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Evolution of Waste Management Policies in India: From Traditional Practices to Smart City Frameworks

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Abstract: The progression of waste management regulations in India illustrates the nation's shift from traditional sustainable methods to organized, technology-driven systems designed to meet the challenges of contemporary urbanization. Historically, Indian civilization depended on decentralized, sustainable practices such as composting, reuse, and community-oriented sanitation, which were closely associated with cultural and religious principles. The emergence of industry, population expansion, and the proliferation of non-biodegradable materials severely burdened these conventional systems, revealing substantial deficiencies in public health and environmental safety. This study examines the chronological evolution of India's waste management rules, starting with the Municipal Solid Wastes (Management and Handling) Rules, 2000, and concluding with the comprehensive Solid Waste Management Rules, 2016. It analyzes the expansion of legal frameworks to encompass diverse waste streams—including plastic, biological, and electronic trash—while simultaneously redefining the responsibilities of local authorities, companies, and individuals. The research emphasizes the incorporation of advanced technology inside national programs such as the Swachh Bharat Mission and the Smart Cities Mission, concentrating on approaches like decentralized waste management, source segregation, and circular economy concepts. This article highlights the significance of inclusive governance, technological innovation, and public participation in the development of sustainable urban settings by examining the evolution of this strategy. It provides an analysis of the problems and opportunities confronting India in its pursuit of developing efficient, resilient, and ecologically sustainable waste management systems.

Key words: Waste Management, India,Policy Evolution,Solid Waste Management Rules,Traditional Practices,Smart Cities Mission,Swachh Bharat Abhiyan

1.INTRODUCTION

Waste management in India has experienced a remarkable transformation—from the organic, community-based traditions of ancient civilizations to the technology driven, policy-regulated systems creating today's metropolitan landscapes. In the early stages of Indian society, trash was managed in decentralized and sustainable ways, where reuse, composting, and little waste generation were culturally engrained. Ancient literature like the Manusmriti and Arthashastra highlight cleanliness and environmental management, demonstrating a deep-rooted concern for ecological equilibrium. However, with the introduction of industrialization and growing urbanization in the 19th and 20th centuries, traditional systems were overwhelmed by the increasing amount and complexity of trash. The uncontrolled rise of urban centers, coupled with the emergence of non-biodegradable materials, exposed substantial deficiencies in municipal infrastructure and sanitation. These issues culminated in many public health catastrophes, drawing attention to the urgent need for systematic waste management legislation.

Over the past two decades, India has taken crucial advances toward formalizing its waste management systems. From the establishment of the Municipal Solid Wastes (Management and Handling) Rules in 2000

to the overall Solid trash Management Rules of 2016, the policy landscape has evolved to cover varied forms of trash, explicit stakeholder roles, and stronger environmental criteria. These policies have grown in accordance with national initiatives such as the Swachh Bharat Abhiyan and the Smart Cities Mission, stressing decentralized processing, segregation at source, and technological integration such as waste-to-energy (WTE) facilities and GPS-enabled collection systems. This article explores the evolution of India's waste management policies, assessing its historical underpinnings, legal changes, and modern adjustments. It analyzes how ancient wisdom has been blended with modern regulatory frameworks to produce a more sustainable and inclusive waste management environment. Special attention is placed on the shift toward smart city solutions and circular economy concepts, showing the way ahead for cleaner and more resilient urban futures.

1.1 Background

In India, waste management has long been an integral part of the country's culture, economy, and ecology. Reusing, composting, and allowing garbage to break down naturally were the cornerstones of Indian society's long-established approach to waste management. Archaeological finds in places like the Indus Valley indicate that long-ago human settlements had sophisticated drainage and sanitary infrastructure. Cleanliness, hygiene, and proper waste disposal were also deemed crucial to social welfare in ancient Indian writings such as the Manusmriti and Arthashastra. But, India's population, urbanization, and consumerism all increased at exponential rates during the industrial revolution of the nineteenth and twentieth centuries, drastically changing the kind and amount of garbage that was produced. Plastics, chemical waste, and other non-biodegradable materials have proliferated, causing problems with both the environment and human health. Open dumping, poorly managed landfills, and unclean conditions became commonplace as a result of cities' inadequate infrastructure to handle this shift. The Indian government saw the need for swift action and passed the Municipal Solid Wastes (Management and Handling) Rules, 2000 to provide uniform guidelines for garbage sorting, collecting, and disposal. Afterwards, reforms could be built upon these guidelines. With the introduction of source segregation, an emphasis on scientific processing technologies, and the expansion of obligations to other stakeholders, the Solid Waste Management Rules were revised in 2016 to offer a more inclusive and contemporary approach.

