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TOWARDS SUSTAINABLE WASTE MANAGEMENT: EXAMINING INDIA'S PROGRESS

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Abstract

The generation of waste is an inherent aspect of human activity, and despite significant advancements in social, economic, and environmental domains, the implementation of effective solid waste management (SWM) practices remains a substantial challenge. Municipal and industrial waste, in particular, pose severe threats to living organisms, underscoring the urgency of adopting sustainable SWM approaches as India strives for industrialization. Developed nations have successfully managed their waste through the utilization of advanced facilities, robust government institutions, and efficient bureaucracies. However, developing countries, such as India, are still in the process of transitioning towards improved waste management practices. In the face of rapid population growth, clear government policies and competent bureaucracies are imperative to address the adverse impacts of current SWM systems on public health, the environment, and the economy.

This paper presents a comprehensive review of the current state of waste management in India and aims to explore various issues concerning waste streams as of the present date. The review highlights the pressing need for sustainable waste management systems and facilities to mitigate the environmental and health hazards associated with increasing waste generation. Moreover, it emphasizes the importance of effective government policies and bureaucratic competence in establishing a well-organized waste management framework in the country.

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1. Introduction

Generation of waste is a natural phenomenon. Despite social, economic and environmental development, there is a long way to implement an effective solid waste management (SWM) practice. A substantial amount of municipal waste and industrial waste is extremely dangerous to the living organisms (Misra & Pandey, 2005). SW is expected to increase significantly in near future as India strives to attain an industrialized nation status (Sharma & Shah, 2005). Therefore, there is an urgent need to move to more sustainable SWM with new management systems and facilities. Developed countries manage their wastes with advanced facilities, competent government institutions and bureaucracies. Developing countries like India are still in the transition towards better waste management (WM). Current SWM systems having negative impact on public health, environment and economy need clear government policies and competent bureaucracies especially in countries having rapid population growth. This paper comprehensively reviews current status of WM in India and makes an attempt to track various issues concerning waste streams as on date.

2. Objectives of the Paper

The prime objectives of the study are to-

- Present the current status of WM in India
- Carry out analysis showing the reasons of improper WM ▪ Offer suggestions to overcome the same.

3. Data and Research Methodology

The study basically depends on secondary data. The researcher, being an external analyst, has to depend mainly on current literature available on the issue in the form of books, journals, articles, research studies, websites, etc. for the examination of current status of WM. Editing, classification and tabulation of data collected from these sources have been done as per requirement of the study. Different statistical techniques and tools have also been applied for the purpose of the analysis.

4. Literature Survey

Sharholy et al., (2007) in their report over municipal solid waste management (MSWM) in Indian cities discussed about the different aspects of disposals and treatment of MSW. They suggested to work towards further improvement of the present system. Talyan et al., (2008) observed the policies and initiatives of the Government and Municipal Corporation of Delhi and suggested to improve the existing MSWM system. Kumar & Goel, (2009) examined MSWM practices with various parameters. They proposed integrated SWM plan and augmentation in labor and vehicle inventory for better treatment and disposal facilities. Narayan (2008) in his report on landfills, incineration and composting practices in India from MSWM identified the most economical and best option possible to combat the waste disposal problem. Unnikrishnan & Singh (2010) focused on clean development mechanism (CDM) projects and the CDM opportunities in India and revealed in comparative study between Brazil and India that India does not have well designed sanitary landfills. India should make conscious efforts towards developing more scientific landfills, capture methane and take carbon credits. Vij (2012) in the report on SWM assessed the current practices of SW and the problems associated with it and suggested measures to conduct this waste in healthy and environment friendly manner to prove resource instead of waste.

5. Waste Management (Or Wm) - Concept

'Waste Management' collectively means management of waste from its inception to its final disposal. Thus, WM includes collection, transport, treatment and disposal of waste along with its monitoring and regulation. All kinds of wastes, right from municipal waste to agricultural waste to hazardous residues and special wastes such as sludge, health care wastes come under one umbrella. Industrialization along with rapid urbanization witnesses building up of waste. Efficient WM implies full exploration for final disposal of waste.

6. Indian Scenario

6.1 Magnitude of Problem

India is suffering from acute increase in waste generation. Collection efficiency is not much developed. Crude dumping is practiced everywhere. Sound waste management can tackle waste production scientifically. Types of SW depend on its source, composition, phase, treatment, etc. (Table-1).

