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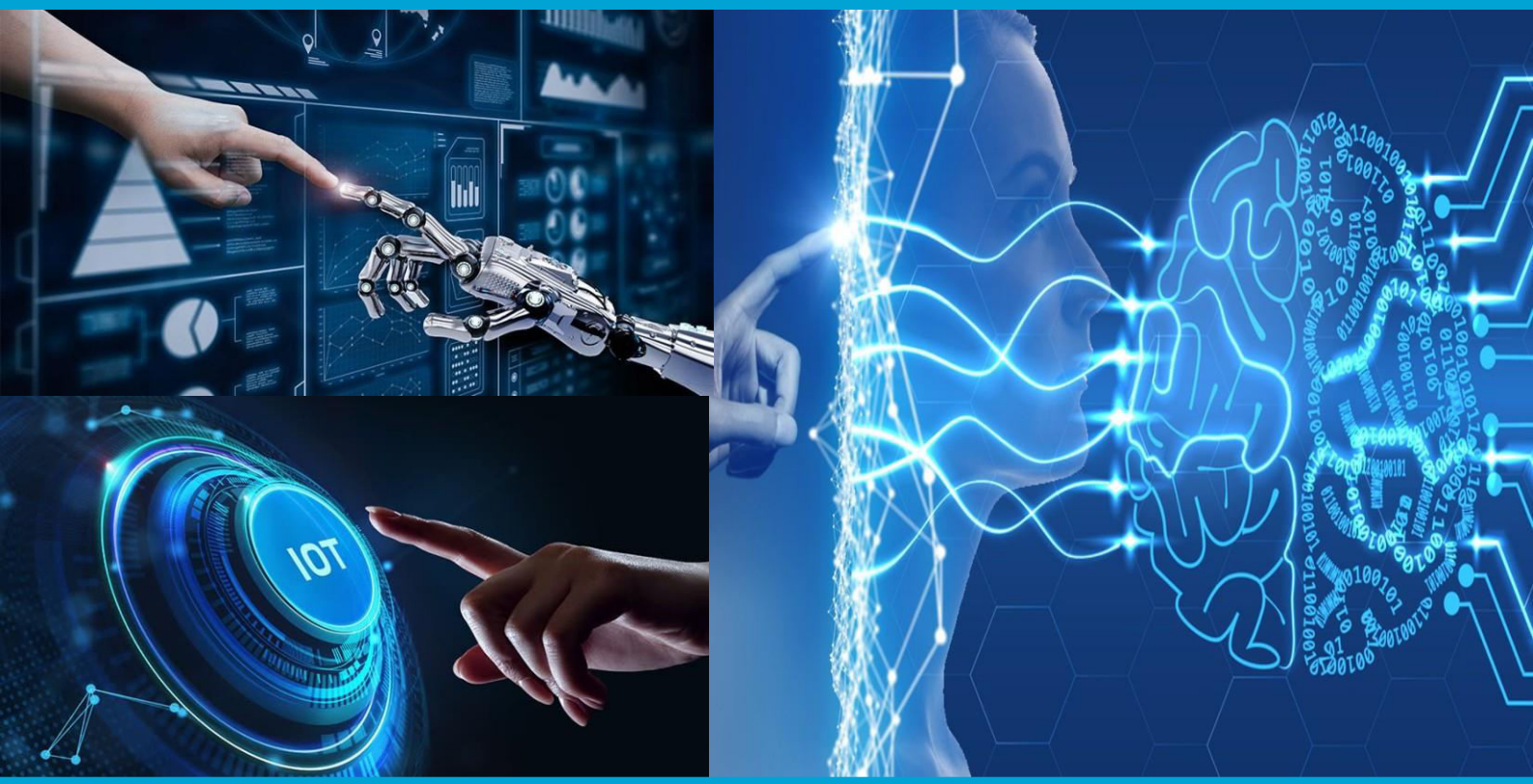

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Solid Waste Management Practices: An Analysis and Comparison between India and the Developed Nations

