

# Integrated Sustainable Waste Management: A Review

<sup>1</sup>Dhaval N Patel, <sup>2</sup>Prof.Jagruti Shah

<sup>1</sup>M.tech Student, <sup>2</sup>Asst.Prof

<sup>1</sup>Infrastructure Engineering & Technology, BVM Engg.College, V.V.Nagar, India

<sup>2</sup>Structural Engineering Department, BVM Engineering college, V.V.Nagar, India

**ABSTRACT** : Solid waste is considered as unwanted material because it has served its purpose and the process of collecting, treating & disposing of solid waste and it's know as solid waste management. In Small and medium scale of town and their nearby villages has solid waste management major issues. Nowadays landfilling and open dump are the most conceivable and reuse or recyclable of waste is less in developing countries, but in developed countries they are giving priorities to Waste-to-energy, Recycling of waste and many other advanced options for sustainable disposal of Municipal Solid Waste. Majority of population in India is rural areas and it has seen that their SWM network is lagging behind with compared to urban areas. Hence opportunities for rural areas to Improved their Solid Waste Management through Integrated Solid Waste Management which could be a very potential and effective tool deal with poor Waste Management System.

**Keywords** - Integrated Solid Waste Management, Rural and Urban Area, Waste Management, Solid Waste Issues, Developing Countries, Developed Countries

## I. INTRODUCTION

Solid waste is the unwanted or useless solid material generated from human activities in residential, industrial and commercial area. It can be categorized on the basis of its origin and according to its contents like organic material, paper, glass, metal, plastic etc.

Solid waste management is the collecting, treating, and disposing of solid material. Improper disposal of solid waste can create unsanitary condition, and these condition in turn can lead to pollution of environment and human disease. Management of solid waste reduces unfavorable impacts on human health and environment and helps to enhance economic development through participation of community or society<sup>[1][18][27]</sup>. The quality and quantity of Municipal Solid Waste (MSW) relies upon particular community, social & economic status, population, culture pattern, commercial activities and urban structure<sup>[3]</sup>. The most prevalent ways to manage solid waste are Sanitary landfills, Incineration, Recycling and Recovery, composting and Pyrolysis. Appropriate solid waste Management is significant for the assurance of community health, environment quality & for conserve the natural beauty of our own earth.

## II. SCENARIO OF SOLID WASTE MANAGEMENT IN DEVELOPED COUNTRIES

All developed countries generated 34% (683 millions tonnes) of total waste generated by Globe<sup>[26]</sup>. Almost all developed countries had adopted modern waste management techniques to deal with waste rather than those conventional techniques to handle their waste like they gives priorities to waste bin monitoring technology using GSM, Automated sorting, compact garbage collection truck, multi-compartment system and many more depends upon spending budget in Solid Waste

Management System. In Europe and Central Asia's Belarus, \$25 millions of World bank loan is supporting the introduction of a regional approach to solid waste management. In Azerbaijan, establishment of a state-owned waste management company, increasing the population served by the formal solid waste management system from 53% in 2008 to 74% in 2012. Helping achieve a 25% recycling and Reuse rate<sup>[26]</sup>. Germany is using mobile sorting, enhanced resolution that are verifying to be very plentiful in dodging the waste. Although it will creates a better proposal of reuse and recycling. With dumping ground was help of those techniques allowed an enlarging the level of recycling to 62% till 2010, along with dumping ground was relatively decreased to nil by that time<sup>[8][21]</sup>. With technical considerations there should be also legislation and sufficient laws are need to be necessary for waste free country<sup>[15]</sup>.