Smart City solutions : Comparative analysis of waste of management models in loT- enabled environments

1.2 Traditional Waste Management Practices in India

1.2.1 Self-Governed Sanitation and Recycling Programs

Waste management was an integral part of community life in pre-modern and ancient India and was mostly decentralized. There were established procedures and duties for waste management in both rural and urban

areas, typically based on social stratification such as caste or occupation. Things like street sweeping, household waste collection, and cleanliness were responsibilities of certain communities. Local governance systems (like panchayats) were able to successfully oversee these endeavors by establishing community agreement and holding each other to account, as opposed to depending on governmental agencies. One of the cornerstones of conventional garbage disposal methods was recycling. Recycled or sold to craftspeople and merchants were things like old clothing, metal cookware, glass bottles, and even bones and ashes. People usually repurposed or passed down household goods rather than throwing them away. Households and communities often composted or fed organic waste, such as leftover food and agricultural materials, to animals. This kind of material use reduced waste and increased the useful life of commonplace items.

1.2.2 Composting and Organic Waste Management in Ancient Societies

In ancient India, organic waste management was an inherent and essential component of both agricultural and household systems. Most households employed backyard composting as a means of managing their own biodegradable trash, which allowed organic materials to break down and be recycled as fertilizer for farms and plants. This concept of nutrient cycling is intrinsically sustainable, and it improved soil fertility while decreasing the requirement for chemical inputs. People living in rural areas would gather cow manure and put it to use as both a fuel source (in the shape of dung cakes) and a fertilizer for their crops. Natural systems, such pit latrines, were commonly used to treat human waste since they allowed for safe decomposition. In addition to being inexpensive, several of these methods caused little harm to the environment. Sanitation has been recognized for a long time in ancient books like Kautilya's Arthashastra, which focus on the planning of urban settlements with an emphasis on hygiene, cleanliness, and waste disposal.

1.2.3 Cultural and Religious Values Related to Cleanliness and Waste

There is a strong emphasis on cleanliness (shauch) in religious and cultural practices in India. There is a strong connection between spiritual purity and hygiene in Hinduism. As a sign of the connection between one's physical and spiritual purity, rituals frequently commence with washing and tidying up one's environment. It was considered impure to treat waste, especially animal and human excrement, with care and regard for religious standards. A result of this was the establishment of procedures that prioritized cleaning on a regular basis, waste area isolation, and segregation. Instead of letting biodegradable garbage (like flower garlands, leaves, and food offerings) build up, it was composted or thrown into rivers as part of religious festivals and daily rituals. Temples, residences, and public areas were all expected to be kept clean on a regular basis according to social norms and religious texts, which contributed to a culture of cleanliness. Prior to the development of contemporary sanitation services, these principles encouraged personal accountability and discipline in trash disposal. There are many lessons to be learned about eco-friendly lifestyle choices and community-based trash management from these time-honored customs. Sustainable urban development and circular economy objectives can be greatly advanced by revitalising and incorporating them with contemporary technology and policy frameworks.

1.3 Impact of Industrialization and Urbanization

1.3.1 Increase in Non-Biodegradable Waste

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1.3.2. Strain on Traditional Waste Systems

In India, slums and informal settlements grew alongside the fast urbanization that began in the 1950s and continued into the modern era. This resulted in extremely crowded city populations. The garbage volumes created by these rapidly expanding metropolitan centers were too much for traditional waste systems, which depended on decentralized and community-led practices. Inadequate provision for sanitation facilities, trash collection, and transportation networks occurred as city spatial structures got more complicated. Open dumping and improper landfilling became common practices as a result of municipal bodies' inability, inadequacy, and lack of resources to manage the evolving waste dynamics. The result of this change was widespread poor management, which led to trash piling up in public spaces, clogged drains, and polluted ground and water. Volunteer trash collectors filled the void, but they were unofficially recognized and lacked proper safety gear, making their work both limited and dangerous. Urban garbage systems are disjointed, overworked, and inefficient because of the shift away from a culture of recycling and community responsibility.

