INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 4 - V7I4-1816)
Available online at: https://www.ijariit.com

Sustainable Municipal Solid Waste Management through 3R Initiatives in India: Lessons to be learned from the success stories

Priyamvada Singh
priyamvada01@gmail.com
Jamia Millia Islamia, New Delhi, Delhi

ABSTRACT

With the rising quantity of waste on a global and national level and more serious projections in the coming future all over the world, sustainable solid waste management practices and initiatives have become a necessity like never before. Rampant Increase in population urbanisation and resultantly more consumption is adding to the already existing load of waste. It has become a compulsion thus that solutions to these problems are timely thought of and practices and initiatives that reduce the burden of waste are put into place. This paper thus attempts to understand the dynamics of the 3R perspective in sustainable waste management in the Indian context. It tries to understand the principles of 3R and then find out the scope of applying these principles in India and the challenges that it faces in the present scenario. This paper attempts to discuss the successful initiatives that have been taken by a number of cities in India to reduce, reuse, and recycle. The study mainly relies on available online and Secondary data and successful case studies in 3R in India. It tries to explain what are the efforts taken keeping the socio-economic dimension in India that can make SWM sustainable in India and what future steps can be taken to make it a reality.

Keywords— *Solid Waste,3R, Sustainable, Initiatives*

INTRODUCTION

With a rapid increase in population growth and urbanisation across the world the generation of waste is increasing by heaps and mounds. A large portion of the population around the world consumes products and generates waste without much consideration as to what consequences it will have on our health, on our economy on our society, and most importantly to our planet and its environment that is already so adversely affected by the climate change! "Out of sight ", out of mind " attitude is just going to revert to us in such a way that we will not be able to cope up with it if we don't take action now. The waste that we just so casually throw without paying any attention doesn't just collapse on its own it stays there in our environment for hundreds to thousands of years without degrading. Solid waste is one of the most pressing issues now. The management of waste is now no more a challenge for the local governments it has become a global challenge now posing threat to our planet more than ever before. Waste generation projections for the next 25 years show a 70 percent increase mostly from low-income countries. Low-income countries already deal with poverty issues and lack of resources for existing issues but what is even more problematic is waste management requires a high budget, many local bodies already have a lack of technical know-how and resources. The ever increasing population is already placing pressure on the local governments and municipalities. All these factors collectively demand action and planning on a global level and especially from lower and middle-income countries as the projections for the future clearly show that they will be the ones who will be affected the worst.

Since India is also one of the nations that are middle and low-income countries and is undergoing rapid urbanisation and population explosion. Lack of resources and poor planning give significant reasons to seek proper and timely actions to deal with the aforesaid situation that can, if not managed properly turn out to be very appalling. As per the World Bank database projections for the year 2025, the quantity of municipal waste generated will increase significantly from 1.3 billion tonnes per year to approximately 2.2 billion tonnes per year in India. An average Indian generates around half a kilo of waste per day and about 62 million tonnes of garbage is generated by 377 million people living in urban India. With this development, the amount of waste generated by 2047 is projected to be around 260 million tonnes. It is a huge volume and if proper mechanisms are not planned on the time it poses serious risks to the society, economy, and environment of the country. Though solid waste management is one of the prime facilities provided by the municipalities, the current scenario of neglect and poor waste management in India shows a very dismal performance.

