

## SCENARIO OF EXISTING SOLID WASTE MANAGEMENT PRACTICES AND INTEGRATED SOLID WASTE MANAGEMENT MODEL FOR DEVELOPING COUNTRY WITH REFERENCE TO JHENAI DAH MUNICIPALITY, BANGLADESH

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### ABSTRACT

*With an increasing population and urbanization, the solid waste management has become a major social and environmental challenge for the local authorities in developing countries all over the world. In Bangladesh in particular, the combined influence of poverty, population growth and rapid urbanization has tended to worsen the situation. Solid waste disposal, in particular has become daunting task for the municipal authorities who seem to lack the capacity to tackle the mounting waste situation. Solid waste is indiscriminately dumped on roads and into open drains, thus leading to serious health risks and degradation of living environment for millions of urban people. In response to the waste challenge many developed countries have embarked upon ambitious environmental reforms, recording remarkable advances in best practices and sustainable management of Municipal Solid Waste (MSW). However like many developed countries, Bangladesh has faced many problems to manage MSW such as lack of manpower, awareness, knowledge of proper practices, financial capacity etc. The aim of this study is to find out the major weakness of existing system, an analysis on solid waste management practices and to develop an integrated waste management model for Jhenaidah municipal area and for the similar environment..*

**Keywords:** *Municipal Solid Waste, Waste Management, Environment, Jhenaidah Municipality.*

### 1. INTRODUCTION

Municipal Solid Waste Management (MSWM) is a challenging problem for the developing countries like Bangladesh where the trend of urbanization is very high. In Bangladesh, the municipal bodies render the solid waste management services. Though it is an essential service, it is not attaining proper priority, which it deserves and services are poor. This has caused many problems in urban environment as well as to the public health in most of the Bangladeshi cities and towns (Ahmed & Rahman, 2003).

During the last few decades, the problems associated with Municipal Solid Waste (MSW) management have acquired an alarming dimension in the developing countries. High population growth rate and an increase of economic activities in the urban areas of developing countries combined with the lack of training in modern solid waste management practices complicate the efforts to improve the solid waste management services. In developing countries, the per capita generation of the solid wastes in urban residential areas is much less compared with the developed countries; however, the capacity of the developing countries to collect, process, dispose, or reuse the solid wastes in a cost effective manner is significantly limited compared with the developed countries (Tchobanoglous, Theisen, & Vigil, 1993). Bangladesh is a developing country and is the ninth most populous and twelfth most densely populated countries in the world. In urban, the projected urban population growth rate from 2010 – 2015 is 3%. Current waste generation in Bangladesh is around 30 million tons per year or 150 kg/cap/year (Iqbal, Tasnim, Chowdhury, Islam, & Islam, 2015). The Waste Generation Rate (kg/cap/day) is expected to increase to 0.6 in 2025 (Alamgir & Ahsan, 2007). The total waste collection rate in major cities of Bangladesh is near only 35%. These trends pose a challenge to cities,

which are charged with managing waste in a socially and environmentally acceptable manner. Municipal agencies spend about 10-15% of their budget on solid waste management (Iqbal, Tasnim, Chowdhury, Islam, & Islam, 2015). But it is not enough because like in most developing countries, the solid waste management has so far been ignored and least studied environmental issues.

## 2. METHODOLOGY

In order to achieve the objectives and to design the research paper the following research methodologies are followed:

### 2.1 Study Area

Jhenaidah is located in the western part of Bangladesh. The town is located on the bank of the river Nabaganga and Kumar. Jhenaidah is considered as one of the most beautiful city in Bangladesh. The area of the Jhenaidah district is 1949.62 sq km and located in between 23°13' and 23°46' north latitudes and in between 88°42' and 89°23' east longitudes. The area of Jhenaidah city is 44.33 sq km. Jhenaidah city is comprises Jhenaidah pourashava which has 9 wards. The population of Jhenaidah district is 1579490 where male 815576, female 763914; Muslim 1415379, Hindu 162808, Buddhist 835, Christian 161 and others 307 and the population of Jhenaidah municipality is 157822. In Figure 1 Jhenaidah municipality map is given.

