

Urban Waste Management and Governance

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Abstract:- The management of urban solid waste is considered one of the most immediate and serious environmental problems facing municipal authorities in developing countries in Asia. Solid waste management is a matter of great concern in developing countries like Bangladesh. Although municipal authorities recognize the importance of proper solid waste collection and disposal as well as resource recovery and recycling, it is largely beyond their resources to deal effectively with the quantity growing solid waste generated by expanding cities. Bangladesh is a developing and densely populated country. The urbanization process is increasing day by day in this country. Dhaka is one of the busiest cities in the world. Overcrowding and huge consumption lead to large amounts of waste. Waste management is one of the most serious and instantaneous problems for Dhaka City Corporation (Islam, 2016). Due to the limited space, locating and constructing a new Solid Waste Management (SWM) facility is a major challenge in Dhaka. A SWM facility should be recognized socially as well as ecologically and economically. It is therefore seen as one of the most serious environmental problems faced by urban areas in both developed and developing countries. Dhaka also faces difficulties in solid waste management, as almost no sorting is done while dealing with waste, which binds the Solid Waste Management System (SWM) to paralyze and be unproductive and makes any type of recycling impossible. Old waste transportation system that operates with an inadequate number of vehicles, most of which are open to the environment and cause serious environmental pollution. In addition, the absence of a composting system results in untreated organic waste which causes serious pollution (Talukder et. al., 2011). While the current municipal solid waste disposal (MSWM) scenario is far from satisfactory, several results and estimates in the study have shown that there are sufficient ways to deal with and improve the situation. The study recommends giving the highest priority to institutional / organizational strengthening of the guardianship section since without adequate configuration, manpower and adequate equipment it will not be possible to obtain the desired improvements (Das et. al., 2015).

In this paper the problems associated with existing SWM of Dhaka is critically discussed and accordingly, some remedies have been proposed such as organic waste will be transported to composting site and the other type inorganic waste will be sent to proper recycling industry. This type of composting and recycling are proposed for its low cost. The city of Dhaka is almost surrounded by the Buriganga River and all

existing dump sites in Dhaka are in addition to several rivers.

Keywords:- Waste Management, Plastic Waste, Environmental Degradation and Solutions, Recycling, Reuse.

I. INTRODUCTION

Waste are unwanted or unusable materials. Waste is any material that is disposed of after initial use, or is worthless, defective and useless. In contrast, by-product is a joint product with relatively secondary economic value. A waste product may become a by-product, a joint product, or a resource through an invention that raises the value of the waste product above zero.

What constitutes waste depends on the eye of the beholder; one person's waste can be a resource for another person (Assa, 2018). Though waste is a physical object, its generation is a physical and psychological process (Assa, 2018). In the United States, people who work with waste professionally use four terms - trash, garbage, refuse, and rubbish; trash is dry, garbage is wet, refuse is both and rubbish is refuse plus construction and demolition debris (William, 2001). The definitions used by various agencies are as below.

According to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal of 1989, Art. 2(1), "Wastes' are substance or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law" (Basel Convention, 1989).

The UNSD Glossary of Environment Statistics describes waste as "materials that are not prime products (that is, products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded." (Glossary of Environment Statistics, 1997).

Under the Waste Framework Directive 2008/98/EC, Art. 3(1), the European Union defines waste as "an object the holder discards, intends to discard or is required to discard." (Waste Framework Directive, 2008).

The term waste is an inevitable by-product of human activities. Economic development, urbanization and the improvement of the standard of living in cities have led to an increase in the quantity and complexity of the waste generated. Rapid urbanization and population growth are largely responsible for the increased rate of solid waste generation in Bangladesh. This is a major threat to the environment and public health. Due to lack of motivation, awareness, appropriate choice of technology and adequate financial support, a significant portion of waste, 40-60%, is not properly stored, collected or disposed of in places designated for its final disposal (Ahsan et al., 2005). As a result, this solid waste causes environmental problems. Solid waste consists of four components: recycling, composting, landfilling and waste for energy generation (WTE) through incineration (Anwarul and Jahiruddin, 2015).

