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A Review Paper For Urban Soild Waste Management Jhansi (A Framework for Sustainable Technology & Development)

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Abstract- Solid waste management is one of the most challenging issues, which are facing a serious pollution problem due to the huge quantities of solid waste. This paper presents a development work for solid waste monitoring and management system. This research developed a component monitoring system with the aim of achieving an effective waste management system. With this system we will able to monitor the collection and transportation system and manages the process. It provides real time information of solid waste from generation point to disposal site. The development consists of new technologies which may be beneficial to encourage the researchers to work towards further improvement of the present system. These technologies are good enough to ensure the practical and perfect for solid waste collection and transportation monitoring and management for greener environment. The development often application with identification and communication technologies such as RFID and GSMuses some software packages. Indian cities are often characterized by poorly rendered services including waste management—the most ignored of all basic services, on account of various reasons. The situation worsens with increasing population pressure in urban centers. Jhansi is one such metropolitan city of North India, having an inefficient, outdated and unscientific waste system. This paper attempts to assess the existing state of municipal solid waste management (MSWM) in Jhansi city with the aim of identifying the main obstacles to its efficiency and the prospects for improvisation of the solid waste management system in the city. The existing solid waste management system in the city is found to be highly inefficient. Primary and secondary collection, transportation and open dumping are the only activities practiced that too in a non-technical manner. This paper systematically assesses the obstacles in the existing solid waste management system in Jhansi city and also tries to assess the potentials for its improvisation.

Keywords:- Real time; solid waste; monitor; management; RFID; GSM.

I. INTRODUCTION

Generally, the solid waste is defined from household's refusal and non-hazardous solid waste is from industrial, commercial and institutional establishments such as hospitals, market waste, yard waste and street sweepings (GAIA, 2003).

In the developing countries, waste management is becoming an acute problem as urbanization and economic development increase leading to larger

quantities of waste materials (Fadel, 2006). This paper presents an innovative approach to monitor and manage the solid waste collection and transportation system.

Waste management is the collection, transportation, processing, recycling or disposal of waste materials, the ones produced by human activity, try to reduce their effect on human health or amenity.

The main problems of the existing solid waste collection and transportation process and management system are as follows:

- Lack of the proper system for monitoring the trucks, trash bins, rickshaws and houses.
- Lack of information related to collection time and area.
- No quick way to response the consumer's complaints.
- India has, in the past two decades, become a potential economic world leader and is experiencing a steady economic growth.
- This increased growth has led to increasing consumerism, especially in the urban sector.
- This is fast leading to depletion of natural resources and poses a significant challenge to the country's sustainable and ecological development.
- Indian cities generate an estimated 0.115 million metric tonnes of waste per day and 42 million metric tonnes annually (3iNetwork, 2006).
- The per capita waste generation ranges between 0.2 and 0.6 kg per day in the Indian cities that is lower than that in developed countries.
- However, lifestyle changes due to economic growth and fast rates of urbanization have resulted in per capita waste generation increasing by about 1.3% per year.
- The Energy Resources Institute (TERI) has estimated that waste generation will exceed 260 million tones per year by the year 2047—more than five times the present level (3iNetwork, 2006).
- It is observed that bigger the size of the city (population and density wise), greater is the quantity of waste generated.
- This is the phenomenon observed world over and India is no exception to this.Waste generation in urban centers in India.
- Type of cities Tonnes/day Percent of total garbage
- The 7 mega cities 21,100 18.4
- The 28 metro cities 19,643 17.1
- The 388 class 1 cities 42,635 37.1
- Total 83,378 72.5
- Other 3955 urban centers (population less than 100,000) 20,125 17.5.

II. OBJECTIVES OF THE STUDY

The study was undertaken with the following objectives:

- Assessment of existing system for solid waste.
- Development of a real time system.
- Establishment of an efficient plan for monitoring the solid waste collection and transportation system.

Systems approach has also been attempted at by few authors dealing with one or few aspects of MSWM (Dyson & Chang, 2005; Karavezyris, Timpe, & Marzi, 2002; Karen, 2004).