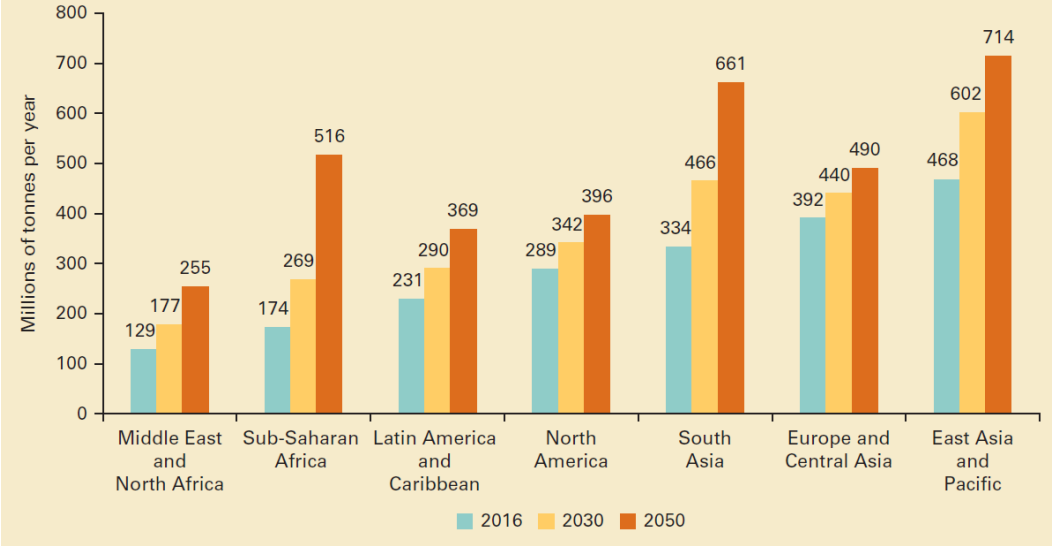

Figure 1: Projected Waste generation, by region (millions of tonnes/year): Trends in Solid waste management, what a waste 2.0. A global snapshot of solid waste management to 2050(2018).

The increasing amount of waste that is being generated is not just increasing in quantity but is also changing composition along with the changing economic needs. Around the 1960s and 70, the waste composition of the waste was mostly biodegradable due to the agro-based economy but due to privatisation and liberalisation the situation has reversed, and now 60 percent of the waste composition comprises of non-biodegradable waste. What is more problematic is that the proper mechanism to treat and dispose of the waste largely remains unplanned in India. Proper waste collection, segregation is still not practiced in a major part of India. A huge amount of waste is not treated, open dumping and burning of waste is still the most opted method. Poor construction and operation of landfill sites are very unsatisfactory. All of this deteriorate our aesthetics and environment and costs heavily on our health and economy.

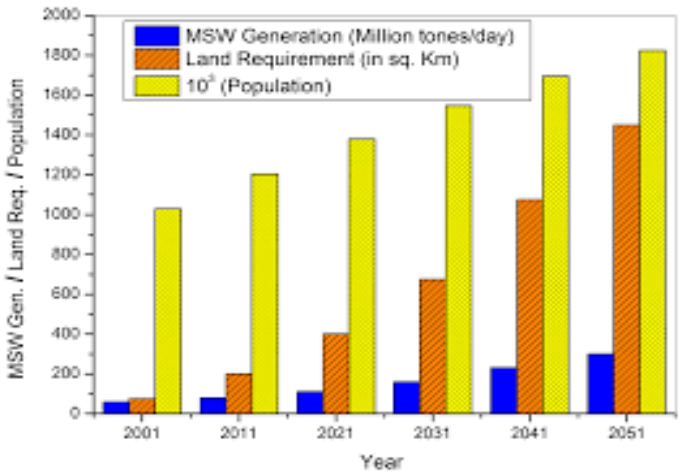

Figure 2: Prediction plot for MSW generation, land requirement, and population from 2001 to 2051: Status and challenges of municipal solid waste management in India: A review,Joshi,R., Ahmed, S.(2016).

THE 3R PRINCIPLE

Waste is one of the factors which if not handled properly creates problems in achieving an environment that is sustainable and healthy. The principle of 3R is one such approach that helps to promote the concept of reduce, reuse, and recycle (3Rs) on a global level and plays a significant role in the reduction and diversion of the amount of waste generated and in the maximum recovery of resource and energy. The incorporation of the 3Rs leads to efficient and effective use of resources and materials. If we try to look at the historical perspective of waste The initial solid waste management models in 1970's were mainly related to various optimisation techniques to deal with particular aspects of solid waste management practices. It was in 1990's that recycling as a method for planning related to effective solid waste management .Integrated sustainable waste management was not used till this time. Most of the strategies used at this time mainly focused on the technical and environmental aspects but social aspects were still not discussed much. Although in the last few years ,the concept of Integrated sustainable waste management has been discussed widely which depends on the successful interaction of a variety of activities assimilated together to make tailored approach towards an efficient solid waste management system. The latest approach in Integrated sustainable Waste management is the concept of Circular economy. Rather than taking the linear path of waste management this approach gives value to the waste as a resource right from the source of its generation. This approach moves from waste disposal to waste management discourse where the value of waste is recognised at every stage of waste hierarchy and maximum recovery of its value is given importance.