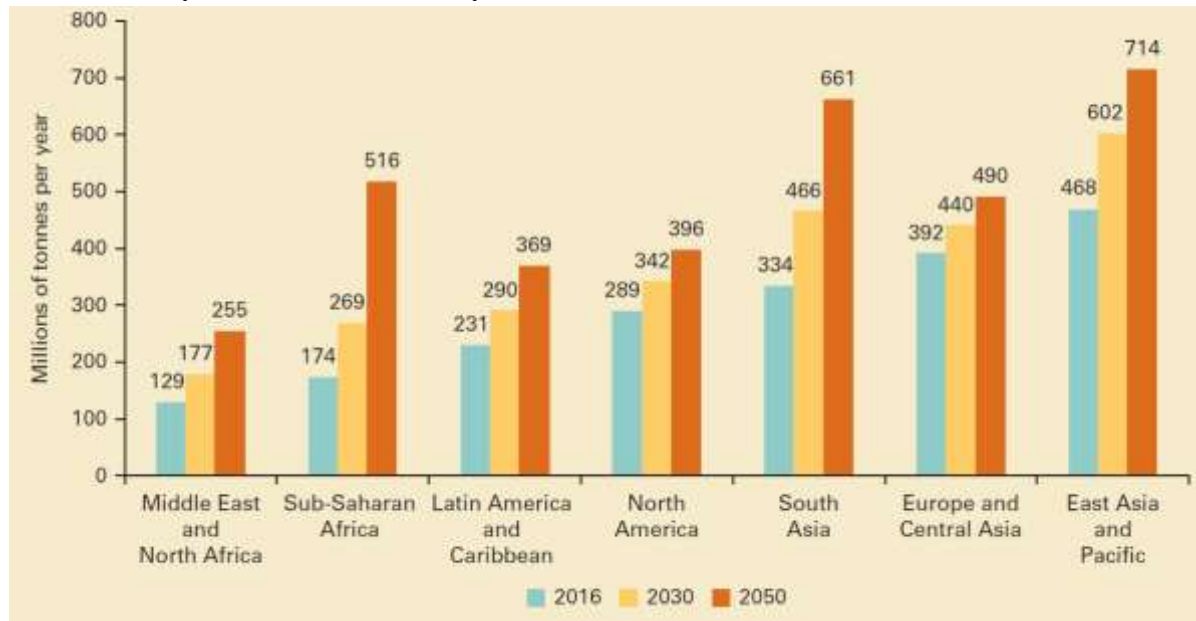


Figure 1 Projected waste generation, by region (millions of tonnes/year) (Sources: World bank)

### III. SCENARIO OF SOLID WASTE MANAGEMENT IN DEVELOPING COUNTRIES

Improving in Solid Waste Management is challenges for developing countries. As per World Bank global review cities of world generates about 1.3 billion tonnes of MSW yearly, the amount may reach 2.2 billions tonnes by the end of 2025<sup>[10]</sup>. Major amount of Municipal solid waste disposed through irrational way in open pots and landfill which will creates adverse effect on public health & Environment and certainly large amount of valuable land is being wasted. Disposing of wastes via inflammation in open dump sites are not preferable from most point of views. Infrastructure deficiencies for the SWM services are the dominant opponents in developing countries. The MSW Management disposal is a worldwide dilemma<sup>[11]</sup>. Which comprises maturing concern for cities in developing countries<sup>[12]</sup>. In Asia it is found that about US\$25 billion spend yearly for MSW, and it is predicted to charge up to US\$47 billion till 2025<sup>[14][13]</sup>. Hence it is a major part to control the expenditure of the system of waste management. In Nepal, a results- based financing project of \$ 4.3 million increased user fee collection and improved waste collection services in five municipalities, benefitting 800,000 residents.

### IV. SCENARIO OF SOLID WASTE MANAGEMENT IN INDIA

According to census data 2011 India had 1.2 billion population , among them 68.84% people lives in rural areas and 31.16% people lives in urban areas of India. On the basis of population, the urban housing development, Gujarat has classified towns in 4 classes, population more than 1 Lac: Class-

A, population ranging from 50,000-1,00,000 considered as Class-B, population between 25,000-50,000 considered as Class-C and population ranging from 15,000 to 25,000 considered as Class-D. Municipal Solid Waste (management and handling) Rules 2000 under the provisions of the Environmental Protection Act 1986 make treatment and discarding of MSW mandatory for all municipalities (Urban local bodies).

India generated 708,445 tonne e-waste in 2017-18 and in 2019-20 1,014,961 tonne. India collected just 10% of e-Waste estimated to have been generated in the country 2018-19 and 3.5% of that in the generated in 2017-18, said a recent report by the Central Pollution Control Board. The rule mandates that dismantlers have a space of 300 square metre for capacity of 1 tonne of e-waste per day. The same for recyclers is 500 square metre. Urban India generates 62 million tonne, with an average annual growth rate of 4%. In that total waste 70% are collected, 20% are treated and 50% are dumped in landfill sites. The composition of waste in India is nearly 10% to 30% recyclable, 30-50% inert waste, 40-60% compostable<sup>[13]</sup>. Accordingly, with 5% yearly rise in per capitageneration landfill area needed for disposal of waste could be many folds(CPCB, 2013).