1.3.3. Emergence of Public Health and Environmental Issues

As a result of poor waste management, major public health and environmental issues emerged in urban and industrial areas. Disease vectors including flies, rats, and mosquitoes were drawn to accumulated garbage in open spaces, which aided in the spread of respiratory ailments, malaria, dengue, and cholera. Many urban slums and surrounding areas began to experience water contamination, unpleasant aromas, and air pollution caused by burning garbage. The environmental impact was substantial, and it was not only a problem for people's health. Industrial effluents seeped into groundwater and surface water, plastic trash clogged rivers and lakes, and emissions from garbage decomposition added to atmospheric concentrations of greenhouse gasses like methane. As was demonstrated in multiple high-profile instances in places such as Delhi and Mumbai, uncontrolled dumping grounds become environmental dangers, occasionally igniting or crumbling. The critical importance of incorporating environmental planning into urban development, transitioning to scientific waste processing, and modernizing waste governance became clear in light of these issues. Waste management in India is now beset by complicated and systemic issues, which have their roots in the country's rapid industrialization and urbanization, which have rendered conventional methods outdated. The emergence of smart city plans and formal governmental actions to achieve sustainable trash solutions was facilitated by these shifts.

1.4 Policy Milestones in Waste Management

1.4.1 Municipal Solid Waste (MSW) Rules, 2000

Introduced under the Environment Protection Act of 1986, the first comprehensive national-level regulatory framework for urban waste management in India was the Municipal Solid Waste (Management and Handling) Rules, 2000. Public health concerns, environmental deterioration, and the prevalence of improper garbage disposal procedures in cities prompted the government to enact this ordinance. Under the MSW Rules, 2000, ULBs were tasked with the scientifically-based management of MSW, including collection, sorting, storing, transportation, processing, and disposal. The elimination of open dumping and burning,

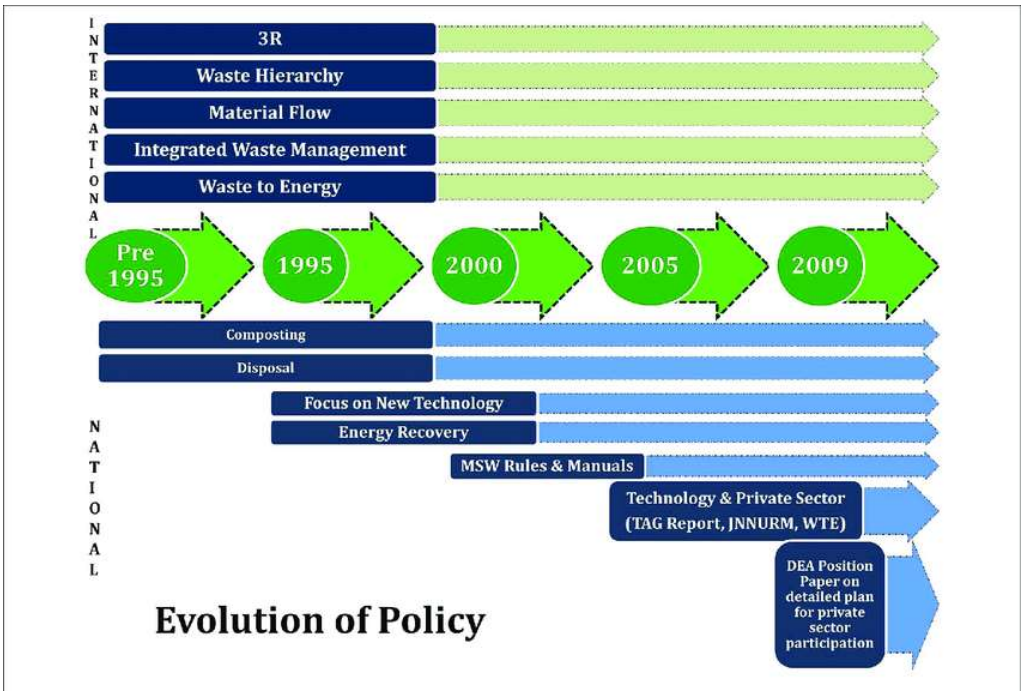
the introduction of sanitary landfills for waste disposal, daily door-to-door garbage pickup, and the separation of biodegradable and non-biodegradable trash containers were all important requirements. Despite the rules' innovative nature, they failed to make a significant impact because of lax enforcement, low public awareness, and inadequate resources at the local level. The concept of scientific waste management was introduced to the public debate, and structured waste governance in India was put out by them.