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ABSTRACT: As human civilization has evolved from prehistoric to modern times, the society has undergone rapid urbanization, industrialization and a drastic change in the lifestyle patterns which has also affected the pattern of waste production. Solid waste which earlier comprised mainly of left over kitchen waste, street sweepings, discarded metals, plastic articles, garden debris, construction and demolition waste, agricultural waste now includes industrial and hazardous waste, biomedical waste and electronic waste . India, currently the third largest producer of solid waste has experienced a multiple fold increase in waste generation due to its burgeoning population. If this solid waste is not managed properly it can lead to land, soil, water and air pollution posing serious threat to the environment, flora, fauna and human health. The problem is further aggravated by the fact that the infrastructure, technical expertise and financial resources to handle this massive quantity of waste remains inadequate. This paper critically examines the solid waste management practices in India and compares it with the practices adopted in developed nations like United States and Europe. Further it proposes strategies to enhance the solid waste management system in India addressing policy frameworks, technology adoption and stakeholder cooperation.

KEYWORDS: Methods of waste management, reuse, recycle, waste disposal, land filing, environmental pollution, health effects

I. INTRODUCTION

The modern consumeristic society is contributing immensely to the growing junk of solid waste. Increasing use of single use packing items, disposables, plastic bags, waterbottles are all adding to the solid waste, a menace which if not handled intelligently can cause land, soil ,air and water pollution which will be detrimental to the environment and human health. Rising global population coupled with economic growth, improved lifestyle and consumerism causes the cities to face a challenge of increasing levels of solid waste. The world is expected to generate 2.59 billion tonnes of waste annually by the year 2030 which is likely to rise to 3.40 billion tones by 2050. Currently available statistics state that at least 33% of the waste globally is not managed in an environmentally safe way. Disposal of waste in landfills contributes to nearly 5% of global greenhouse emissions which are directly responsible for environment degradation leading to global warming. Unlike low income countries which collect only 10% of the generated waste, the developing countries collect 50-80% of the generated waste. Developing nations spend as much as 20-50% of their budgets in waste collection out of which 80-95% is spent on collecting and transporting waste. Management of solid waste is a complex and costly affair. It involves a coordinated effort which includes waste collection, onsite storage, transfer and transport, processing, recovery and final disposal of the solid waste. Efficient and sustainable waste management practices involve ensuring environmental safety and sustainability, economic affordability, social acceptance and public engagement in the waste management practices.

II. METHODOLOGY

The present study employs the desktop research methodology of collecting and analyzing data from existing literature. The data has been collected from official documents, government websites, technical reports, newspaper articles and published articles. The collected data was analyzed, collated and conclusions drawn and presented.

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Status of Solid Waste Generation:

The total quantity of solid waste generated in the country is 150761 TPD of which 145957 TPD of waste is collected as per which overall collection efficiency of waste collection works out to 96.8%. 70881 TPD (47.01 %) of waste is treated and 40952 27 (16%) TPD is landfilled. 38928 TPD which is 25.8% of the total waste generated remains unaccounted.

As per the World Bank Report "What a Waste 2.0: A global snapshot on Solid Waste Management to 2050" published in 2018 the solid waste generation statistics of some countries is given below:

S.No	Country	GDP	MSW (Million TPA)	TPA/per capita
1.	China	16092.30	395.081	0.28
2.	United States	61498.37	265.225	0.81
3.	India	6496.81	189.75	0.14
4.	Germany	53784.78	50.628	0.61
5.	United Kingdom	46290.12	30.771	0.46

The above table shows that United States is the biggest generator of waste worldwide with per capita waste generation of 0.81 tonnes per annum. Similarly developed or industrialized nations like Germany and United Kingdom also have a high waste generation of about 0.61 TPA and 0.46TPA which is almost more than double that of the citizens of India and China. The above table also points to the fact that countries with higher GDP produce more waste as compared to the countries with lower GDP.

Characteristics of Solid Waste in Developing and Industrialized Countries:

Municipal solid waste (MSW) is a heterogeneous waste generated usually from households, street sweepings, waste from hotels, shops; the composition of this waste varies from region to region depending upon the living standards, food habits and the natural resources available in that particular area. Urban solid waste generally has organic as well as inorganic components. The primary difference between the waste generated in developing nations and developed or industrialized nations is the prevalence of higher organic content in the former. The extent of difference is indicated in the Table **1** which gives the relative quantity and composition of solid waste in several countries.