Table 1. Type of SW

Source	Waste Generators	Type of Solid Waste
Residential	Household activities	Food, paper, plastics, wood, metals, electronic items, etc.
Industrial	Manufacturing units, power plants, process industries, etc.	Housekeeping wastes, hazardous wastes, ashes, etc.
Commercial & Institutional	Hotel, restaurant, market, office, school, hospital, prison, etc.	Biomedical, food, glass, metals, plastic, paper, etc.
Construction and Demolition	New construction, road repair, demolition of structures, etc.	Wood, steel, concrete, dust, etc.
Municipal Services	Street cleaning, parks, water treatment plants, landscaping, water, recreational areas, etc.	Tree trimmings, usual wastes, sludge, etc.
Agriculture	Crops, orchards, farm, dairies, etc.	Agricultural & Hazardous waste, etc.
Mining	Open-cast mining, underground mining, etc.	Basically, inert materials like ash, etc.

Source: Author's own elaboration

6.2 Composition, Characteristic, Generation, etc. of SW

Composition, characteristic, generation, etc. of SW vary from place to place in India (Figure 1 &Table-2,3).

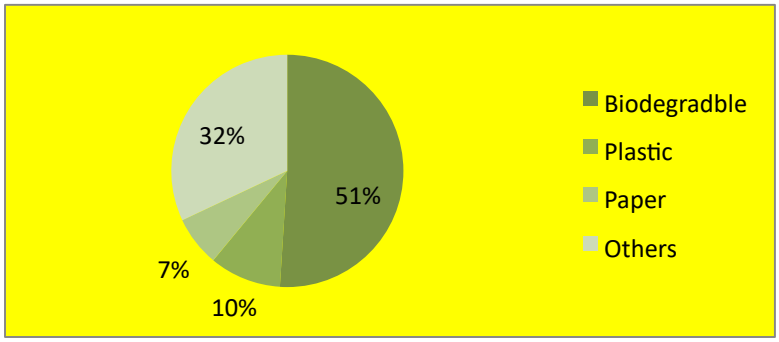

Figure 1. Composition of Municipal Solid Waste in India

Source: Task Force on Waste to Energy, Planning Commission

Table 2. Physical Characteristics of SW in Indian Cities

City	Paper	Textile	Leather	Plastic	Metal	Glass	Ash, earth, others	Fine matter	Compostable
Ahmedabad	6	1		3			50		40
Banglore	8	5		6	3	6	27		45

Bhopal	10	5	2	2		1	35	45
Mumbai	10	4	1	2		1	44	40
Kolkata	10	3	1	8		3	35	40
Coimbatore	5	9		1			50	35
Delhi	7	4	1	2	3	1	52	32
Hyderabad	7	2		1			50	40
Indore	5	2		1			49	43
Jaipur	6	2		1		2	47	42
Kanpur	5	1	5	2			53	40
Kochi	5			1			36	58
Lucknow	4	2		4	1		49	40
Ludhiana	3	5		3			30	40
Madras	10	5	5	3			33	44
Madurai	5	1		3			46	45
Nagpur	5	7	2	1	1	1	53	30
Patna	4	5	2	6	1	2	35	45
Pune	5			5		10	15	55
Surat	4	5		3		3	45	40
Vadodara	4			7			49	40
Varanasi	3	4		10			35	48
Visakhapatnam	3	2		5		5	50	35
Average	6	4	1	4	2	2	40	42

Source: 1) Municipal Bodies of Different Cities; 2) Central Pollution Control Board (CPCB), 2012

India has rapid urbanization with physical, climatic, geographical, ecological, social, cultural and linguistic diversity (Table 4). In fact, people still throw household waste without following proper WM channel; few industries dump its wastes illegally and lack of awareness is still there. Besides, nuclear waste is important for its adverse environmental impact.

Table 3. Estimates for SW Generation

Year	Source	Annual Generation (million tons)
2017	Our Estimate- 1 based on 450 gm per capita daily generation and urban population of 440 million*	72
2017	Our Estimate- 2 based on 400 gm per capita daily generation and urban population of 440 million*	64
2014-15	Central Pollution Control Board	52

2014-15	Ministry of Urban Development	52
2013-14	Task Force on Waste to Energy, Planning Commission	62

Source: CPCB, Ministry of Urban Development and Planning Commission

Population growth increases waste much in India. Mega cities have dynamic economic growth and high waste generation per capita (Table 4).