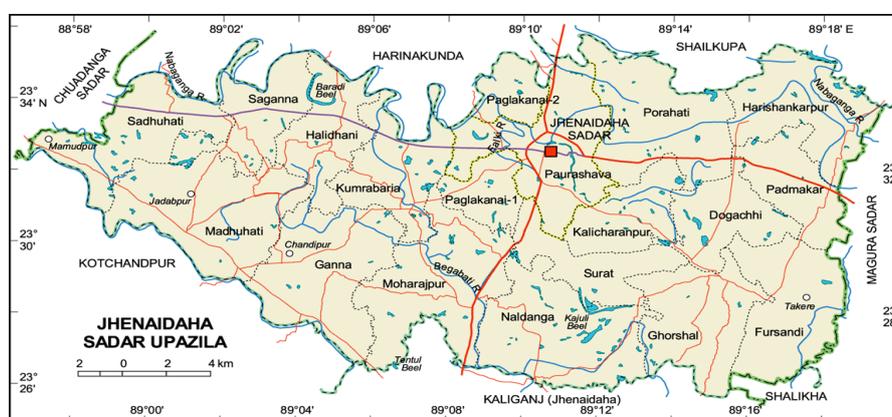


Figure 1: The map of Jhenaidah Municipality(JM)

### 2.2 Waste Components in Jhenaidah Municipality

Table 1 presents the percentage of components of MSW collected and analyzed in the study area. Table 1 shows the percentage of food and vegetable waste components in the waste stream as 65.9%. Hot and very humid climatic conditions are considered as important causes behind the high percentage share of organic food and vegetable waste in the waste stream. It was observed that, a large volume of food and vegetable wastes were generated from the residential areas in the form of kitchen waste, garden waste and fruit waste. Wastes sources like lawns, parks, playgrounds and institutional campuses have also contributed sizeable volume of food and vegetable wastes in the waste stream. Moreover, fruits and vegetable residues from the both wholesale and retail market areas, leftover foods from the hotels, restaurants, hostels, community halls etc. have increased the percentage of food and vegetable waste to such an extent. The quantity of paper and paper products was found high about 7.6% in the total waste volume. Such types of wastes were mainly derived from covered and open drains. The percentage of polythene and plastic was found high about 6.7%. The percentage of wastes were found for rubber and leathers 3.8%, medical waste

5.4%, glass and ceramics 3.1%, brick concrete and stone 0.2%, Textile and Wood 1.02%, metal and tins 0.4% and others 5.88%.

Table 1: Composition of MSW in Jhenaidah municipality

Waste Components	(% by weight)
Food and vegetable wastes	65.9
Paper and paper products	7.6
Polythene and plastic	6.7
Rubber and leathers	3.8
Medical waste	5.4
Glass and ceramics	3.1
Brick, Concrete and Stone	0.2
Textile and Wood	1.02
Metal and tins	0.4
Others	5.88

### 2.3 Estimation of Waste Quantum

Table 2 presented the result of the exercise performed in the study area. The number of trips made by different vehicles for seven consecutive days and the approximate amount of waste carried to the disposal site is shown in the Table 2. From the average daily number of trips performed by each category of vehicles and the approximate load carried by these vehicles, the total quantum of MSW generated in the town was estimated. Thus, the average amount of wastes was estimated at 37.168 tones with an average amount of 0.236 kg/person/day.

Table 2: Quantum of MSW generated and number of trips conducted by the vehicles in Jhenaidah Municipality.