Sudhir, Srinivasan, and Muraleedharan, 1997, attempted to develop a generic model to study the potential and systemic consequences of various structural and policy alternatives for a sustainable urban SWM system in Chennai city by employing system dynamics model. It has been observed that despite the development of various models, there is no suitable model applicable to Indian conditions and which takes all the stakeholders of waste management in a holistic and integrated manner.

In this paper, Jhansi's urban SWM is introduced in detail with regard to the city's solid waste characteristics, management, collection system, treatment processes and the disposal methods. The major problems pertaining to SWM faced in the city have also been analyzed. An attempt is further made to explain the future challenges and opportunities for improving the SWM system in the city.

The first question that arises in our mind is What Is Municipal Solid Waste?

Though widely understood as a concept, waste—garbage, rubbish, discards, junk—eludes definition, varying by who defines it. Engineers define MSW as materials that are discarded from residential and commercial sources (1, 2) or as materials that have ceased to have value to the holder (3).

Anthropologists hold that garbage is factual evidence of a culture, that "what people have owned—and thrown away—can speak more eloquently, informatively, and truthfully about the lives they lead than they themselves ever may" (4, p.

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54). Ecologists claim that there is no waste in nature (5), and industrial ecologists view waste as "a right thing in a wrong place, like a pig in the parlor instead of the barnyard" (6, p. 1050).

How waste is treated reflects its definition; refuse workers in hauling waste to a landfill treat it as valueless, and waste pickers who recover materials from refuse treat it as ore (7). Despite the variety of meanings given to waste, its presence and proliferation are undisputed.

III. THE CHANGING NATURE OF WASTE IN JHANSI

Demographic changes are concentrating waste in cities. Waste production tends to increase with wealth, urbanization, and population (2, 8, 9). While the global population is rising, the distribution of the population is changing more dramatically. The world is urbanizing at a rapid and unprecedented scale, and most of this urbanization is occurring in small- and medium-sized cities within low-income nations (10).

The same areas that are seeing the greatest urbanization trends are also home to a billion new consumers—people from 20 developing and transition nations whose combined spending capacity is equal to that of all US consumers (11).

Table 1. This table shows the change occurs in waste in Jhansi.

Sample number	Items	1988	1999
1	Paper	1.4	4.0
2	Boidegradable	53.3	44.3
3	Inert	25.8	39.2
4	Glass	0.5	0.8
5	Metals	0.3	0.002
6	Textile	1.6	5.0
7	Plastic, Leather, rubber, etc	0.67	7.8

This newly affluent population is dramatically increasing their consumption of meat, cars (the cars owned in the developing world grew 89% from 1990 to 2000, with China's fleet increasing 445% and Colombia's 217%), electricity, and other consumer goods (12).

Two consequences result from this increased consumption: More natural resources are used (to produce those goods), and more waste is produced (when consumers discard them).

IV. CLASSIFICATION OF SOILD WASTE COLLECTED FROM URBAN AREAS OF JHANSI

The soild waste collected from urban areas of Jhansi can be classified as:

- Boi – degradable waste
- Non-boidegradable waste

On, further sib divided them we can say soild waste can be categoised in dry and wet waste. A typical solid waste collected from the city of Jhansi shows presence of following materials: card boards, carry bags, pins, containers, glass bottles, tin containers, plastic items, leather, papers, rags etc.

The size of waste in not only dominated by population but also by other factors like lifestyle type of locality, awareness about environment etc. Solid waste of each municipal corporation is diversified in nature. The characteristics solid waste varies from different places.

Factors like income level, the sources, the population, social behaviour, climate, industrial production and the market for waste materials are influential (Srivastava et al., 2017). National Environmental Engineering Research Institute (NEERI) has carried out studies in more than 50 cities and towns in India. The Characterization of MSW showed that the waste consists of 30–45% organic matter, 6–10% recyclables, and the rest as inert matter.(Pandey, Vyas, Pandey, & Gaur, 2016).

Fig 1. Types of seperate waste bins.