In the Indian context,the Muncipal Solid Waste (Management and Handling)Rules,2016 of the Ministry of Environment and Forest guides all the urban areas of the country to adopt the 3R practices and waste minimization at source an other principles of 3R. The National Urban Sanitation Policy,Swachh Bharat Mission ,National Environmental policy and other waste management

and handling rules for plastic ,hazardous,e-waste all favour the adoption and proper implementation of 3R.Apart from this , the Government of India also sanctioned 12th and 13th Finance Commission grants and many other projects like Jawaharlal Nehru National Urban Renewal Mission etc got funds from the Government of India for the same.

The principle of 3R is a chain or sequence of steps to be followed for effective and proper handling of waste. It can be understood clearly through a waste management hierarchy, which is an order of actions to be taken for waste reduction and to manage waste properly. The first three priorities are Reduce, Reuse, and Recycle (3Rs) later on the 5R concept was added introducing Recovery and Disposal as other efficient methods of minimizing waste.

Figure 3: Waste management hierarchy:Waste4change(2019).

The components of the waste hierarchy can be explained as follows:
1.Reduce – under this the main priority is to prevent the generation of waste right at the source. .Under it efforts are made right from the beginning to avoid generating waste. It asks for some life choices for example repetitive use of a product or using own shopping bags or containers etc.

2.Reuse – it means when the generation of waste could not be avoided safely reusing the materials. Reusing an item helps in creating alternative usage of any material for a different purpose, for example, using drinking plastic bottles as planters or using cardboard as a table.

3.Recycle –when any kind of waste could not be reused it is used as a resource and undergoes recycling process where the same material is either melted or chopped to remanufacture into an entirely new product. Write an example here

4.Recovery –this procedure comes when a non-recyclable item is processed to get new material or energy which are also environmentally safe and also helps to divert it from reaching a landfill.

5.Disposal – this step comes when the residue or byproduct after the recovery process is left in the form of ash etc and is finally disposed of at the landfill to protect the environment.

Thus it is clear that if the 3R principle is practiced it will help us achieve environmental sustainability goals by bringing it into our lifestyles to reduce, reuse and recycle waste as much as possible and consequently making the environment cleaner and greener. While it helps in recovering the resources it also helps significantly in diverting the waste from landfills and thus making it feasible to reduce investment and maintenance costs. It also plays a very important role in integrating the informal sector that constitutes almost 1 percent of the global urban population and provides them more job opportunities thereby helping them in improving their living standards.

CURRENT SCENARIO OF 3R IN INDIA

Scope

To achieve sustainable municipal solid waste management, the concept of 3R has been favoured and supported by many government policies and programmes like National Urban Sanitation Policy (NUSP), Swachh Bharat Mission along with Solid Waste (Management and Handling Rules,2016 under the aegis of Ministry of Environment and Forest. Apart from this other initiatives by the non-governmental organisations like the garbage recycling program by the Indian Pollution Control Board are also in place to guide and adopt many mechanisms for proper implementation of waste minimisation process through reduce, reuse and recycling of waste at every stage of the waste hierarchy.