Table 4. Major Cities in India and Waste Generation Data

City	Population(Million) Waste Generated(TPD) Waste Generated(TPD) (TPD) Waste Generation (2011 Cencus)	Waste Generation (kg per capita per day)
Ahmadabad	6.3 2300	0.36
Hyderabad	7.7 4200	0.54
Bangalore	8.4 3700	0.44
Chennai	8.6 4500	0.52
Kolkata	14.1 3670	0.26
Delhi	16.3 5800	0.41
Mumbai	18.4 6500	0.35

Source: CPCB Report, 2012

6.3 Statistics on Waste Generation and Waste Characterization

Estimating and forecasting of waste generation and its characteristics is fundamental to successful WM planning. India generates a large amount of SW per day; but collection and treatment is not enough. SW generation per capita in India ranges from about 0.17 kg per person per day in small towns to about 0.62 kg per person per day in cities (Kumar & Goel, 2009). Waste generation depends on population density, economic status, commercial activity, culture and region.

6.4 Waste Characterization Data

Waste composition has a significant impact on WM practices. Biomedical Waste (Management and Handling) Rule governs MSW which contains hazardous wastes, compostable organics waste, healthcare waste, etc. Households and inert waste from construction, demolition and road sweeping generate organic waste. Waste samples collected from different cities shows varied MSW composition. Average (%by weight) composition of MSW in Indian metro cities is found to be compostable (41), inert (40), paper (6), plastic (4), glass (2), metals (2), textile (4) and leather (1) respectively (Sharholy et al., 2007). Rag-pickers and recyclers of neighborhood in processing waste reduces waste headed to landfill and prevents rag-pickers from having to rummage through waste. Onus lies with the citizens. The citizens have to follow few basic steps in disposing waste such as collection, segregation, dumping, composting, drainage, treatment of effluents before discharge, etc.

7. Waste Management in India

Less than 60% of waste is collected from households and only 15% of urban India's waste is processed in the country (PIB, 2016). Collection vs. dumped position is exhibited in Figure 2).

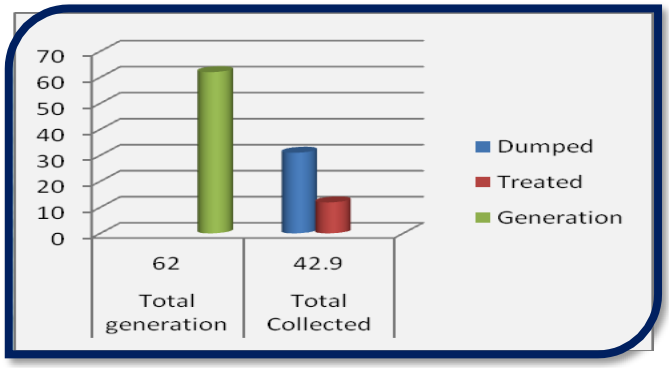

Figure 2. Collection vs. Dumped Statistics in Million MTp.a.

7.1 Prediction on Future Waste Growth

Asia shares about one-third of expected world waste with major contributions from China and India by 2050. Waste in urban areas increase due to population and lifestyle. In 2011, urban India generated 47.30 million tons of waste and by 2036, it is predicted to be 131.2 million tons, a fivefold increase (Table 5).

Table 5. Predicted Population Growth and Impact on Waste Generation

Year	Population (Million)	Waste Generation (Kg per capita per day)	Waste Generation (Million tons per year)
2011	260.1	0.498	47.30
2021	342.8	0.569	71.15
2031	451.8	0.649	107.01
2036	518.6	0.693	131.2

Source: Annepu, RK, 2012

7.2 Scenario of Waste Collection and Transportation

Of late, Waste Management Rules under the Environment Protection Act has changed the atmosphere. Ministry of Environment and Forests (2015) and updated published draft Rules have re-issued to ensure sound WM in India. Municipal authorities implement these rules and develop infrastructure for collection and waste disposal methods. Integration of the methods increases collection efficiency (Talyan et al., 2008). Many states like Gujarat, Maharashtra, Andhra Pradesh, Delhi, Tripura with local bodies and NGOs have taken initiatives to increase collection efficiently while states like Arunachal Pradesh, Nagaland are yet to comply with the MSW Rules and unscientific methods. Table-8 exhibits waste collection of different states of India. Table 6 shows state-wise waste collection of India.