In low-income countries like Bangladesh, much of the inorganic waste (such as plastics, metals, glass, etc.) is partially recycled by the informal sectors mainly, while NGOs are taking the lead in converting the organic fraction into compost on a limited scale. And the recycling sector is not yet touched so. However, much of the organic part and other worthless waste remain a major problem. This often constitutes more than half the weight of the total municipal solid waste generated and requires costly removal and disposal (Ali, 2004). In this contrast, the waste management situation in Bangladesh is very alarming, posing serious threats to the health of humans and nature, and it demands immediate and sustainable solutions (Anwarul and Jahiruddin, 2015). Therefore, this study attempts to summarize the state of waste generation, the waste management system and waste management technology, the existing legal framework related to waste management and the associated waste management issues for ensuring environmental sustainability.

Waste is the abandoned object of the use of living elements. Waste with urban life and part of a routine activity. The waste can be identified as the remaining or acceptable and residual part of the products produced by the mills starting from daily food.

By urban waste we mean the day-to-day activities of the city dwellers i.e. food preparation, consumption, house sweeping, street sweeping, office court mills and factory discharges.

There are two types of urban waste disposal:

- ✓ Solid waste
- ✓ Liquid waste

Solid waste

Solid waste is used in household shops - part, office court, industrial factory, hospital, clinic, khabazar (kitchen Market) etc.

Liquid waste

Liquids mixed with chemicals emitted from industrial factories, hospital clinics and homes, hotels etc. Which

usually cannot be managed through reuse and processing. In this case, waste water is used to wash and clean garden roads, cars, etc. by processing the waste water used for cleaning work.

The population is gradually increasing through the two processes of Globalization and Urbanization. At the same time, the elements of life are increasing. The use of a variety of accessories in the name of modernity is increasing. As a result, the supply of industrial data, market houses and infrastructure, services, consumer goods are expanding. At the same time the amount of waste is increasing. The type of waste is also changing. Waste is a hot topic in the world's major cities. In this regard, the management process is continuing through the research and research of urban experts, planning experts, planning experts, seminars, task force, round table meetings, etc. In the developed world 3 Differences are observed between waste production and management in the developing world. 750 million urban dwellers in the developing world alone. In the last two decades, the rate of urban waste generation in developing countries was three-fold per year, which will reach five-fold by 2015 due to rapid urbanization.

According to JICA, Dhaka produces more than half a kilogram (65) of waste per capita per day. There is a difference in this rate between rich and poor. The poor produce far less waste than the rich. In the same way, the per capita waste generation in Bangkok, a somewhat richer city than Dhaka, is almost one and a half times higher. Compared to cities in America and other rich countries. The following is an account of urban waste generation in Bangladesh based on per capita waste generation and total population:

- 1995: 10642 tons / day
- 2001: 16,000 tons / day
- 2025: (Allocation / Idea): 48064 Tons / Daily.

This shows that waste generation is increasing rapidly. In Dhaka alone, 3200 tons of waste is generated every day. According to other sources, this amount has been found to be 4500-5000 tons. Dhaka City Corporation collects 43% of the total waste in an official manner. And some of it is picked up from dumping sport and recycled. Forty-three percent of the total waste is either deposited by the waste generators themselves or dumped in various places illegally. Thirteen percent of the total waste is taken for recycling in one way or another. This work is done mainly through Tokai, Bhangari and workshops. It is estimated that more than one lakh people are involved in Dhaka metropolis at different stages of waste collection, removal, segregation, transportation, recycling etc.

Waste type

Many of us say waste is two types of liquid waste and solid waste. But of the current urban waste, solid waste is the one that affects urban life the most. Solid waste is again of two types;

- A. Organic
- b. Inorganic

Apart from this, in the age of modern information technology, new waste is created which is considered as waste of information technology. The following is a diagram of the type of waste.

- A. Organic waste: Food and vegetables, fruits, peels, herbs, leaves etc.
- B. Inorganic waste: plastic, rubber, wood, leather, paper, brick, stone, metal, garden, house, house, building residue, motor vehicle part.
- C. Waste of information technology: television, computer, mobile phone, CD, VCD, cassette, film, etc.

Different types of waste generation

Food & Boats Curry (50%) Plastic Rubber Wood & Leather (16-75%) Paper Material (10-7%) Garden Residue (9%) Brick Stone, Rubbish (2.3%) Metals (0.15%) is described by the table below:

Types of waste	Waste generation rate (percent)
Food & Vegetable	80%
Plastics, Rubber, Wood, Leather,	16.75%
Paper Materials	10.8%
Gardens and others	10%
Brick stone etc.	2.3%
Metals (IT waste and others)	0.15%

The rate of production depends largely on the nature of the urban dwelling species. In most cases, the use of food drums and awareness of the necessities of life.