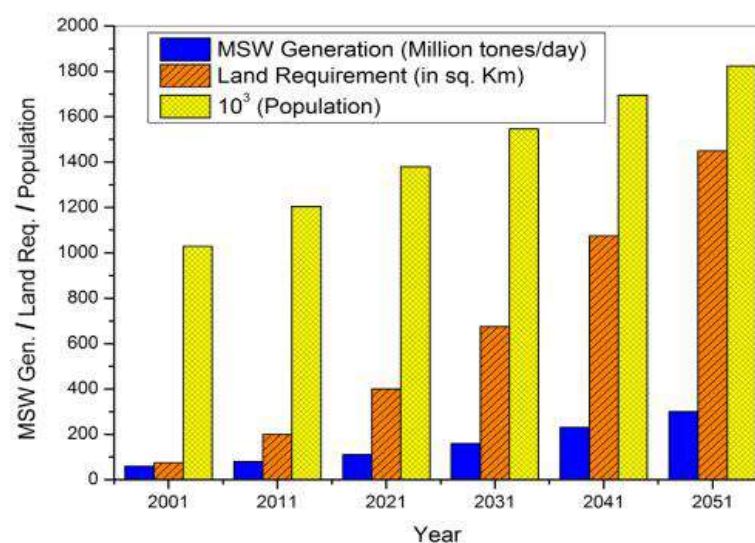


Figure 2 plot of prediction for MSW generation, land requirement and population from 2001 to 2051 (Source: Rajkumar Joshi, Sirajuddin Ahmed (2016) Status and challenges of municipal solid waste management in India: A review)

## V. SCENARIO OF SOLID WASTE MANAGEMENT IN RURAL AREA OF GUJARAT

According to details 2011 Census, out of total population 57.40% people lives in rural areas of Gujarat. There are 33 administrative districts in the state (as per 2011). The major occupation of people in rural areas of Gujarat is farming and they were engaged with agriculture economy thus generated municipal waste in rural areas is very organic with lower in amount with compared to urban areas as population is the significant factor behind MSW generation. From the Received data of district level, which suggests that

25% of the Gram Panchayat across the Gujarat state having Door to Door collection and 52% Panchayats have dumping pit of the same MSW depends on self-disposal of waste<sup>[22]</sup>. Nearly 23% Panchayats are have solid waste collected over dustbin in streets and disposed in pits<sup>[22]</sup>.

The characteristics of production of waste in rural areas are different than the urban areas cause of population and activity based criteria. where generated MSW in rural areas is 0.08 Kg/capita/day, although the Composition of waste for small scale town is 48% perishable, 30% recyclable and 22% inert<sup>[3]</sup>. In most rural areas, people does not adopt hygienically practices like do not use separate container for decomposable and non-decomposable waste. It has been also noted that major amount of solid waste is dumped though open dumping near water body which will creates adverse effects to



the water body and water is being polluted. The composition of waste in rural areas where 73% waste is decomposable, 20% recyclable and 7% inert materials<sup>[3]</sup>.