Table 6. State-Wise Waste Collection

State	Quantity Generation (TPD)	Collection (TPD)	State	Quantity Generation (TPD)	Collection (TPD)

Andaman& Nicobar	50	43	Lakshadweep	21	21
Andhra Pradesh	11500	10655	Madhya Pradesh	4500	2700
Arunachal Pradesh	94	NA	Maharashtra	19204	19204
Assam	1146	807	Manipur	113	93
Bihar	1670	1670	Meghalaya	285	238
Chandigarh	380	370	Mizoram	4742	3122
Chhattisgarh	1167	1069	Nagaland	188	140
Daman Diu& Dadra	28+13=41	NA	Orissa	2239	1837
Delhi	7384	6796	Pondicherry	380	NA
Goa	193	NA	Punjab	2794	NA
Gujarat	7379	6744	Rajasthan	5037	NA
Haryana	537	NA	Sikkim	40(capital)	32
Himachal Pradesh	304	275	Tamil Nadu	12504	11626
Jammu & Kashmir	1792	1322	Tripura	360	246
Jharkhand	1710	869	Uttar Pradesh	11585	10563
Karnataka	6500	2100	Uttrakhand	752	NA
Kerala	8338	1739	West Bengal	12557	5054
			34 States	127486	893

Source: CPCB, 2012

7.3 Role of Informal Sector

Informal sector is an integral part of WM system. Waste pickers, in India, mostly depend on it for income. Table-7 & 8 show collection efficiency, estimation of MSW collection and segregation at source in selected Indian cities.

Table- 7. Collection Efficiency of Indian Cities

Name of the City	Collection Efficiency (%)	Name of the City	Collection Efficiency (%)
Bombay	97	Madurai	52
Madras	90	Pune	70
Banglore	68	Baroda	60
Coimbatore	65	Bhopal	94
Ahmedabad	90	Salem	19
Kanpur	70	Lucknow	83
Indore	83		

Source: Gupta et al., 1998; Khan, 1994

Table-8. MSW Collection and Segregation at Source in Selected Cities

City	State	Population (million)	Door-to-door Collection from Households(%)	Segregation at Source(%)
Large Cities				
Mumbai	Maharashtra	20	80	-
Delhi	-	19	39	-
Bengaluru	Karnataka	10	71	50
Chennai	Tamil Nadu	10	80	-
Hyderabad	Telangana	9	73	-
Ahmedabad	Gujarat	8	95	-
Surat	Gujarat	6	60	12
Pune	Maharashtra	6	50	52
Mid-size Cities				
Indore	Madhya Pradesh	3	90	53
Bhopal	Madhya Pradesh	2	100	na
Ludhiana	Punjab	2	25	-
Chandigarh	-	1	95	-
Mysuru	Karnataka	1	95	55
Small Cities				
Warangal	Telangana	1	90	na
Tirunelveli	Tamil Nadu	1	100	100
Alappuzha	Kerala	0.2	100	76
Suryapet	Telangana	0.1	100	NA
Gangtok	Sikkim	0.1	90	30
Panaji	Goa	0.1	100	90

Note: Large cities-Population greater than 5 million, Mid-sized-1 million to 5 million and small cities-Less than 1 million. Data for Kolkata are unavailable.

Source: Municipal Bodies of Different Cities 7.4 Waste Disposal Options

Waste disposal is at critical stage in India. Well-engineered waste disposal saves public health and preserves key environmental resources. Important disposal options available are: i) Non-engineered Disposal- In many Indian cities, poorly managed and commonly practiced dumping give birth to acute environmental degradation and public health. Above 90% of SW in cities and towns are directly disposed on land in an unsatisfactory manner (Sharholy et al., 2008). ii) Sanitary Land filling- Sanitary land filling option avoids harmful effects of uncontrolled dumping, minimizes surface water and gas escaping from waste. Engineered landfill allows safe disposal of residual and reduces greenhouse gas (GHG) emissions and slope instability issues. However, land filling is the most widely adopted practice in India to ensure sanitary land filling (Kansal, 2002). iii) Composting: Many

largescale compost plants have been set up in major cities and towns. Compost has very high agricultural value (Tchobanoglous et al., 1977). iv) Incineration: In India, incineration is usually limited to hospital and other biological wastes for high organic material, moisture contact and low calorific value (Kansal, 2002; Bhide & Shekdar, 1998). v)Vermicomposting Municipal Solid Waste: In this method, earthworms feeding on organic matters in SW convert into casting rich in plant nutrients. vi) Reuse and Recycling of Waste materials: Reuse and recycling minimize waste by converting discarded materials into useful products. Hierarchical Process having 3R's, namely, Reduce, Reuse and Recycle is the cornerstone of WM strategies. The basic principle lying is that all the generated residues are utilized to maximum while only a minimal amount of waste is left for resourcefully reusing through other viable channels (Table 9).