Sources of waste:

Waste is generated on the basis of waste activity. The main sources of solid waste are residential houses (49%), commercial centers, shops, jute etc. (21%), industrial factories (23%) and hospital clinics (7%). Among the different types of waste, hospital waste is deadly and risky. The disease spreads among humans. Pollutes the

environment in deadly forms. Industrial waste is very harmful in many cases especially in water and soil pollution. Chemicals released from industry pollute the soil and destroy the fertility of the soil, disrupting the production of plants and crops. The contaminants in the water level also contaminate the water in the stupa, resulting in outbreaks of harmful diseases like arsenic. At present, concerted efforts are being made in the field of hospital waste disposal. Strategies to protect the environment from damage in various ways.

The following table shows the main sources of waste:

Table 1: Source of table

Source of waste	Waste rate
House hold	49%
Industrial factory	23%
Trade centers and shops	21%
Hospitals and clinics	7%

Solid waste generation in urban areas increases as the population grows. Table 2 is showing the scenario in details. According to Alamgir and Ahsan (2007), a total of 7,690 tons of municipal solid waste (MSW) is produced daily from the six major cities in Bangladesh, namely Dhaka, Chittagong, Khulna, Rajshahi, Barishal and Sylhet, while Dhaka contributes 69% of the total waste stream. Table 3 is showing the scenario in details. The composition of the entire waste stream is about 74.4% organic matter, 9.1% paper, 3.5% plastic, 1.9% textile and wood, 0.8% leather and rubber, 1.5% metal, 0.8% glass and 8% other wastes (Anwarul and Jahiruddin, 2015). Factors that contribute to waste formation are population density, lifestyles, economic conditions, fruit seasons, climate, recycling, and waste management program.

Table 2. Urban solid waste production in Bangladesh.

Year	Total urban population	Urban population (% total)	Waste production rate (kg/cap/day)	Total waste production (ton/day)
1991	20872204	20.15	0.49**	9873.5
2001	28808477	23.39	0.5***	11,695
2004	32765152	25.08	0.5***	16,382
2025	78440000	40.0	0.6 **	47,064

** Source: ADBI and ADB, 2000, *** Zurbrugg 2002

Table 3. Generation of different categories of wastes in six major cities of Bangladesh (Alamgir and Ahsan, 2007).

Waste category	Per capita waste generation (kg/day)						
	Dhaka City Corporation	Chattogram City Corporation	Khulna City Corporation	Rajshahi City Corporation	Barishal City Corporation	Sylhet City Corporation	All waste stream
Organic matter	3647	968	410	121	105	158	5409
Paper	571	130	49	15	9	18	792
Plastic	230	37	16	7	5	8	303
Textile & wood	118	28	7	3	2	5	163
Leather & rubber	75	13	3	2	1	1	95
Metal	107	29	6	2	2	2	148
Glass	37	13	3	2	1	2	58
Others	555	97	26	18	5	21	722
Total	5340	1315	520	170	130	215	7690
Population	11.00	3.65	1.50	0.45	0.40	0.50	-
Per capita (kg/day)	0.485	0.360	0.347	0.378	0.325	0.430	0.387

Table 4. Per capita generation of wastes in six major cities of Bangladesh (Alamgir and Ahsan, 2007).

Income level	Per capita waste generation (kg/day)						
	Dhaka City Corporation	Chattogram City Corporation	Khulna City Corporation	Rajshahi City Corporation	Barihsal City Corporation	Sylhet City Corporation	Average
High socio-economic	0.504	0.378	0.368	0.343	0.327	0.429	0.392
Middle upper socio-economic	0.389	0.343	0.333	0.320	0.278	0.395	0.343
Middle socio-economic	0.371	0.350	0.319	0.242	0.247	0.340	0.312
Middle lower socio-economic	0.305	0.253	0.264	0.309	0.269	0.248	0.275
Low socio-economic	0.270	0.189	0.203	0.239	0.172	0.260	0.222
Average	0.368	0.030	0.297	0.291	0.259	0.334	0.309
SD	0.090	0.079	0.065	0.047	0.057	0.080	0.070

The per capita generation of waste and the percentage composition of the waste components are the two most important aspects for decision makers. This information helps identify waste components for source reduction and recycling programs. In families with high socioeconomic scores, daily waste generation rates are generally higher than in other families with lower socioeconomic scores. The per capita production rate ranged from 0.325 to 0.485 kg / capita / day, while the average rate for the six major cities was 0.387 kg / capita / day (See Table 4). Waste is generated from different sources viz. domestic, commercial, industrial, street sweeping, sanitary facilities, etc., of which the domestic source predominates (See Figure 1).

