmatkar.*

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