Table 9. Land Allocated for Developing Landfills

City	No. of landfills sites	Area (acre)	City	No. of landfills sites	Area (acre)
Chennai	2	1150.3	Jaipur	3	77.6
Coimbatore	2	721.5	Kolkata	1	61.0
Surat	1	494.2	Chandigarh	1	44.5
Mumbai	3	345.9	Ranchi	1	37.1
Hyderabad	1	300.2	Dehradun	1	11.1
Ahmedabad	1	207.6	Jamshedpur	2	10.1
Delhi	3	164.1	Faridabad	3	5.9
Jabalpur	1	150.7	Asansol	1	4.9
Indore	1	147.0	Varanasi	1	4.9
Madurai	1	120.1	Agra	1	3.7
Bengaluru	2	100.6	Lucknow	1	3.5
Vishakhapatnam	1	100.1	Rajkot	2	3.0
Ludhiana	1	99.8	Shimla	1	1.5
Nasik	1	85.0			

Source: CPCB,2011

8. Government Policy and Legislation

The Ministry of Environment and Forests (MOEF) with the Central and State Pollution Control Board takes care of the WM issues. The Technology Advisory Group under the direction of High Court submits its report from time to time relating to the scope of improvement and implementation of new technologies. The Government has also passed Plastic Waste (Management and Handling) Rules, 2011 and E-Waste (Management and Handling) Rules, 2011 to solve the issue. Article 48-A of the Indian Constitution advises each state to recycle and reuse its waste. Final SW is disposed in landfills to minimize adverse environmental impact to reduce toxicity and its final volume (Misra & Pandey, 2005). The state governments have taken initiative to ban plastic carry bags and electronic goods for better disposal. Unlike European countries, Extended Producer Responsibility (EPR) concept has not become successful in India. Vehicle management has become a challenge to tackle the issue. CPCB (2012)

has published 'Guidelines for Environmentally Sound Management of 'End-of-Life Vehicles' (ELV)" to solve adverse impact of vehicles on environment. Table 10 shows benchmark set by the Government.

Table 10. Benchmark set by the Government of India

Activity	Percentage (%)	Activity	Percentage (%)
Collection Efficiency	100%	Cost Recovery	100%
Segregation	100%	Redressal of Complaints	80%
Recovery/Recycling Efficiency	80%	Collection of User Charge	90%
Cost Recovery	100%	Treatment of MSW	100%

Source: Ministry of Urban Development

9. Current Scenario

India having vast population with growing economy cannot afford to effective WM. Policy framework is available on paper; but ground reality is alarming. The Government has taken initiatives; still there is a long journey to travel to achieve desired results. 'Swachchh Bharat Abhiyan' also known as 'Clean India Mission' is a bold step to awaken citizens about the importance of WM approach. The Government has also opened its doors for private sector. Public-Private-Partnership (PPP)Model can help generating revenues and eventually competency level for effective SWM. However, lacking finance, public support and institutional deficiency create obstacles. India has adopted the following legislations to strengthen her hands of administration about major waste streams (Table-11).

Table 11. Major Waste Streams Legislation in India

Type of waste	Applicable Legislation	Impact
Hazardous Waste	Hazardous and Other Wastes (Management and Tran boundary Movement) Rules, 2016	Pollution; Fire hazard; Food; Climate; Food; Health; Habitat loss; Bio-magnification, soil fertility, etc.
Bio-medical Waste	Bio-Medical Waste Management Rules, 2016	Infection; Pollution; Climate; Food; Health; Habitat loss; Flora/Fauna, etc.
Plastic Waste	Plastic Waste Management Rules, 2016	Sewerage; Drainage; Digestion; Food; Health; Flora, etc.
Lead Acid Battery Waste	The Batteries (Management and Handling) Rules, 2001	Pollution; Lead poisoning; Habitat loss; Health, Food,; Resource, etc.