As, all the government agencies aware people to keep the dry and wet waste separate city people

influced much but was still a challenge in urban areas where people are not much aware of it.Government placing small camps to educate people about waste decomposition so that they keep waste separate.

Jhansi Government has placed these types of seperate waste bins and insure people to use them.

V. GENERATION AND CHARACTERISTICS OF URBAN SOLID WASTE

Waste generation is the first element of waste management. It is a prerequisite to any waste management plan to have adequate knowledge of the generators of waste, its physical and chemical characteristics.

To analyze the physical and chemical composition of wastes in urban areas of jhansi, wastes generated from different sources, such as, different income-groups, commercial waste, waste from industries, waste from vegetable markets, collection depots and disposal site have been considered and presented in Tables 3 and 4.

Table 2. The table illustrate that there are wide variations in characteristics of waste samples from various sources.

Sources	Type of waste
Households	Mostly organic with some plastic.
Schools	Mostly papers
Healthcare facilities	Infectious and non-infectious waste
Industries	Chemicals,metals,leather waste
Slaughterhouses	Bones,blood,intestines,etc
Wastewater treatment plants	Chromium rich toxic wastes

These tables illustrate that there are wide variations in characteristics of waste samples from various sources. It has also been observed that the average density of municipal wastes in the city is 873 kg/m3 based on the 10 samples collected from various generation points (Jhansi Nagar Nigam report, 1999)(13).

This average density is very high compared to that in other Indian cities of comparable size whose average waste density is 425 kg/m3 (MOUDPA, 2000). The possible reasons of this wide variation in density of wastes might be due to generation different type of waste.

VI. SOLID WASTE MANAGEMENT CHALLENGES

Postconsumer waste, through its production and management, affects air quality, water quality, and public health, and it contributes to climate change (14). Improperly managed waste can affect the environment at different scales. Open dumping of wastes contaminates nearby water bodies with organic and inorganic pollutants. It also threatens public health by attracting disease vectors and exposing people living near the waste to the harmful products within (15).

Incineration of waste emits a variety of pollutants, including dioxins and furans (16), persistent organic pollutants that mix globally and harm human and ecological health. Waste management also emits a variety of greenhouse gases (GHGs); the most significant sources are landfills, which emit methane as organic waste decomposes.

The Intergovernmental Panel on Climate Change estimates that waste management emits less than 5% of the global GHG emissions (and emits 9% of methane released globally), but this estimate is uncertain and variable, as waste management can act as either a net source or sink of GHGs (17). Because waste poses a threat to people and the environment, provision of waste management services has often fallen to cities, which are charged with providing public goods to their citizens. Global trends in waste production—the increasing quantity and complexity of MSW—compound the challenge, making waste management "one of the biggest challenges of the urban world" (18).

VII. URBAN AREAS PROBLEMS DUE TO IMPROPER SOLID WASTE MANAGEMENT

In most of urban areas there is still open dumping according to them the most easy and popular solution of waste disposal is open dumping. The open dumping of solid waste is the most un-scientific method of disposal. It has been found that there are major problems of the open dumping practice.

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The chemicals leach out from the garbage and pollute the ground water and soil. The gases like carbon dioxide and methane, released from the site pollutes the air.

Fig 2. Open dumping in Jhansi.

These problems are classified as;

1. Environmental Problems:

The impact of waste on environment also differs from different categories of waste. The waste which may appear harmless at its generation point could be dangerous as it comes in contact with environment. For example a kitchen waste, which include left over leaves vegetable fruits etc. appears harmless at its generation point. However once it enters the environment, it attracts flies insects and prove site for growing disease producing microorganisms (19).

Another example is of plastic which appears inert at initial stage. This plastic leads to choking of drainage, clogging of canals, ill health of animals. The plastic leaches out and releases different chemicals which severely affect the environment. Hence a strategy has to be adapted right from handling of solid wastes to its treatment. (Che, 2011).

Water samples were collected from the dug wells and bore wells, around the dumping site at "Nauraiya Kheda". The sampling was carried out in the mid of every season i.e. summer, Monsoon and winter for two years. It has found that the concentration of the metal ions is increasing with respect to the vicinity to the dumping site. The continued practice of waste dumping may result in further pollution of ground water sources.