1.4.2. Solid Waste Management Rules, 2016: Key Reforms and Additions

The government of India introduced the Solid Waste Management Rules, 2016 to address the shortcomings of the 2000 regulations and the increasing complexity of municipal solid waste. The breadth and aim of these regulations were greatly increased. Not only did the regulations expand their scope to include RWAs, manufacturers, shops, street vendors, and informal trash workers, but they also extended to municipal authorities and bulk garbage generators. A new era of multi-stakeholder accountability began with this. Stricter regulations for landfill operations, more support for decentralized waste processing methods like composting and biomethanation, and the incorporation of informal waste pickers into the formal waste system were all important reforms. So was the requirement that waste be segregated at the source into biodegradable, non-biodegradable, and domestic hazardous categories. Manufacturers are now held accountable for their products' entire life cycles, including the disposal of packaging waste, thanks to Extended Producer Responsibility (EPR), which was heavily emphasized in the 2016 Rules. Technology to track garbage collection and processing was also advocated for, and the creation of Material Recovery Facilities (MRFs) was pushed for.

1.4.3. Evolution of Stakeholder Responsibilities

The redefining and redistribution of obligations among diverse stakeholders has been a major movement in India's waste management policies over the years. The majority of the responsibility for waste management was placed on local governments in earlier models. But policies have changed to be more participative and decentralized as time has progressed. People are now required to stop littering, take part in composting and recycling initiatives, and actively separate their trash at the source. Commercial businesses, educational institutions, and residential welfare societies are all responsible for trash management. Conversely, scientific processing, public awareness, infrastructure development, and rule enforcement are all responsibilities of municipalities. The EPR standards have increased producer and industry responsibility for post-consumer waste management, particularly in the packaging, electronics, and plastics industries. Furthermore, federal legislation now acknowledges the importance of the informal sector, especially trash pickers and scrap dealers. The regulations enacted in 2016 promote their incorporation into official systems, which can lead to better waste recovery rates and better prospects for livelihood enhancement. In line with worldwide trends toward integrated and inclusive waste governance, this expansion of duties signifies a change from a centralized to a shared responsibility paradigm for trash management. In terms of solid waste management, India has come a long way since these policy landmarks. These reforms seek to handle the increasing environmental and logistical issues of urban garbage in a way that is inclusive, scientific, and future-oriented by broadening the area of responsibility, updating rules, and incorporating sustainable practices.



Evolution of Waste Management Policy in India

2.LITERATURE REVIEW

In order to facilitate the growth of smart cities in India, Adapa (2018) offers a thorough framework that incorporates greener manufacturing processes. The research stresses the need of incorporating environmental responsibility via cleaner production programs into sustainable urbanization, in addition to infrastructure and technology advancements. Adapa suggests a unified paradigm in which resource conservation, pollution mitigation, and stakeholder participation are all integral parts of urban planning. In order for smart city projects to make a real difference in environmental sustainability, especially in waste reduction and material recovery, the research stresses the importance of systemic reforms and collaborative governance. Connecting sustainable waste management practices with urban development, this paradigm provides a core reference.

The case study of Saharanpur Smart City, which emphasizes the actual implementation of innovative waste management systems, is presented in detail by Ansari, Dutt, and Kumar (2024). Their research demonstrates how new approaches to city planning, public engagement, and technology advancement can lead to better waste management in the long run. Changing from antiquated waste management methods to modern, tech-enabled ones is a daunting task for many local governments, which the writers address. Their research shows that public awareness campaigns, financial incentives, and regional planning are key to effective implementation. This study sheds light on changes happening at the grassroots level and offers practical advice to other emerging towns that are trying to achieve smart waste management objectives.