Vehicle Types	Load Carrying capacity (Ton)	No of vehicle in operation	Approximate average amount of load carried by each vehicle per trip	Total no.oftrips performed by the vehicles daily	Average Approximate quantity of waste carried daily in (Ton)	Total Number of Trips Performed in a week	Approximate quantum of waste carried weekly (Ton)
Mini Truck	4	4	3.80	8	30.4	56	212.8
Van	0.5-0.6	6	0.54	12	6.48	84	45.36
Trolley	0.01-0.015	8	0.012	24	0.288	168	2.016
<b>Total</b>	4.51-4.6	18	4.352	44	37.168	308	260.18

Average quantity of solid waste generated by each person per day in JM

=Total amount of waste generated/Total estimated population

=37168/157822 = 0.236 kg/person/day

### 2.4 Present Waste Management Scenario

In Jhenaidah municipal area about 37.168 tons of wastes were generated daily and to store the wastes only 42 numbers of community bins have been used. As the numbers of community bins were few and distributed haphazardly without any planning, residents have no other alternatives rather than to deposit the wastes along the road sides and in the open drains. The urban local body has used RCC bins and metallic containers to store the wastes and 144 numbers of workers were engaged to handle the waste management task. The sweeping crew collects the wastes from road sides and deposit in the nearby community bins by using tricycles. To transfer wastes three types of vehicle is used such as Mini truck, Van and Trolley. Every day, mini trucks performed 2 trips each while the van and the trolley performed 2 and 3 trips respectively. The collected wastes were carried in open trailers and

trucks for about 6.6 Kilometers to the final disposal site located at Nagarbathan. The collection drive starts at 7 A.M and continued till 2 P.M in the afternoon. Collected wastes were finally disposed by simply dumping and land-filling processes. The dumping site is located about 6.6 Kilometers away from the town. The final waste dumping site is about 0.0182 square Kilometers in area. Open air burning and unscientific land filling of wastes not only causes air pollution but also contamination of ground and surface water in the nearby location.

## 2.5 Integrated solid Waste Management System

Integrated waste management is concerned with synthesizing a range of different options to deliver an environmentally and economically sustainable system for a particular area. Hence, it describes an approach in which decisions on waste management take account of different waste streams, collection, treatment and disposal methods, environmental benefits, economic optimization and social acceptability. To integrate a solid waste program within a community, the program should address the needs of the community as a whole. In other words, waste generated from individual houses, apartments, public places, business, and industries located within a community should be taken into consideration for efficient management. Enough flexibility should be built into a program so that it can protect the environment. Willing participation of the community as a whole in reducing waste is essential. Thus, apart from management practices, due consideration should be given to educating the source reduction concept coupled with proper storage, effective collection, transfer, treatment and disposal of waste.

## 2.6 Planning integrated solid waste management

To ensure better human health and safety there will be a need of effective solid waste management system for the urban areas. The system needs to be safe for workers and public health. Besides these requisites, the system must be environmentally sustainable and economically feasible. An economically and environmentally sustainable solid waste management system is effective if it follows an integrated approach. The planning of integrated solid waste management system has been explained below in a case study for Jhenaidah municipality.

1. Reduction of waste at source with the active participation of the community. Wastes can be reduced by changing the consumption pattern, use of recyclable materials, practice of waste segregation and refusing the use of polythene bags etc. About 20% reduction in waste generation is possible through simple housekeeping measures that require no marginal investment.
2. There are considerable benefits of increasing solid waste recycling and reuse. Source separation and recycling of waste reduces the volume of the waste considerably. Promoting recycling as an alternative to the existing forms of waste disposal may be economically gainful. Further, thousands of poor people are directly or indirectly participating in waste collection and recycling to support their families.
3. Composting seems to be a very effective measure of waste disposal in the study area as organic waste constitutes about 72% of the waste stream. Composting is a form of source reduction or waste prevention as the materials are completely diverted from the disposal facilities and require no management or transportation. Diverting such materials from the waste stream frees up dumping space or the materials that cannot be compost.
  - a. Practice of dumping of waste along the final disposal site is found to be unscientific and highly vulnerable to environmental and public health. Sanitary land fill not only reduces the risk to the environment and public health but also proper use of landfill site to the fullest extent. Therefore, adoption of sanitary land filling will be a better option for final disposal of wastes in the study area.
  - b. Community participation is essential for smooth and efficient operation of solid waste management system. Performances of such system depend on the meaningful

participation of individuals, communities and institutions, producers, NGOs and government. The key element of the community participation is involvement of the community in the decision and implementation process. Therefore, a consistent and ongoing educational program is necessary for the success of the waste management system.