2. Health:

The organic waste present in garbage degrades and hosts several living organisms. Flies, insects, rodents etc get attracted to such site. The birds, cattle and dogs lead to further spreading of the waste. The colonies of living organisms further pollute the site. The wind and rain also act as agents to spread the waste. The site gives offensive odours due to degradation of organic matter.

3. Social:

The site of open dumping is always disliked for aesthetic reasons. The people surrounding the site face majority of health problems (20). About 90% municipal solid waste is disposed of unscientifically and unmannered way in open dump places creating problems to public health and environment. Such an open dumping not only causes environmental problems but also distort the aesthetic beauty.

Fig 3. Jhansi Nagar Nigam Vehicle.

VIII. DRIVERS IN WASTE MANAGEMENT DEVELOPMENT

Four imperatives drive the development of waste management plans: public health, environmental protection, resource recovery, and climate change (21). Are also choosing to improve their waste management for aesthetic reasons. Any combination of drivers may be motivating changes in a city's waste management, at any given time, though the dominant driver tends to change over time.

1. Resource Recovery:

Although resource recovery also provides environmental benefits, it drives changes in waste management through economic signals. Where resources are scarce, materials are recovered, repaired, or reused, rather than discarded. Resource recovery was the dominant mode of waste handling in preindustrial societies; Strasser (22) provides a nice history of the trade in waste materials in the preindustrial United States.

Resource recovery is an important driver in cash-poor cities throughout the developing world; is crucial to the economies of India and China, which depend on secondary materials; and is the motivating force behind informal recycling systems (23).

2. Climate Change:
Climate change has emerged as a driving force for changes in waste management in both industrial and industrializing nations (24). The threat of climate change has made GHG emission reductions from waste management a policy goal for many states. Though waste contributes only modestly to global GHG emissions (<5%), waste management has the potential to be either a net source or sink of GHGs (8).

Because landfills are the largest source of these gases within waste management systems, and because these emissions are growing in developing nations, many waste projects in less-industrialized countries have focused on containing these emissions through the construction of new sanitary landfills (25).

Where OECD nations may look to reduce the carbon emissions from their waste management to meet national emission reduction targets, industrializing nations are increasingly using the Clean Development Mechanism from the Kyoto Protocol to fund improvements in their waste management plans and so must select GHG-abating waste management projects to qualify.

3. Waste Processing:
Waste is processed remote from the source of waste generation. Source-separated wastes are usually processed at materials recovery facilities, transfer stations, or combustion facilities (26).

In less-industrialized countries, processing may occur at landfill disposal sites (27). Processing often includes manual or mechanized separation of waste components by size, size reduction by shredding, separation of ferrous metals using magnets, and volume reduction by compaction and combustion (28).

3.1 Biogenic Waste Transformation: The oldest biogenic transformation methods use biological systems to convert the oldest of wastes—biogenic wastes—into energy and soil amendments. The degradation of organic waste is a natural process, mediated by microorganisms, and people commandeer this process to extract useful resources from waste (29).

These technologies are of particular interest in less-industrialized countries, where solid waste is mostly biodegradable. Two new technologies convert solid waste to liquid fuel, thus providing a market incentive to separate waste at the source. One historic technology is receiving increased attention for its carbon sequestration potential.

3.2 Nonbiogenic Waste Transformation:
Incineration, pyrolysis, gasification, and recycling are processes that use waste as an energy or material resource. Thermal treatment provides a number of waste management services: It reduces the volume of waste, it destroys harmful chemicals and pathogens, and it can produce electricity and heat (30). Recycling is the reprocessing of discarded materials into new products (31)

4. Waste Disposal:
Every waste management system requires a method of final disposal. In an urban world in which waste complexity is high, complete reuse and recycling of waste is very difficult. The most basic form of disposal, open dumping, directly exposes people and the environment to waste products. Sanitary landfills are facilities designed to limit the health and environmental impacts of waste (32).