With a focus on their use in trash management systems, Bellini, Nesi, and Pantaleo (2022) provide a comprehensive analysis of the technical underpinnings of smart cities enabled by the Internet of Things. Smart bins, sensor-based trash tracking, and real-time data analytics are just a few of the technologies highlighted in the research as having revolutionized garbage collection and processing. Their studies show how these technologies provide open feedback processes, which in turn reduce operating costs, improve service delivery, and encourage public engagement. This study lends credence to data-driven waste policies in smart city settings by placing IoT into larger urban management systems, which in turn demonstrates the technical possibilities for improving trash infrastructure.

In their 2020 study, Bhattacharya et al. investigate how developing nations might benefit from a sustainable framework for smart city development. Key aspects for long-term urban sustainability, according to their concept, include environmental resilience, inclusion, and cross-sectoral collaboration. In this approach, waste management takes center stage, necessitating coordinated strategies for energy, transportation, housing, and environmental services. Smart cities, according to the authors, run the danger of escalating inequality and environmental damage if they don't take a comprehensive approach. In order to make sure that technology interventions are community-focused and context-sensitive, their research shows that waste management needs to be part of smart urban development's larger ecosystem.

Based on policy analysis and empirical findings, Cheela et al. (2021) examine the various methods in which smart cities in India might achieve sustainable waste management. Decentralized composting, material recovery facilities (MRFs), and public-private partnerships are some of the best practices identified by the report, which also ranks Indian cities according to their waste management strategies and their level of maturity. Many cities suffer from insufficient infrastructure and a lack of technical knowledge, which the writers point out as a reason for the inconsistent execution of national waste policy. Scaling up effective waste management strategies across urban India requires more money, stronger institutional coordination, and improved capacity-building, according to their research. Within the smart city paradigm, this research sheds light on operational issues and the execution of policies.

Hoelscher (2016) examines how India's smart cities agenda has developed over time, both in terms of ideas and policies, and how it fits in with international discussions on sustainable and innovative cities. Developmental goals, foreign alliances, and infrastructure aspirations have all had a role in shaping India's smart city narrative, which is examined in this study. It draws attention to the disconnect between the ideal of technologically sophisticated urban centers and the actual situation of infrastructure disparity and governance constraints, and it criticizes the top-down approach of many smart city programs. As part of a larger plan for urban modernization, this study places waste management in the context of the political and institutional dynamics driving India's urban change.

In the field of smart city waste management, Ijemaru, Ang, and Seng (2022) investigate the transition from the IoT to the IoV. Their studies center on the ways in which vehicle-to-infrastructure connectivity and autonomous trash collection trucks are changing the face of urban waste logistics. The authors state that IoV has the potential to greatly enhance MSS efficiency, route optimization, and real-time decision-making. Cities that are prepared for the future will find this shift particularly relevant as they work to create a single smart infrastructure that can handle transportation, environmental monitoring, and resource recovery. Their research highlights the importance of new technology in improving the responsiveness and adaptability of waste systems.

An all-encompassing strategy that connects infrastructure, government, and citizen services is proposed by Joshi, Saxena, and Godbole (2016) as an integrated framework for the development of smart cities in India. The authors state that data-driven decision-making, inclusive planning, and digital governance platforms are crucial enablers for smart city development to be effective. Their approach does not limit itself to garbage collection; rather, it places trash management within the larger context of urban utilities, drawing attention to the interconnectedness of waste with other sectors such as electricity, healthcare, and transportation. In order to provide trash management and other scalable and sustainable urban services, the study stresses the significance of smart infrastructure standards and interoperability.

To examine the course of smart city development in India, Kesar and Ache (2024) use an institutional perspective. Their research delves at the ways in which administrative capacities, policy inertia, and institutional structures impact the execution and trajectory of smart city initiatives. While the Smart City Mission's goals are lofty, they say that bureaucratic red tape and disjointed leadership are the main obstacles.