Construction and Demolition Waste	Construction and Demolition Waste Management Rules, 2016	Pollution; Sewerage, Drainage; Health; Habitat loss; Biomagnification, Soil fertility, etc.
Municipal Solid Waste	Solid Waste Management Rules, 2016	Pollution; Sewerage; Drainage; Climate; Fauna; Food; Material corrosion; Bio-magnification; Infection, etc.
Radioactive Waste	Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987	Health; Pollution; Resource depletion; Flora/Fauna, etc.
Fly Ash	Fly Ash Notification , 1999	Health; Pollution; Resource depletion, Flora/Fauna, etc.

Source: CPCB, 2012

9.1 Rapid Urbanization

Unplanned urbanization increases pollution level and environmental degradation. Reverse flow of money encourages residents generating more trash and also making dumping a more popular option to recycling or composting. Thus, all stakeholders need to be incentivized to maximize collection, minimize dumping and maximize composting and recycling operations. India needs a paradigm shift from dumping based approach to efficient utilization of construction and demolition (C & D) waste. C & D waste recycled to replace natural building material is beneficial for environment and also saves substantial costs and resources. About 30% of C & D waste in India contains bricks masonry while 35% constitutes soil, sand and gravel (GIZ, 2016). Construction and Demolition Waste Management Rules, 2016 contain the functions of C & D waste generator. Further, CPCB, (2012) has published guidelines on Environmental Management in the matter.

9.2 Challenges in India

Collection, segregation, insufficient land, dumping, unawareness, etc. are key issues and challenges in India. Simple dumping cannot mobilize financial resources for expensive technology. A closer look at the scenario reveals that waste needs to be treated holistically. Urban migration and density of population can make WM a difficult issue in future. Although there have been a variety of policy responses to the its problem, sustainable solutions to either organic or inorganic waste still remain unattended. Recycling is the most economically viable option for employment opportunity to the urban poor. Critical issues like industry responsibility, sustainable recycling and catalyzing waste reduction have not been touched upon sufficiently. Every kind of material used for packaging cannot be recycled in the low-end technology. Besides, safety provisions of the waste-pickers and workers are very poor. Modern technology can deal with urban waste problem. Developed countries are doing away with incinerators because of high costs. But developing countries have become potential markets for dumping such technologies.

10. Suggestions for Future Improvement

Table-12 outlines major waste stream, its block and offers recommendations for sound WM:

Table 12. Interventions Concerning Major Waste Stream

Type of Waste	Bottleneck	Recommendation
Hazardous Waste	Shortage of staff; Absence of Treatment and Disposal Facilities, Distance between generator and treatment/disposal sites, etc.	Increase number of staff; Establish TSDF, etc.
Biomedical Waste	Shortage of staff; Undone tracking of plastic stream from bio-medical waste; No mechanism to cross check quantity of waste generated.	Increase number of staff; Track the plastic stream; Annual publication of consumption of medical consumables by concerned department
Plastic Waste	Shortage of staff	Increase number of staff
Lead Acid Battery Waste	Shortage of staff	Increase number of staff
Construction and Demolition Waste	Shortage of staff & recycling facility; Unawareness among people; etc	Increase number of staff; Create awareness through various mass communication media; Encourage recycling facilities under PPP model at the outskirts of local bodies; Encourage prefabricated building.
Municipal Solid Waste	Shortage of staff & processing facility; Unawareness among stakeholders; Difficulty in adopting 'Polluter Pay' principle, etc.	Increase number of staff; Create awareness through various mass communication media; Encourage recycling facilities under PPP model at the outskirts of each local bodies,; Collect SWM; High levy on hazardous/ infectious waste generators.
E-Waste	Shortage of staff; Unawareness among people; Entry of End-of-life mercury bearing lamps, etc.	Increase number of staff; Create awareness through various mass communication media; Phase out mercury bearing lamps
Radioactive Waste	Cremation of people underwent radiotherapy might release residual radioactive substance into environment.	Shift the crematorium away from city limits; Train people in crematorium about hazardous involved; Monitor emissions and ash from crematoriums.
Fly Ash	Lack of research with respect to utilization of ash in ash pond.	Encourage research with respect to utilization of bottom ash.