The rate of waste generation was found to be higher during the rainy season and lower during the dry season, with the rate of waste generation per capita per day being 500 g during the rainy season and 340 g during the rainy season. the dry season (JICA 2005).

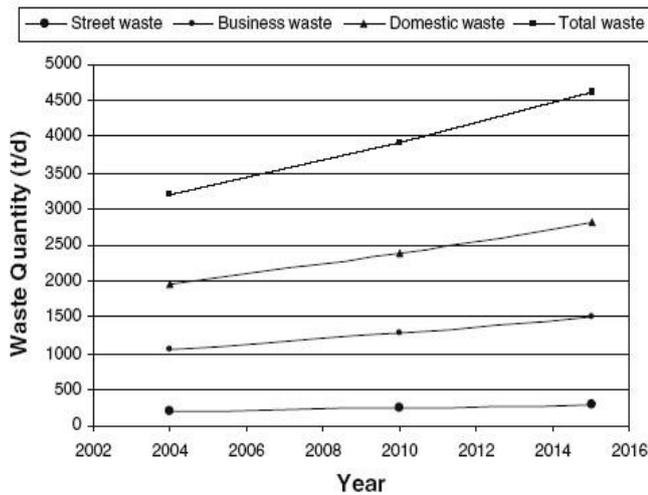


Figure 1. Forecast of solid waste generation amount from 2005–2015. (Source: JICA, 2005)

waste generation or production, collection, desalination, transportation, recycling and dumping. Every city in the world has waste management. At this stage, locally adopted waste management system is known as the waste management of the city. The responsibility of waste management lies with the municipality or city officer.

Waste management processes involve different types of manpower. The stages include the initial collection from the house or shop, the market, the office. Usually this work is done by children at home.

This work is usually done by child laborers or female laborers and in some cases by adult male laborers at home. They collect the collected waste in a push van / bicycle van and take it directly to the nearest DCC dustbin. It is the responsibility of the city authority to collect garbage from the dustbin and deposit it at the DCC dumping spot. Many people are involved in waste collection while collecting waste at home or in the market.

Waste Management:

Waste management is a chain process i.e. from waste generation to final stage work. There are various stages of

Conventional Waste Management –

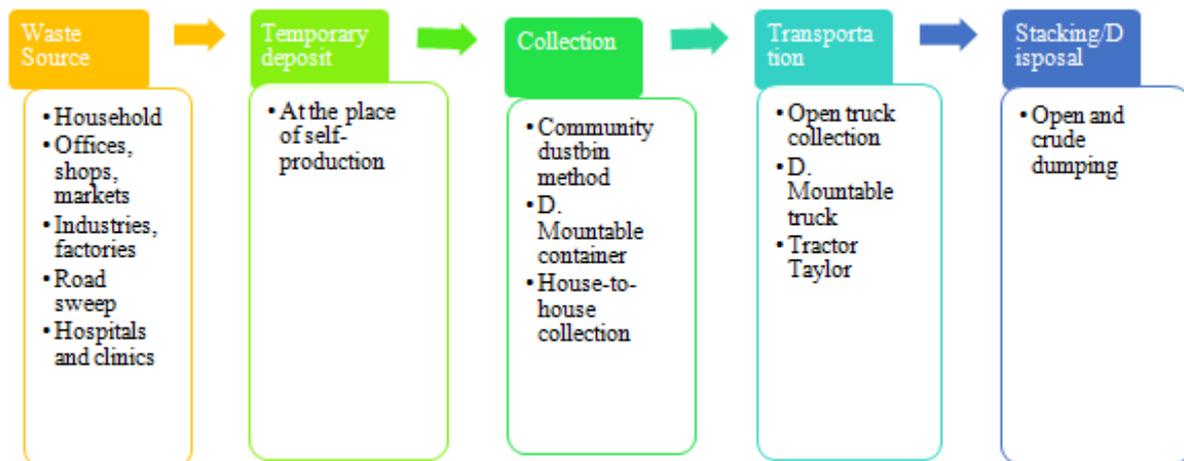


Figure 2: Conventional Waste Management

Except in big cities like Dhaka and Chittagong, there is no proper system for garbage collection and removal. Even in the capital city of Dhaka, garbage removal and management is unsatisfactory. Garbage piles on the side of the city streets are a very normal sight. The people of the city have become accustomed to a lot of garbage. The efficient manpower, transportation and processing system of Dhaka City Corporation for waste management is very fragile. Waste management in such a big city is impossible for them to afford. Can collect 42% of total waste generated. The rest of the waste is deposited in the drain. In the fast-