As a fundamental component of the mission, waste management is frequently hampered by these governmental constraints. To address implementation deficiencies, the authors advocate for further decentralization, inter-agency cooperation, and policy coherence. If we want to know how problems with systemic governance impact the implementation of smart waste infrastructure, their opinions are invaluable.

Smart environmental systems, such as those for waste management, air quality monitoring, and water purification, are the subject of Kumar's (2020) conceptual model for smart cities. According to his research, in order for a city to be considered "smart," it must put an emphasis on both technical progress and environmental preservation. Kumar emphasizes that a smart environment for trash management must incorporate smart sensors, GIS-based route planning, and Internet of Things (IoT) enabled collecting systems. The study also highlights the significance of multi-stakeholder collaboration, governmental support, and public knowledge when it comes to creating eco-friendly urban areas. Along with other municipal services, it argues that trash management is a social and environmental problem that requires technology solutions.

3.METHODOLOGY

Research Design

The foundation of this study is an analytical and exploratory qualitative research approach. Our major objective is to chart the course of waste management policy in India from its earliest, more grassroots forms to the more modern, tech-driven, and urban-focused frameworks of today. Academic journal articles, policy papers, legislative frameworks, official reports, case studies from urban centers, worldwide environmental guidelines, and academic journals are the only secondary data sources used in the research. These resources lay the groundwork for comprehending the evolution of waste management practices and the ways in which policy responses have adjusted to new social, technological, and environmental realities. In order to compare policy objectives with actual results, evaluate the effect of different policy interventions, and discover recurrent themes, a document analysis approach is employed. Furthermore, the study uses a chronological comparison to emphasize important turning points, such as the Swachh Bharat Mission and Smart Cities Mission's incorporation of waste policies, the amendment of the Municipal Solid Wastes Rules in 2016, and its establishment in 2000. This study expands our knowledge of the local level policy impact by looking at how various cities have used and understood these regulations.

Theoretical Analysis

This study's theoretical underpinnings come from two important frameworks: the Circular Economy Model and Environmental Governance Theory. When it comes to waste management and other environmental issues, Environmental Governance Theory stresses the significance of stakeholder roles, regulatory frameworks, participatory decision-making, and institutional arrangements. This theory is useful for studying the dynamics of governance and how policies are impacted by the level of cooperation (or lack thereof) among public agencies, private companies, NGOs, and municipalities. It also sheds light on the relationship between waste policy interventions' effectiveness and accountability and openness. As an alternative, the Circular Economy Model evaluates current waste management practices through a sustainability-focused lens. The approach advocates for a closed-loop system that avoids landfill disposal by reusing, recycling, or converting materials into energy. The "5Rs" (Refuse, Reduce, Reuse, Recover, Recycle) and waste-to-energy (WTE) technologies are in sync with this policy feature. There is also Extended Producer Responsibility (EPR). This research examines India's policy evolution from a variety of theoretical angles to determine how well it strikes a balance between social inclusion, economic efficiency, and environmental protection.

Ethical Consideration

Maintaining a high standard of ethical conduct is essential to the research, even when no direct contact with human participants is required. Academic articles, government documents, and digital archives are all examples of secondary sources that have been meticulously chosen from reputable and verifiable sources. In order to prevent plagiarism and maintain intellectual integrity, proper credit is given through regular reference. An effort to be objective and free from institutional or personal biases is made in the construction of the interpretations that are offered. Furthermore, the study does not include any data manipulation or conclusions that are not backed by evidence. In addition, by following fair use regulations, the research honors the rights of the original writers by utilizing published information. To maintain objectivity and respect for all parties concerned, the information is presented in a balanced and factual way whether addressing case studies or quoting policy outcomes. Maintaining credibility, openness, and academic honesty in all aspects is the overarching goal.