Equipped with liners, leachate collection, and gas extraction systems, they collect and treat the by-products of waste degradation (e.g., methane, leachate). Between open dumps, which have no environmental controls, and sanitary landfills, which mimic a long-lived plastic bag for waste, a continuum of disposal options exists (33).

IX. SEGREGATION AND TREATMENT OF WASTE

The segregation of waste is carried out as wet and dry waste. However in several wards the idea is not taken seriously and waste occurs as mixed waste. The mixing of dry and wet waste makes the process complicated. Depending on characteristics of waste treatment should be decided.

X. AWARENESS PLAN

Most of the residents are unaware of threats related to handling of wastes. Practices like burning of waste containing plastic waste are carried out without any care for the environment.

The open dumping of waste in channels and gutters is another such deadly practice.

XI. CONCLUSION

The problem of solid waste will grow rapidly if not given due attention. The waste which appears harmless at its source could prove to be a major problem if not treated well. The efforts taken by municipal authorities regarding solid waste handling and treatment need to improve. With the aid of technological intervention in the treatment process the scenario of solid waste handling and treatment practices can be altered.

The solid waste management laws are meant to protect the environment. A vigilant eye should be kept on their implementation.

It seems that though the generation of solid waste cannot be controlled. However enough measures should be practiced for its disposal and treatment. There are lessons to be learned from the past. The future of solid waste management practices can surely alter future and development of Jhansi.

REFERENCES

[1] Armijo de Vega, C., Ojeda Benítez, S., & Ramírez Barreto, M. E. Solid waste characterization and recycling potential for a university campus. Waste Management, 2008; 28(1). https://doi.org/10.1016/j.wasman.2008.03.022.

[2] Babaei, A. A., Alavi, N., Goudarzi, G., Teymouri, P., Ahmadi, K., & Rafiee, M.Household recycling knowledge, attitudes and practices towards solid waste management. Resources, Conservation and Recycling, 2015; 102: 94–100. https://doi.org/10.1016/j.resconrec.2015.06.014.

[3] Che, A. M. Ensuring environmental sustainability in the printing industry, 2011; 694.

[4] Chittoor Jhansi, S., & Kumar Mishra, S. Waste water Treatment and Reuse: Sustainability Options. The Journal of Sustainable Development, 2013; 10(1): 1–15. https://doi.org/http://dx.doi.org/10.7916/D8JQ10Q1.

[5] De Sousa Jabbour, A.B. L., Jabbour, C. J. C., Sarkis, J., & Govindan, K. Brazil's new national policy on solid waste: Challenges and opportunities. Clean Technologies and Environmental Policy, 2014; 16(1): 7–9. https:// doi.org/10.1007/s10098-013-0600-z.

[6] Figueirêdo, C.B.M., de Souza, J.R., Soares, D.H. G., Silva, C. C. de A. R., & de Lorena, V. M. B. Clinical and economic aspects of the use of rituximab in non-Hodgkin's lymphoma. Brazilian Journal of Pharmaceutical Sciences, 2014; 50(3): 445–456. https://doi.org/10.1016/j.rser.2015.06. 010.

[7] Iqbal, M. A., & Gupta, S. G. Studies on Heavy Metal Ion Pollution of Ground Water Sources as an Effect of Municipal Solid Waste Dumping. African Journal of Basic & Applied Sciences, 2009; 1(5–6): 117–122.

[8] Jayakrishnan, T., Jeeja, M., & Bhaskar, R. Occupational health problems of municipal solid waste management workers in India. International Journal of Environmental Health Engineering, 2013; 2(1): 42. https://doi.org/10.4103/2277-9183.122430.

[9] Kaushal, R., Varghese, G., & Chabukdhara, M. Municipal Solid Waste Management in India-Current State and Future Challenges: A Review. International Journal of…, 2012; 4(04): 1473–1489. Retrieved from http://www.ijest.info/docs/IJEST12-04-04-196.pdf.