End-of-Life Vehicle	No exclusive legislation orIncorporate provisions with respect to provision in the existing legislation;disposal of end-of-life vehicles in Mostly dismantled endof-lifeexisting rules; Introduce EPR, Track vehicles sent for recycling byend of life vehicles. informal sector; No formal tracking of end of vehicles and its status, etc.
Food Waste	No exclusive legislation orIncorporate provisions to reduce, provision in the existing legislation;reuse, recycle and disposal of food No formal tracking of food waste,waste in existing rules; Quantify and etc. track food waste.
Slaughter House Waste	No exclusive legislation or Incorporate provision for proper provisions in the existingdisposal of slaughter house waste in legislation; No formal tracking ofexisting rules; Introduce EPR, etc. slaughter house waste, etc.
Bottom Ash	No exclusive legislation orIncorporate bottom ash in existing provisions in the existingrules; Encourage research regarding legislation; Lack of research forutilization of bottom ash utilization of bottom ash, etc.
Disaster Waste	No exclusive legislation or provision in the Incorporate provisions for disaster waste in existing legislation; No estimation of waste existing rules; Estimate and publish waste envisaged in each local body at different envisaged in each local body for different possible calamity, etc. possible calamity

Author's own elaboration

10.1 Further Suggestions

- Technical aspects should make strategy for planning and its implementation according to situation of the country.
- Wastes need to be increasingly sorted at the source to separate recycled materials and to reduce the magnitude of wastes.
- Changes in the habits of segregation, littering can alter the approach. A mechanism to generate revenue from the citizens should also be developed.
- Separate parallel decentralized schemes by the Government can facilitate right impetus for the development of WM method.
- Integration of informal sector can help achieve sustainable SWM on the one hand and improving their living standards on the other.
- Scenario based on socio-economic, environmental and health considerations should fulfill the basic goal of recycling the maximum waste generated, creating maximum employment without reducing potential health hazards.
- Self-Employed Women's Association improves the living standard of women paper-pickers by organizing them into cooperatives.

- A flawless flow sheet matching financial support, discipline and attitudinal change in all concerned is obviously the key to success of WM.
- In India, authorities practicing landfill do declare that they assiduously implement requirements for recommended landfill to assuage citizen concern.
- Recycling and reuse of plastics with new techniques can minimize pollution level.
- The Ministry of Urban Development and Poverty Alleviation, as well as Agriculture, should develop market for compost and provide subsidies for compost manure-first.
- Planning and its implementation should start from general public level followed by block level, district level and state level.
- India needs integrating waste policy with migration, industrialization, education, housing, tourism and transportation.
- The state governments with banning of plastic carry bags should also put an end to electronic goods to ensure better disposal of e-waste.
- Awareness among the young generation can alter public apathy by building campaigns and educational measures.
- Research efforts should concentrate on biological methods of waste treatment. In the modern hi-tech age, problem of USWM is to be addressed in broader dimension.
- A well-defined strategic SM plan and its strong implementation prevents epidemic and makes each city healthy.
- Sensitization of the community helps achieve the objectives as every city in India is already a hotbed of many contagious diseases.
- Working on a holistic approach by NGOs and private sectors helps developing responsible citizens who will treat waste as resource opportunity.

11. Conclusion

Time has come to encourage technology-based entrepreneurship for effective WM. Authorities must protect fundamental rights of citizens and citizens also must perform their fundamental duties to their best practices. Most of the populated areas show the picture of sadly managed and uncontrolled dumpsites. Lackadaisical attitude of the common people has compounded the problem and have left the entire responsibility to the civic authorities. Environmental degradation has led to unregulated use of environment and its wide spread. Absence of complete market makes use of alternative method essential to find solution for the environmental issues. In fact, implementation of environment laws is yet to impact on ecosystem and, therefore, on the health and living conditions of the citizens.

12. Concluding Remarks

Waste generation basically depends on population, climate, urbanization, socio-economic criteria, etc. The Government should simplify the rules and encourage all the citizens to practice the same in their households and may arrange for reward to the best WM practitioner. Methods like vermicomposting, energy generation from solar cells and e-wastes using recycled water for household practices can be easily preached to the common people. This enhances the fertility of our soil, reduces environmental pollution, increases ground water level ultimately making our environment a safe haven to live. This will be the real legacy we have to leave behind for the forthcoming generation.

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