growing Dhaka metropolis, 100 hectares of land is required every year to fill low-lying areas by removing or dumping waste.

Disposal of waste in the conventional way is not health and environment friendly. Dumping under the open sky spreads inaccessible and then destroys the environment and damages the soil and water. Harmful aspects of removing raw waste under the open sky are shown in the figure below.



Figure 3: Impact of crude waste stacking.

Efficient management or management or governance is consistent with every action. Through efficient management, it is possible to build a habitable and healthy city by using the waste disposal system in a timely and appropriate manner. We can divide waste management into two parts.

1. The method of making the right decision / policy
2. Policy implementation procedures

1.The method of making the right decision / policy:

The only major hero of the city's waste management is the government or its authority. The authorities formulate various rules and regulations for proper management. Introduce the right method by making laws. In the case of waste management in a city, the national waste management system is formulated depending on the local geographical, social and economic conditions. No such method has been applied in Bangladesh yet. In Yokohama, Japan, a developing country in the world. Waste management in Manila or Jakarta in the Philippines may be commendable and worthy of imitation. Appointment methods:

- Formation of Partnership Task Force on Waste Management
- Legislation of city authorities to pay waste generators like taxes.
- Rapid segregation of waste
- Encouraging entrepreneurs in waste processing small scale industries and providing all business facilities.
- Participation and promotion of social waste removal movement to the people.
- Preparation training for removal and processing of school level waste in the national curriculum.
- Discourage unnecessary and indigestible packing in industry and marketing.

Following and managing the above methods for a sustainable and sustainable waste management can turn a city into a waste resource. Urban economic activity may increase. Unemployment can be eliminated. Urban poverty

will be alleviated. If applied properly, the waste will be the raw material of big industrial factories. At the same time, linkage will develop into a small industry which may at one time go even further than the garment industry.

2. Policy implementation method:

In a chain process, everyone is involved, that is, interconnected. In this case, it can take responsibility based on the stage of implementation of the policies. Such as:

- Corporate management.
- Local level management.
- National stage management.
- International stage management.

At each of the above levels there will be a waste management authority and they will implement the enacted laws. The government will play a key role at each stage. This means that the public sector can encourage waste management in partnership with other sector stakeholders. Such as: government letter, individual letter, community letter, NGO can participate together.



Figure 4: Stakeholders of waste Management

A task force consisting of different stakeholders of a city can manage waste through good governance. Both the director of good governance recommendations and the implementing director will be responsible for the needs or wants of the present and future society. Waste management will be improved if accountability, responsibility and skills are combined in all areas. The following figure illustrates a well-directed scenario of waste management in Bangladesh.

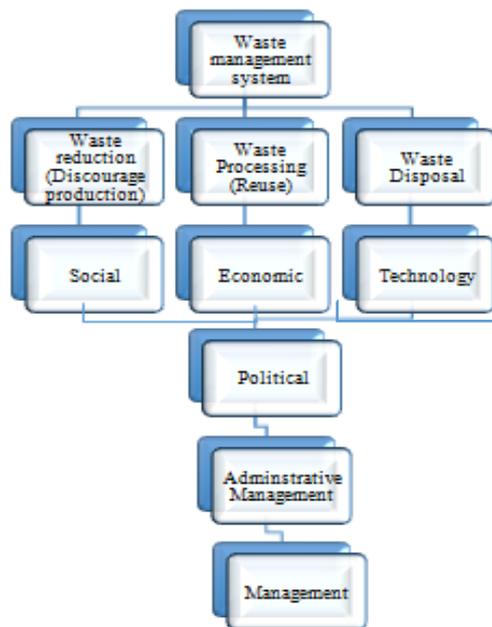


Figure 5: Waste management system in Bangladesh

Legal framework for solid waste management

There are national and local levels of legal framework in relation to solid waste management. They are stated below.