The opportunities or scope for sustainable waste management in India through 3R initiatives hold relevance since it is in the ethos of the Indian lifestyle for ages. The philosophy of the Indian lifestyle is in "simple living and high thinking" which further strengthens the symbiotic relationship that we share with nature. Many examples can be taken from our daily lives where life choices are made that directly or indirectly promotes the concept of 3R. The reuse and recycling principle of 3R can be seen broadly being practiced very often in India, especially in rural areas. For a very long period, the Indian economy has been agro-based and thus the waste generated is mostly biodegradable. Its use, reuse, and recycling constitute a major part of waste management. It has somehow become a prominent part of our culture for example vegetable or fruit peels are not discarded but are fed to the cattle. This practice of reusing the waste can also be seen in many rituals of Indian worshipping like govardhan pooja where the sundried cow dung cakes are worshipped and considered auspicious for the agricultural yield. Dried Cow dung cakes are also used in many rural households for cooking and other domestic purposes. Before plastic carry bags and packaging arrived in India, bags made of clothes called "Jholas" were used. Apart from this many handicrafts of India are also made from different kinds of grass and papers.

Another way in which 3R has a wider scope in India is in the recycling sector. Since the kabadiwala system already exists in India and forms a major part of the recycling process .Its proper integration and involvement in the 3R hierarchy can prove to be very useful and meaningful in extending the possibilities of sustainable waste management in India. High unemployment and low labour costs make this labour intensive process very economically feasible. The informal sector in low and middle-income countries plays a very significant role in making it circular in nature and thus maximizing resource recovery and diverting waste from going to the landfills. According to a study by the world bank, the informal sector in developing countries recovers many tons of materials and resources than the formal sector. As per the study, waste pickers in Mumbai, Jakarta, and Buenos Aires have an economic impact of us$ 880+million annually.

Challenges

1. *Lack of proper research*- Proper research in the field of waste management is an issue that needs to be dealt with in India. Consequently, the waste issue faces a lack of data. Due to changes in the demographics and economy, proper waste quantification and characterisation of the waste is important so that uniquely tailored approaches in social, economical, and technological aspects are made possible to manage the waste.
2. *Waste segregation* -Segregation of waste into biodegradables and non-biodegradables right at the source of generation is of utmost importance to manage waste properly in other stages of the waste hierarchy. No segregation of waste makes it costly and time-consuming in the further stages to handle waste efficiently. It is important that citizens are made aware of the importance of segregation and also the labour is trained to segregate waste into different categories so that the waste is treated properly.
3. *Lack of institutional and political will*-Although initiatives in waste management has been in place for a very long time but in term of a concrete waste management mechanism, it still has a long way to go. Adopting a technology or approach from developed nations is not the solution. Proper and diligent policy making, implementation, monitoring, and evaluation are still lacking. Corruption and red-tapism is another factor that is adversely affecting it. There is a lack of self initiatives on the part of municipalities to adopt waste mechanisms suitable for them. Poor legislations make it hard for the private sector to participate in this sector thereby considerably affecting the economies of waste.
4. *Behaviour Change*- Not in my backyard (NIMBY) is a phenomenon that is very prevalent among the citizens. Successful and sustainable waste management requires a collaborative effort on part of every stakeholder involved in the generation of waste. Thus it is very important that the citizens not just rely on the government or the municipalities to have clean backyards but also take an active part in the waste management and try to unburden load of these institutions to have a clean and safe environment.

SUCCESS STORIES

Mysuru- Mysuru, in Karnataka, has been following many good practices that are paving way for other cities to manage their waste efficiently. What makes Mysuru different from the existing practices on waste handling is its involvement of the citizens through the" let's do it Mysore" initiative. In Mysuru, which has a population of 0.89 million the quantity of garbage produced is 0.45 kg per person. But it is only because the citizens are actively involved and made aware of the benefits of waste segregation and thus the city boasts of a 100 percent door-to-door waste collection. The segregation initiative apart from being followed at the source of generation is also followed at other nine waste segregation plants, from where the biodegradable waste is treated to produce manure. The city is also making use of technology and uses GPS tracking for its vehicles and chip readers for waste collection from homes. Financial sustainability is also practiced by generating revenue from the sales of dry recyclables like plastic and manure.