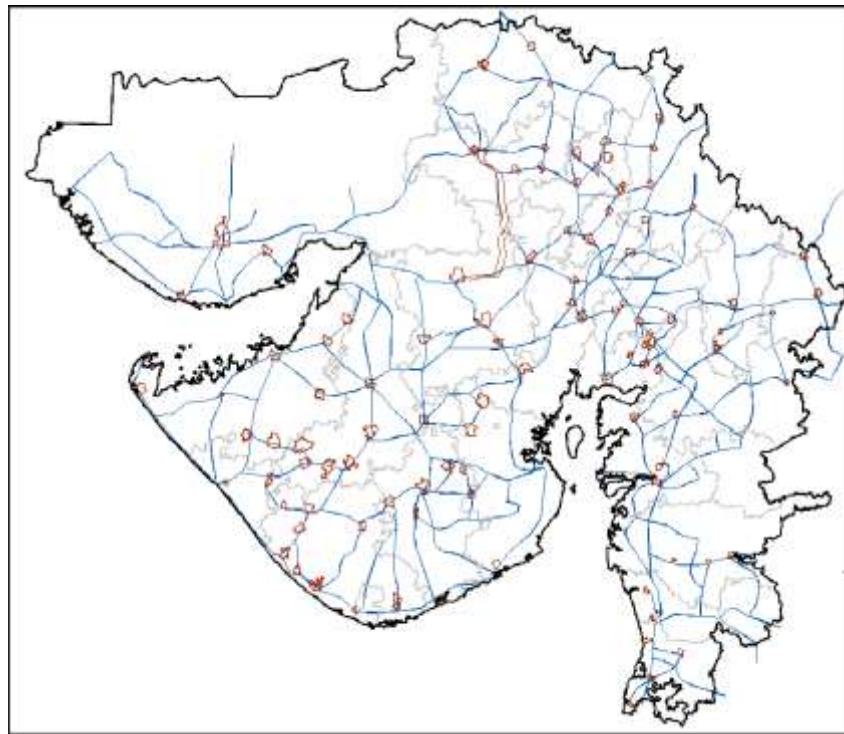


Figure 3 Forecasting of Municipal Solid Waste Generation for Medium Scale Towns Located in the State of Gujarat  
(Source: semanticscholar)

After improving sanitation conditions across rural and urban Gujarat, the state government has come with a comprehensive policy for solid waste management. Now both rural and urban Gujarat have been declared open defecation free(ODF). Under a new policy, The ‘Urban Sanitation and Cleanliness Policy’. Collection of waste in Gujarat’s urban areas will be Streamlined<sup>[10]</sup>. Gujarat presently generates more than 8300 metric tonne of solid waste daily. Under the new policy, all major urban civic bodies have been asked to ensure 100% waste segregation to ensure less generation of solid waste. Gujarat is looking to reduce dependency on landfills and send collected waste directly to waste treatment plants. Construction waste will be recycled and reused<sup>[15]</sup>.

## VI. INTEGRATED SOLID WASTE MANAGEMENT THROUGH INTEGRATION OF WASTE IN RURAL AREAS

ISWM is the strategic approach towards to sustainable SWM. Which will includes all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with significance on increasing resource use efficiency<sup>[16]</sup>. ISWM and Reuse, Reduce & Recycle have turn into ordinary terms for legislators and practitioners upon field of SWM<sup>[16]</sup>. In many nations ISWM is taken as corresponding to standard Municipal Solid Waste Management (MSWM). In several countries, ISWM is presumed or at upcoming concept though which manage their Municipal Solid Waste by enhancing efficiencies from 3R Concept.

The efficiency of waste management in rural and semi-rural areas can be enhanced through Integration of waste at local level like forming clusters of villages or small scale town rather than the providing disposal facility at individual source of generation and the quantity of decomposable. With that the further quantity of abandoned waste decreases. Accordingly it is not feasible to operate SWM facility viz. collection, segregation, transportation & disposal on daily basis. Which becomes

complex and although it is not financially viable to manage at each villages<sup>[15]</sup>. As a matter of fact discovered that the expenses of land & cost of construction is very pricey when sorting at sites are established at every village With improvement through collection of waste for rural and semi-rural areas by forming the clusters through which overall Municipal Solid Waste Management costs can be saved. Consequently opportunities have to be identified through the Process of Integrated Solid Waste Management (ISWM) which includes the criterion study on characteristics and quantity of waste for its generating location where ISWM has to be implemented, evaluation of existing waste management practices and its system. To implement ISWM system all the concern regarding technologies, financial, environment and social issues are to be consideration of all the significance policies.

## VII. CONCLUSION

In developed countries the solid waste management system is well maintained and they have new Integration Solid Waste Management techniques and financially very well. In developing countries the management of municipal solid waste is considerable challenges and they try improvement in management. In India majority of studies have been carried out on large and medium scale town and metropolitan municipality. It is observed that less attention has been paid toward rural and semi-rural areas. Which can be recognized to be technologically reliable and advisable side. Hence, emphasis and opportunities for developing countries and it's rural areas have to be explored for Sustainable Municipal Waste Management through ISWM.

## VIII. ACKNOWLEDGEMENT

I am thankful to Prof.Jagruti Shah for her guidance and supportive approach from department level of Infrastructure Engineering & Technology, Birla Vishvakarma Mahavidhyalaya, V.V.Nagar.