Table 1 : Evolving Roles of Key Stakeholders in Waste Management in India

Stakeholder	Traditional Role (Pre-2000)	Modern Role (Post-2000)	Role in Smart City Frameworks (2015–Present)
Citizens	Passive participants reused/composted at household level	Responsible for segregation at source; subjects to fines and incentives	Active contributors via mobile apps, real-time reporting ,community composting
Municipal Bodies	Basic collection and open dumping	Legal enforcement of waste segregation, user charges, processing infrastructure	Use of IoT, data analytics, performance monitoring, GPS-tracked vehicles
Informal Sector	Unregulated ragpickers and recyclers	Recognized in policies; integrated in door-to-door collection and MRFs	Digitally registered; trained for formal waste handling and segregation
Private Sector	Minimal involvement	PPPs in waste-to-energy, composting, collection services	Investment in smart technologies, circular economy solutions, innovation in logistics
State/Central Govt	Limited role, occasional campaigns	Framed MSW Rules, SWM Rules; provided funding and regulatory oversight	Launched Smart Cities Mission; supports urban innovation, data-driven governance
Technology Providers	Not applicable	Began offering compactors, composters, recycling units	Developed AI/IoT-based waste tracking, real-time dashboards, citizen engagement platforms

4.FINDING & DISCUSSION

Findings

As a result of changes in demographics, economics, and the environment, the study reveals that waste management methods and policies in India have undergone a thorough evolution. In the past, traditional and decentralized methods were the backbone of India's garbage disposal systems. The biodegradable nature of most trash at the time made these systems rely on reuse, natural composting, and community-led sanitation activities effective. Because it was deeply embedded in their culture and spiritual practices, early societies placed a premium on cleanliness. As a result, waste was minimal and handled locally. Traditional systems started to fail in India due to rising urban populations, varied waste compositions, and larger amounts of garbage as the country became more industrialized in the 1800s and 1900s. The environmental threats and public health issues caused by the surge of non-biodegradable materials, chemicals, packaging waste, and plastics were beyond the capabilities of old systems to handle. The Municipal Solid Wastes (Management and Handling) Rules, 2000, India's first piece of formal waste management law, established a framework for organized municipal participation in waste collection, sorting, and disposal in response to these issues. Despite its importance, the results show that this step had a restricted scope and enforcement. Commercial entities, bulk trash generators, informal waste pickers, and residential communities were all made liable for waste management under the Solid trash Management Rules, 2016, marking a major shift in policy. Decentralized processing, scientific landfill development, source segregation, and Extended Producer Responsibility (EPR) for manufacturers were all important mandates implemented by these guidelines. In addition, the results show how the Smart Cities Mission and the Swachh Bharat Abhiyan (Clean India Mission) promoted waste management through attracting political interest, funding, and new technologies. Internet of Things (IoT) garbage cans, data-driven monitoring, and GPS-enabled trash cans are just a few of the digital tools that smart city frameworks have brought. In addition, community composting centers, Material Recovery Facilities (MRFs), and Waste-to-Energy (WTE) facilities have been steadily expanding, particularly in major cities like Surat, Indore, and Pune. While the policy has changed significantly, there is still a lot of variation in how different states and localities have implemented it, according to the results. Inadequate funding, public ignorance, and antiquated infrastructure continue to be problems for many smaller towns. There are still numerous urban and peri-urban regions that deal with issues including unlawful dumping, open burning, and inadequate source segregation.

DISCUSSION

Changes in India's waste management regulations mirror a global trend away from disposal-based, reactive tactics and toward frameworks focused on sustainability. From low-impact, conventional waste management practices to a more institutionalized, multi-stakeholder model, India has made great strides, according to the results. A number of causes, such as an expanding human population, more people moving to cities, higher levels of consumerism, and heightened environmental awareness, have contributed to this change. For example, the SWM Rules 2016 represent a significant break with the traditional model that has been dominated by municipalities. These rules establish a shared responsibility framework that encourages involvement from individuals, businesses, and the informal sector, as well as from centralized entities. Decentralized decision-making, participatory planning, and accountability are key tenets of Environmental Governance Theory, which is in line with these concepts. The topic also highlights how Circular Economy principles—which aim to reduce waste and maximize resource recovery—are becoming more influential in shaping current policy. Important parts of a circular waste economy include recycling, composting, biogas production, and source segregation. Another sign of a change toward making manufacturers answerable for their products throughout their lifespan is the push for Extended Producer Responsibility (EPR) under different regulations, such as those pertaining to plastic and e-waste disposal. To ease the load on local governments, these frameworks push businesses to create recyclable and environmentally friendly goods. On