Alappuzha - Alappuzha in Kerala is following a ward-based decentralised system for handling its solid waste and has received accolades from the United Nations Environment Programme for the same. The city follows segregation of Biodegradable waste at ward level which is then treated in composting plants. Its management of the waste at the household level also deserves a mention where the biogas model is adopted and is very successful. Biogas produced from waste is presently providing biogas for cooking to almost 1,74,000 residents. All these waste management initiatives have significantly improved the coastal areas of this major tourist destination and have helped in financial cost recovery too.

Pune- Pune is one of the leaders in decentralised waste management system for Sustainability. Waste management is an important part of the Advance Locality Management (ALM) practiced in the city. Participatory Budgeting, which is a part of ALM has been successful in bringing into focus many waste management issues. For example the construction of 16 decentralised waste processing facilities and 30 waste sorting centers. One of the distinguishing achievements of waste management in the city has been the successful integration of waste pickers. Pune is the first city in India to register waste pickers and to provide training to them for their upliftment and better living standards.SWaCH is a cooperative in Pune that has 2700 members, mainly constituted of waste pickers.

Indore- Indore is another shining example where initiatives by the Indore Municipal corporation (IMC)has shown remarkable results. From being the biggest plastic generator in 2013 in Madhya Pradesh, Indore has come a long way in introducing practices that have resulted in Indore being at the top rank in Swacha Sarvekshan. The city's approach to recycle non-biodegradable plastic has become an example of minimizing waste. The quantity of municipal waste generated in Indore every day is 50000 kilos. Out of which 13000 kilos constitute of mainly plastic. While earlier most of this plastic was burned, IMC set up a Plastic collection center to reuse and recycle its plastic waste. IMC has incorporated many scientific ways to recycle this waste. It has made plastic segregation more efficient by including the informal waste pickers into the system. While it enhances the livelihood of waste pickers by allowing them to segregate and recycle. The plastic that is not recycled by them is sent to the plastic collection centers where they are processed to be used in cement plants as fuels or for road construction by Madhya Pradesh road development authority. All these measures have to lead to 50 percent reuse of plastic waste and better air quality and less air pollution

Ambikapur- Ambikapur city in Chattisgarh is another city in India that has successfully adopted a decentralised waste management model. The factor that makes it very unique is that it has seamlessly included almost every stakeholder, from institutions to residents to waste pickers and especially the women workforce in the waste sector. At present Ambikapur proudly boasts of no dumping yard and in terms of waste economies, it generates a revenue of 13 lakhs through recycling and composting of waste and has been successful in segregating 90 percent of the waste it generates. To achieve this incredible transformation in a matter of 2 years, took significant efforts. Nagar Nigam Ambikapur started with extensive awareness campaigns from door to door to segregate waste. They tied up with almost 30 women self-help groups and started spreading awareness . Vehicles with different compartments are used further to avoid mixing up of segregated waste. At the secondary level, 17 waste segregation centers are also set up to segregate 25000 kilos of waste collected per day from all the wards. From here wet waste is composted for manure or used in biodigesters for cooking gas and recyclables are sent for further processing. The city also converted its 15-acre landfill into a 'Sanitation Awareness Park "and has declared itself a zero-waste city.

Surat- Surat is another addition in the cities that have improved considerably in waste management planning and implementation. It is the second most cleanest city after Indore in fifth Swacha Sarvekshan. The reason that attributes to such transformation from 14th rank to 2nd is its adoption of 3R practices. Adhering to the Solid Waste Management Rules 2016, the city recently closed a solid waste landfill site near Surat diamond bourse (SDB) at Khajod. The capping of this landfill site spread around 60 hectares of land has significantly contributed in bringing the open dumping to an end. The landfill site is transformed into an ecological park with 30 hectares of lush green parks. Apart from this revenue is also generated by selling recyclables. Almost 75 tonnes of plastic is recycled in Bhatar plant which is further made into pellets and crude oil using the pyrolysis method. Three tonnes of waste from religious places are also vermicomposted and fertilisers of high quality are also made from wet waste. Another very innovative initiative is the Samvedna initiative where food waste from financially well-off people is collected and distributed to the less privileged people thereby contributing to social service of providing food to the needy while also reducing the quantity of kitchen waste.