### 3. ILLUSTRATIONS

In this paper it was found that the solid waste generation rate in Jhenaidah municipality is about 37.168 ton/day and the solid waste generation rate is 0.236 kg/capita/day. The waste characteristics are slightly different with respect to geographical regions, the influence of seasonal variation, population density, habits and custom of living, lifestyles, economic conditions, climate, recycling and waste management program. But there is a little variation due to the awareness of the householders and scavengers.

#### 3.1 Proposed ISWM Scheme for Jhenaidah Municipality

The ISWM scheme for Jhenaidah municipal area have been designed to minimize the initial generation of the wastes through source reduction, then through reusing and recycling to further reduce the volume of the material being sent to landfill sites for final disposal. Efficient management of wastes requires collection of up- to- date information for corrective measures as well as future planning. Integration and assimilation of information from various sources and levels also have been considered important in ISWM. Thus, the strategic approaches for ISWM involve integration of available data, guidelines and framework to eliminate the constraints. The main objective here is to proper storage, effective collection, transfer, processing and disposal of wastes according to the constituents present in the waste stream in a sustainable manner with the participation of the community. To maintain a healthy environment, the LGED has to adopt this approach and set goals to reduce the amount of solid waste in a cost effective manner.

#### 3.2 Focus of the ISWM Scheme

1. Equations Segregation of wastes at source especially the household wastes through active participation of community and in separate containers and regular collection of wastes by using separate fuel efficient vehicles according to nature of the wastes. Use of compactor makes the collection drive more efficient and cost effective.
2. Improve community bins, storage containers for the storage of biodegradable and wet wastes and containers should be placed scientifically using GIS and GPS.
3. Adequate training to all the levels of staff engaged in solid waste management to handle respective functional aspects like collection, generation, storage, segregation of waste etc. and medical check-ups for municipal workers and rag pickers should be mandatory at regular interval.
4. Establishment of some transfer station for smooth operation of the SWM system at some suitable locations.
5. Composting should be done with the help of technological experts and o handle the bulk of waste generated everyday sanitary landfill site have to be set up to dispose off the rejects after composting.
6. Promotion of public participation in the SWM scheme and constitution of citizen forum in each municipal ward involving local people.
7. Developing public –private partnerships leading to privatization of some aspects of garbage collection, recovery and disposal.
8. To tackle various issues such as road sweeping, open dump, open burning, garbage collection, disposal etc. regular monitoring is necessary.
9. Garbage tax should be levied against large and small generators for the disposal of Wastes.