Table 1: Comparison of solid waste characterization worldwide (% wet wt)

Location	Putrescibles	Paper	Metals	Glass	Plastics,Rubber,Leather	Textiles	Ceramics, dust, stones	Wt(g) cap/day
Bangalore,India	75.2	1.5	0.1	0.2	0.9	3.1	19.0	400
Manila, Philippines	45.5	14.5	4.9	2.7	8.6	1.3	27.5	400
Asunction, Paraguay	60.8	12.2	2.3	4.6	4.4	2.5	13.2	460
Seoul,Korea	22.3	16.2	4.1	10..6	9.6	3.8	33.4[a]	2000[a]
Vienna,Austria	23.3	33.6	3.7	10.4	7.0	3.1	18.9[b]	1180
Mexico City,Mexico	59.8[c]	11.9	1.1	3.3	3.5	0.4	20.0	680
Paris,France	16.3	40.9	3.2	9.4	8.4	4.4	17.4	1430
Australia	23.6	39.1	6.6	10.2	9.9		9.0	1870
Sunnyvale, California,USA	39.4[d]	0.8	3.5	4.4	9.6	1.0	1.3	2000
Bexar Country,Texas, USA	43.8[d]	34.0	4.3	5.5	7.5	2.0	2.9	1816

Source: Solid Waste Management UNEP 2005 (Vol I)

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[a] Includes briquette ash (average) ; [b] Includes "all others"; [c] Includes small amounts of wood, hay and straw; [d] Includes garden waste

Analysis of the above table reveals that the solid waste in developing nations like India has more quantity of putrescible matter whereas that of developed nations like USA has more quantity of other things like paper, metals, glass, plastics, textiles, ceramics, etc. The difference in characteristics of waste generated also affects the treatment and disposal patterns of solid waste in these countries. Since the waste of developing nations has putrescible matter hence waste is segregated and the organic component is use to make manure or even for generating biogas which is used as fuel. Waste rich in inorganic matter follows a different treatment process. The recyclable portions of the waste are recycled and reused.

Major Differences in Industrialized and Developing Countries:

The difference in waste characteristics of industrialized and developing nations calls for different strategies of municipal solid waste management in the two. The dominance of organic matter in the waste of latter makes incineration difficult unless the organic matter is segregated and treated separately. Composting of organic matter is important but generally due to shortage of capital, absence of trained personnel and low-tech solutions available in these countries the organic waste generally finds its way into the landfills where the leacheate causes land, soil and ground water pollution. However the major similarity in both developing and industrialized nations is that the quantity of waste generated is increasing very fast in both. Hence it is very important to follow and integrated approach to waste management to address the problem in the interest of the environment and humanity. Waste reduction, reuse and recycling is the best possible approach for managing the waste.

Suggestions for Improvement:

The major problem in waste management is collection of waste. Although the developed or industrialized nations are well equipped with infrastructural facilities for waste collection and transport. They have automated front loaders or side loaders to pick solid waste from destination to destination and carry them to the treatment facilities. Developing nations still lack the infrastructural facilities for the collection and transport of solid waste and rely mainly on manual collection process and transportation through not so advanced facilities like tractors, trucks which are manually loaded and unloaded. However there are certain suggestions for the improvement. Certain functions of municipal solid waste management cycle can be privatized for proper waste management. Privatisation or public private patnership will yield good results in the area of waste collection and recycling, construction of waste facilities, operation of transfer stations, compost facilities, incineration facilities and various other facilities where waste can be converted to wealth like making bricks from the fly ash obtained from cement plants, using waste plastics in road construction, extracting fuel from plastics and so on.

III. CONCLUSION

There is a major difference in the waste management practices of the developed and developing nations. While industrialized countries collect and recycle major fraction of their waste the developing countries are not able to do so and most of the waste finds its way into the landfills in an unsegregated manner. However technology transfer from developed nations to the developing nations which can include usage of RFID enabled waste collection systems, optimization of waste collection routes, proper waste segregation and treatment facilities, public –private partnership for waste management can enable us to reduce the litter in our cities and keep them clean.

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