the other hand, important chasms between policymaking and actual implementation are exposed in the conversation. Many Urban Local Bodies (ULBs) lack the necessary technical knowledge, trained personnel, and funding, even if detailed guidelines are available. Additionally, governmental objectives are being undermined by people' behavioral inertia, which is seen through their incorrect disposal habits, lack of segregation, and limited participation in recycling programs. Official trash processing systems continue to overlook and mismanage the informal sector, despite the 2016 Rules' acknowledgment of it. Even though the Smart Cities Mission's technological developments provide great answers, they are only available to tier-1 cities. Environmental justice and equitable development are hampered by the lack of scalable solutions for smaller municipalities. In addition, there are still questions over the environmental impact, financial feasibility, and social acceptability of WTE technologies, even if they have become more popular. Due to inadequate technical capability and poor waste quality, some factories have been forced to close or go underutilized. Integration with localized realities, capacity-building activities, and active public participation are crucial to the success of India's waste management policy initiatives, which are admirable in scope and goal. For waste management to be successful in the long run, it needs to be perceived as a civic duty that involves everyone in society, not just the government. This duty should encompass sustainability, innovation, and inclusivity. Local empowerment is the bedrock of smart city framework evolution, which in turn requires unwavering political commitment, consistent financing, and flexible governance.

5. CONCLUSION

A more comprehensive story of India's socio-environmental transition may be found in the evolution of garbage management inside the country, from conventional methods to smart city frameworks. Sustainable lifestyles and community-based trash management were integral to traditional Indian society, which allowed for efficient garbage management with little negative effects on the environment. A transition towards organized, policy-driven systems was, however, required by the stresses of industrialization, urbanization, and contemporary consumer habits. To deal with the increasing complexity of garbage disposal, India has built a strong institutional and regulatory structure throughout the years. The Solid Waste Management Rules of 2016, which supersede the Municipal Solid Waste Rules of 2000, are an important step forward in terms of policy since they place an emphasis on technological innovation, stakeholder responsibility, and decentralized processing. Public policy initiatives like the Swachh Bharat Mission and the Smart Cities Mission have elevated waste management to the centre stage, creating a bridge between sustainability, urban planning, and cleanliness. A major shift toward integrated and future-proof waste management solutions is seen in these endeavors. However, there are still obstacles to overcome in terms of public involvement, equal infrastructure access, and implementation, even with these advances. Regional disparities, a lack of human and financial resources, and a lack of community involvement all work against efficient execution. A combination of public education, investment in capacity building, grassroots involvement, and ongoing regulatory refinement will be necessary to close this gap. In the end, the changing waste management strategy in India highlights the importance of a balanced plan that incorporates both ancient wisdom and modern innovation. The country's waste policies must incorporate circular economy principles and inclusive governance if it is to achieve sustainable development, protect the environment, and improve the quality of life for all of its residents as it continues to urbanize and modernize.

Table 2 : Evolution of Waste Management Policies in India

Time Period	Stage/Policy	Key Features	Impact
Pre-20th Century	Traditional Practices	Community-led composting, reuse of organic waste, minimal packaging waste	Sustainable but limited to rural/agricultural settings; low urban applicability

1980s–1990s	Early Modern Interventions	Basic municipal involvement, emphasis on collection and disposal	Inadequate infrastructure; poor segregation; limited public awareness
2000	Municipal Solid Waste (MSW) Rules, 2000	Legal responsibility for segregation at source, door-to-door collection, landfilling guidelines	First formal regulatory framework for urban waste management
2016	Solid Waste Management Rules, 2016	Extended producer responsibility (EPR), inclusion of informal sector, waste processing targets	Strengthened decentralized processing; introduced user charges and penalties
2015–Present	Smart Cities Mission & Swachh Bharat Abhiyan	Integration of ICT, real-time monitoring, segregation at source, GPS-based waste tracking	Promoted citizen participation, digital tracking, smart bins, decentralized waste processing
2020s	Circular Economy & Plastic Waste Management Rules	Ban on single-use plastics, incentivized recycling, EPR for plastic producers	Focus on resource recovery, circular use of materials, policy-tech convergence

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