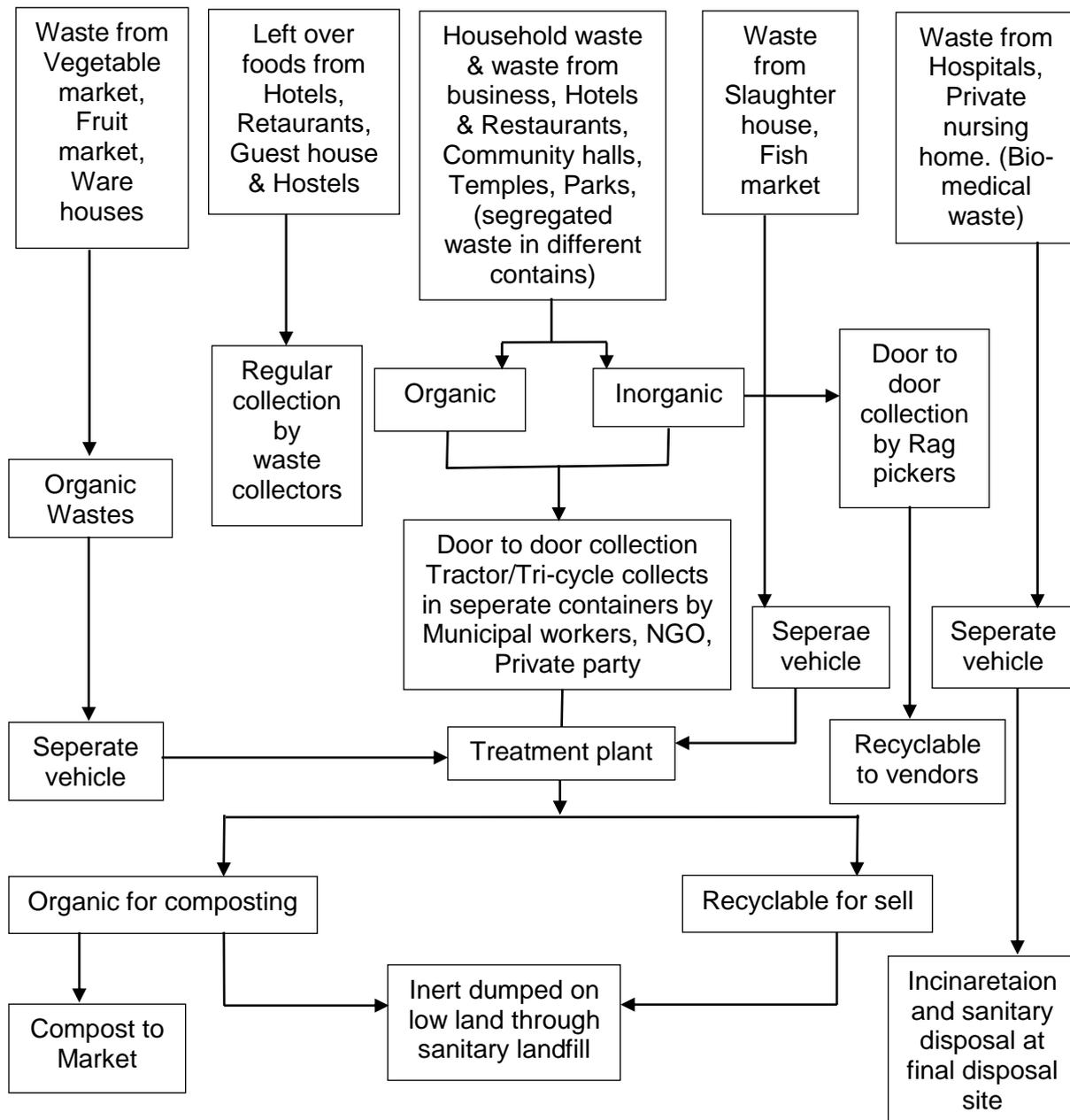


Figure 2: Integrated Solid Waste Management model.

10. Administrative restructuring of the LGED to discharge more efficiency and specific responsibilities. This requires structural changes within administration aimed at decentralizing authority and responsibilities. This also includes periodic meetings among the staff and between the executives and elected wing of the board.
11. Encouraging involvement of local NGO's in working on various environmental awareness programs and areas related to waste management including the public about the importance and necessity of better waste management.
12. Privatize solid waste management facilities or contract for waste disposal services, including recycling.

In Figure 2 the Integrated Solid Waste Management model is shown.

#### 4. CONCLUSIONS

Mismanagement of wastes not only causes serious environmental problems but also risks to public health. Therefore, there is a shift from the traditional solid waste management options to more integrated solid waste management approaches. Waste management system in Jhenaidah municipality is traditional and needs up gradation in the areas of storage, collection, transfer, processing and disposal. Financial hurdles and lack of co-ordination and co-operation between the concerned authority and the public has created bottlenecks in improving its efficiency. The potentiality of the community participation in the waste management system has to be given more and more emphasis for smooth management of the system along with the adoption of latest spatial analytical technologies such as GPS-GIS system. However, government initiative is always necessary to make the system successful. Waste recycling can be promoted through consumer campaigns that will encourage citizen to co-operate in waste separation and to purchase recycled products. In the same time LGED should encourage composting of wastes which will not only reduce the volume of waste to dispose but also maintain a healthy environment and low risks to public health. Finally, proper monitoring of the system in every steps is utmost important for smooth functioning of the system.

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