LESSONS TO BE LEARNT

The 3R principle offers a platform where initiatives and good practices promoting the reduce, reuse, and recycling process can contribute significantly in making the waste management system integrated, including all the social, cultural, economical, and environmental aspects. The current waste management practices in India are at a very initial stage in implementing the principles of 3R in waste management extensively and given the waste generation projections and increase in population timely action is a priority. The 3R initiatives and successful implementation by the cities that we have discussed above are remarkable and paves way for many possibilities to achieve the goals of sustainable waste management.

Following are some of the lessons that we can learn and adopt to promote the principle of 3R in the handling of waste at every stage of the waste hierarchy.

1. Behavioral change and creating awareness through information education and communication measures is the base point on which all the other stages of waste management rely. Thus information and knowledge dissemination on the importance of waste segregation and reduction and recycling must be dispersed as much as possible.
2. Proper waste segregation at the secondary level is another important factor that needs to be kept in cognizance by the municipalities. Proper allocation of compartmentalised vehicles, proper training and capacity building of the waste collectors and other staff needs to be built. Provision of Material recovery facilities to further compartmentalise waste also helps in proper treatment and processing of waste
3. Extensive research and finding ways of maximum cost recovery through introducing practices that lead to financial sustainability, in the long run, should be carried out. For eg quantification, characterisation, and segregation of waste to covert wet waste to compost and dry waste to recyclables. Also, waste generated from various sources like religious places or weddings, or mass gatherings at times of festivities should be procured and processed in the best way possible for both material and cost recovery.
4. For effective and integrated solid waste management it is also very important that all the stakeholders are an active part of it. Be it the residents, or self-help groups, municipalities, governments, or waste pickers. The involvement of all the stakeholders not only helps in handling the way in a decentralised way but also provides job opportunities to the sections hitherto marginalised.
5. With the advancement in science and technology efforts should be made to make use of the latest technology suitable for the individual stages of the waste management process. The use of the latest technology not only saves time and energy but also makes the solid waste management process more organised and regulated. For example use of GPS tracking in vehicles, or RFID tags on the household or community bins. Use of apps to coordinate between different stakeholders and also register citizen feedbacks and grievances. The use of appropriate technology goes a long way in ensuring proper policy implementation, monitoring, and evaluation.

REFERENCES

[1] Samiha, B. (2013). The Importance of the 3R Principle of Municipal Solid Waste Management for Achieving Sustainable Development. Mediterranean Journal of Social Sciences. 4. 129-135. 10.5901/mjss.2013.v4n3p129.

[2] Nandan, A., Yadav, B., Baksi, S., Bose, D. (2017). Recent Scenario of Solid Waste Management in India. World Scientific News. 66. 56-74.

[3] Mehra, S. (2017). Eco-Cultural Solution to the Challenge of Waste Generation at Individual Level: Case Study from India. International Journal of Waste Resources. 07. 10.4172/2252-5211.1000288.

[4] Agarwal, R., Chaudhary, M., Singh, J. (2015). Waste Management Initiatives in India for Human well Being. European Scientific Journal, ESJ, 11(10). Retrieved from https://smartnet.niua.org

[5] Modak, P. (2018). Eight Regional3R Forum in Asia and the Pacific, Creating Circular Economic Potential as a way for Achieving Smart and Sustainable Cities.Retrieved from https://www.uncrd.or.jp

[6] Case studies retrieved from http://3rwastefoundation.org/case-studies

[7] NIUA (2020) "How does urban India manage its waste? An Almanac of Waste Management Practices" Delhi, India

[8] What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.(2018). Data retrieved from https://datatopics.worldbank.org

[9] Joshi, R., Ahmed, S.(2016). Status and challenges of municipal solid waste management in India: A review. Cogent Environmental Science. 2. 1139434. 10.1080/23311843.2016.1139434.

[10] Waste management hierarchy.Waste4Change(2018).Retrived from https://waste4change.com