National Environmental Management Action Plan (NEMAP): The Ministry of Environment and Forest (MoEF) has formulated this action plan. NEMAP has recommended for actions in the areas of sanitation, solid waste management, water supply and environmental awareness etc. Based on the findings and recommendations of NEMAP, the government has taken up projects like community-based water supply and sanitation, community based solid waste management and community-based wastewater treatment (GoB, 1995).

National Policy for Water Supply and Sanitation 1998: The Ministry of Local Government Rural Development & Cooperatives has prepared this policy. Special emphasis has been given on participation of private sector and NGOs in water supply and sanitation in urban areas. Some solid waste

and recycling related strategies under this policy are given below:

- Local Government Bodies (City Corporations and municipalities) may transfer, where feasible collection, removal and management of solid waste to the private sector.
- Measures to be taken to recycle the waste as much as possible and promote use of organic waste materials for compost and bio-gas production
- Private sector including NGO participation in sanitation is encouraged (GoB, 1998).

Local Level Legal Framework: There is no adequate legislation in the country to address the growing problems of solid waste. The responsibility of removal and disposal of municipal solid waste lies with the City Corporations and municipalities. The six City Corporation Ordinances and Paurashava Ordinance 1977 are the only local law that gives some idea about disposal of municipal waste.

Problems of Solid Waste Management

There are many problems and drawbacks of solid waste management in the urban areas of Bangladesh. The major ones are as follows:

- Shortage of suitable lands for final disposal of solid waste;
- Lack of awareness about environmental problems associated with solid wastes
- Lack of partnership between public sector, private sectors and community groups
- Lack of proper handling rules and standard;
- Lack of finance, and inefficient tax collection;
- Inefficient practice of waste collection;
- Absence of national policy to encourage recycling practice;

Recycling and Composting

For the developing countries, large centralized and highly mechanized small-scale decentralized community-based composting plants are often considered as an appropriate option for treating municipal solid waste because of their reduced transport costs, use of low-cost technologies, based mainly on manual labor, and minimize problems and difficulties encountered with backyard composting. Recently using Clean Development Mechanism (CDM) under the Kyoto Protocol Waste Concern alongside WWR (a Dutch company) took an initiative for a 700 tons/day capacity composting plant and land fill gas recovery project at Dhaka city. Recently, a standard has been fixed in Bangladesh for composition of organic fertilizers including all wastes. (Table 5).

Table 5. Standard of a quality organic fertilizer (BARC, 2007).

Parameter	Characteristics	Parameter	Characteristics
pH	5.5 - 8.5	Cu	Max. 0.05%
Organic carbon	10 – 25%	As	Max. 20 ppm
Total N	1.5 – 4.0%	Cr	Max. 50 ppm
C: N ratio	Max. 20:1	Cd	Max. 3 ppm
P	0.5 – 1.5%	Pb	Max. 30 ppm
K	1.0 – 3.0%	Hg	Max. 0.1 ppm
S	Max. 1%	Ni	Max. 30 ppm
Zn	Max. 0.1%	Inert material	Max. 2%

[Organic manure includes cowdung, FYM, poultry manure, compost, sewage sludge or any other waste]

4. Recommendations to be adopted:

Wastes may be turned in to resources by the following recommendations.

- Encouraging effort on recycling of both organic and inorganic waste.
- Proper management of clinical wastes and impose safety measures.
- Promoting activity of civil society and environmental awareness group on waste management and reuse.
- Encouraging micro-enterprises in waste recovery and recycling.
- Ensuring involvement of NGOs and media in environmental awareness program throughout the country.
- Effective and efficient coordination and cooperation among different divisions of City Corporation and other administrative bodies of the government.
- Public awareness on waste management should be raised through mass media to educate city dwellers.
- Legal Aspects should be followed properly in opening a landfill and it should comply with Environment Conservation Act and Rules and Preservation Act.

II. CONCLUSION

In conclusion we can say that waste management is one of the aspects for a beautiful clean, environmentally friendly, quality livable city. Thus, long-term waste management and financial and national benefits can be achieved by following sustainable practices through good management.

So, we need to change the way we think about waste, to think in a new way, whether "waste" is really "waste" or not waste. We can say-

- Garbage can be an asset if we can manage properly.
- Abandoned can be resources if it is reused.
- Spontaneous becoming variables in circular economy if it recycled by modern technology.

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