[10] Kraan, S. We are IntechOpen, the world' s leading publisher of Open Access books Built by scientists, for scientists TOP 1 % Control of a Proportional Hydraulic System. Intech Open, 2012; 2: 64. https://doi.org/10.5772/32009.

[11] Chang, N.-B., & Wang, S. F. (1997). A fuzzy goal programming approach for the optimal planning of metropolitan solid waste management systems. European Journal of Operational Research, 99, 303–321.

[12] Daskalopoulos, E., Badr, O., & Probert, S. D. (1998). An integrated approach to municipal solid waste management. Resources, Conservation and Recycling, 24, 33–50.

[13] Dyson, B., & Chang, N.-B. (2005). Forecasting municipal solid waste generation in a fast-growing urban region with system dynamics modeling. Waste Management, 25, 669–679.

[14] Finnveden, G. (1996). Solid waste treatment within the framework of life-cycle assessment—Metals in municipal solid waste landfills.The

International Journal of Life Cycle Assessment, 1, 74–78.

[15] Haastrup, P., et al. (1998). A decision support system for urban waste management. European Journal of Operational Research, 109, 330–341.

[16] Haan, C. H., Coad, A., & Lardinois, I. (1998). Municipal solid waste management: Involving micro and small enterprises-guidelines for municipal managers. Italy: ITC.

[17] Hokkanen, J., & Salminem, P. (1997). Choosing a solid waste management system using multicriteria decision analysis. European Journal of Operational Research, 98, 19–36.

[18] Ahsan, K., Shah, H., and Kingston, P. (2010), "RFID Applications: An Introductory and Exploratory Study", IJCSI, Vol. 7, Issue 1, No. 3, January 2010.

[19] Arebey, M., Hannan, M., A., Basri, H. (2013). "Integrated Communication for Truck Monitoring in Solid Waste Collection Systems", IVIC 2013, Selangor, Malaysia, November 13-15, 2013, pp. 70 – 80.

[20] Bohn, J. (2008). "Prototypical implementation of location-aware services based on a middleware architecture for super-distributed RFID tag infrastructures", Pers Ubiquit computing Journal, Vol. 12, pp. 155-166.

[21] Bryden, W., Paul, L. (2010). "Demystifying Environmental Management Software, Achieving Goals and Maximizing" ROI: Intelex Technologies Inc. 905 King Street W, Suite 600, Toronto, Canada.

[22] Bundela, P.S., Gautam, S.P., Pandey, A.K., Awasthi, M.K., Sarsaiya, S. (2010). "Municipal solid waste management in Indian cities–A review". International journal of environmental sciences volume 1, no 4, 2010.

[23] Ohri, A. and Singh, P.K. (2010). "Development of decision support system for municipal solid waste management in India: A review." International Journal of Environmental Jhansi nagar nigam.

[24] Da Zhu, Asnani P. U., Zurbrügg Chris, Anapolsky Sebastian and Mani Shyamala (2008), 'Improving Municipal Solid Waste Management in India: A Source book for Policy Makers and Practitioners', The World Bank Washington, D.C.

[25] Ministry of Housing & Urban Affairs (2017), 'Guidelines for Swachh Bharat Mission (Urban)'

[26] Ministry of Housing & Urban Affairs (2018), 'Empowering Marginalized Groups- Convergence between SBM and DAY-NULM'

[27] Ministry of Housing & Urban Affairs (2018), 'Protocol for Making Cities Garbage Free Star Rating of Garbage Free Cities', New Delhi.

[28] Centre for Science and Environment (2018): 'Decentralised Solid Waste Management In Jhansi.

[29] Jhansi Nagar Nigam and RR Collective (2016-17), 'Detailed Project Report on Plastic Waste Management Jhansi, Uttar Pradesh'.

[30] Government of Uttar Pradesh (2018), 'Guidance booklet on Swachh Ward Pratispardha 2018'.

[31] National institute of urban Affairs (2015). 'Compendium of Good Practices: Urban Solid Waste Management in Indian Cities'.

[32] Ministry of Environment, Forest and Climate Change (2016), 'Plastic Waste Management (Amendment) Rules, 2018', New Delhi.