## REFERENCES

1. Adamu Isa Harir, Rozilah Kasim, Bala Ishiyaku, Exploring the Resource Recovery Potentials of Municipal Solid Waste: A review of solid wastes composting in Developing countries, International Journal of Scientific and Research Publications, Volume 5; Issue 4, April 2015.
2. Aman Gandhi, Dr.Arati Pamnani, Integrated Solid Waste Management (ISWM) for Vyara taluka as a revolution in Rural India, International journal of Management, Technology and Engineering, volume 8, Issue V, 2018, Page no 191.
3. Arati Pamnani, Meka Srinivasarao, Municipal solid waste management in India: A review and some new results, International Journal of Civil Engineering and Technology, Volume 5, Issue 2, February 2014, pp. 01-08.
4. Bhalla B, Saini M.S, & Jha M.K, Assessment of Groundwater Contamination near Unlined Municipal Solid Waste Landfill Site, International Journal of Chemical & Environmental Engineering, 4 (5), 2013.
5. Bhide A D, & Shekdar A V, Solid waste management in Indian urban centers, International Solid Waste Association Times (ISWA), 1, 1998, 26–28.
6. Butu A.W, Ageda B.R., & AA B, Environmental Impacts of Roadside Disposal of Municipal Solid Wastes in Karu, Nasarawa State,Nigeria, Internal Journal of Environment and Pollution Research, 1 (1), 2013, 1-19.
7. Central Public Health and Environmental Engineering Organisation (CPHEEO), The Manual of Municipal Solid Waste Management by Government of India, 2016.
8. Christian Fischer, Municipal Solid Waste Management in Germany, 2013.

9. CPCB (2017).Consolidated Annual Review Report on Implementation of Solid Wastes Management Rules, 2016.
10. datatopics.worldbank.org,what-a-waste,trends\_in\_solid\_waste\_management.
11. Downmore M, Shepherd M, Andrew M, & Daniel.N.B.J, Municipality Solid Waste (MSW) Management Challenges Of Chinhoyi Town In Zimbabwe: Opportunities Of Waste Reduction And Recycling, *Journal of Sustainable Development in Africa*, 13 (2), 2011, 168- 180.
12. downtoearth.org.in-news-waste-india-collected-just-3-e-waste-generated-in-2018-10-in-2019-cpcb-report
13. European Commission, Environment: Waste, 2014. Available from: <http://ec.europa.eu/environment/waste/>(Accessed February 2014).
14. European Environment Agency, Managing Municipal Solid Waste - A Review of Achievements in 32 European Countries, 2013.
15. Jenil H Jani, Dr.Arti Pamnani, Prof.Jagruti Shah, Integrated Solid Waste Management for Sustainability: A Review
16. Mustaq Ahmed Memon. Integrated Solid Waste Management International Environmental Technology Centre (IETC), Division of Technology Industry and Technology, Osaka-Japan
17. Pappu A, Saxena M, & Asolekar S R, Solid wastes generation in India and their recycling potential in building materials, *Building and Environment*, 42, 2007, 2311–2320.
18. Prasad S, Jain A, Tata J, & Parthan S, From Rags to Riches: Tapping the Social Capital within the Solid Waste Informal Sector, *South Asian Journal of Business and Management Cases*, 2013, 1 (2), 77–89. Do: 10.1177/2277977912460117.
19. Pratap, Rajeev Singh, Pooja Araujo, Ademir S F Ibrahim, M Hakimi Sulaiman, Othman, Resources, Conservation and Recycling Management of urban solid waste: Vermicomposting a sustainable option: "Resources, Conservation & Recycling" 55 (7), 2011, 719-729.
20. Rajkumar Joshi, Sirajuddin Ahmed, Status and challenges of municipal solid waste management in India: A review, 2016.
21. Rishabh Srivastava, Waste management: Developed and developing countries, *International Journal of Science and Research*, 2016.
22. State of Environment Report Gujarat, Status of Waste Management in Urban and Rural Areas, 2012.
23. Sunil Kumar, Stephen R. Smith et.al., Challenges and opportunities associated with waste management in India, The royal society publishing, 2017.
24. [swachhindia.ndtv.com\\_gujarat-zero-waste-odf-plus-new-policy-manual-scvengers-rehabilitation-23429](http://swachhindia.ndtv.com_gujarat-zero-waste-odf-plus-new-policy-manual-scvengers-rehabilitation-23429)
25. Wajeeha Saleem, Ayesha Zulfiqar, et.al., Latest technologies of municipal solid waste management in developed and developing countries: A review, *International Journal of Advanced Science and Research* Volume 1; Issue 10; October 2016; Page No. 22-29.
26. [worldbank.org-en-topic-urbandevelopment-brief-solid-waste-management](http://worldbank.org-en-topic-urbandevelopment-brief-solid-waste-management)
27. Zia H, & Devadas V, Municipal solid waste management in Kanpur, India: obstacles and prospects.