Environmental and Sustainable Solid Waste Recycling Management in Dhaka City of Bangladesh

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Abstract– Solid waste management is considered as one of the most immediate and serious environmental problems confronting municipal authorities in developing Asian Countries. Bangladesh is a third world developing country, its industries are flourishing over time and due to this rapid industrialization, urban areas are facing great pressure of huge population who has migrated for better civic amenities, job opportunities and improved quality of life. In order to manage these urban cities, concerned authorities are exploring new ideas and trying firmly to minimize human hazards and ensure a better, safer and cleaner and healthier city for living and enjoying their stay over multifarious business.

Although Dhaka City Corporation (DCC) acknowledges the importance of adequate solid waste collection and disposal as well as resource recovery and recycling, it is mostly beyond their resource to deal effectively with the growing amount of solid waste generated by the expanding cities. Consequently solid waste is indiscriminate by dumped on roads and into open drains thus leading to serious health risk and degradation of living environment for millions of urban people. In the last decade, however, importance of community involvement in solid waste management and use of adapted technologies were recognized for improving the solid waste management system.

However, waste management has turned to be one of the major concerns for the authorities. It is also an important facet of environmental hygiene and it needs to be integrated with total environmental planning and management. A solid waste management system is the framework by which the entire activities concerning solid waste come to pass. The ever increasing global concern on environmental health demands that wastes should be properly managed and disposed of in the most friendly and acceptable way. This is to minimize, and where possible, eliminate its potential harm to humans, plants, animals and natural resources.

Keywords— Waste Management, Waste Generation, Recycling, Environment;

I. INTRODUCTION

Bangladesh is the eighth largest and the twelfth densely populated country in the World. Inadequately planned, rapid and haphazard urbanization, along with industrial and commercial activities contribute to the substantial quantity of waste produced in Bangladesh. Dhaka, the capital city of Bangladesh will emerge into strong economic growth during the period from 2001 to 2017. Although waste was considered as "unrecovered wealth", it still remains a major concern in Bangladesh. This would imply that millions of people are involved in some kind of waste picking. The objective of this paper is to examine how the factors that affect the poverty reduction and achieving a sustainable livelihood among the waste workers in Dhaka, Bangladesh. Dhaka city is one of the most densely populated urban areas in the world. The population density of Dhaka is calculated at 50,368 people per square mile or 92000 people per square kilometer, with a total population of around 16 million of growth rate about 6% per annum.

Urban solid waste management is considered one of the most critical environmental problems in developing countries, including Dhaka, Bangladesh. By the end of 2017, Dhaka is expected to produce 4600 tons or more waste per day. A research states that which is 47% increase from the year 2004 when the waste level was at 3,400 tons per day. Pollution and the ceaselessly unmanaged flow of waste contribute to the disruption and destruction of the environment. This also contributes to unhygienic living conditions, which worsens the situation for unsheltered people who live in extreme poverty in slums and unplanned resident area as squatters. Usually, local governments in association with its local bodies/organs in developing countries are responsible for waste management, but they are facing serious problems in dealing with large volumes and quantities of waste produced due to constraints of resources and other logistics and managerial capabilities.

Waste is an unavoidable byproduct of human activities of Economic and Commercial development, rapid urbanization and increase of unplanned growth of slums in cities have led to an increase in the quantity and complexity of generated waste. Rapid growth of population and industrialization degrades the urban environment and places serious stress on natural resources, which undermines equitable and sustainable development. Inefficient management and disposal of solid waste is an obvious cause of degradation of the environment in most cities of the world.

Dhaka, the Capital City of Bangladesh, is expanding rapidly turning it into a mega city with an enormous growth of population at a rate of around 6 percent a year. Dhaka City Corporation (DCC) has an area of 131 km2 and population of 16 million and population density exceeds 92,000 per km2. Rapid growth of industries, lack of financial resources, inadequate trained manpower, inappropriate technology and lack of awareness of the community are the major constraints of solid waste management for the fast growing metropolitan city like Dhaka.

Solid waste disposal poses a greater problem because it leads to land pollution if openly dumped, water pollution if dumped in low lands and air pollution if burnt. Dhaka city is facing serious environmental degradation and public-health risk due to uncollected disposal of waste on streets and other public areas, clogged drainage system by indiscriminately dumped wastes and by contamination of water resources near uncontrolled dumping sites. This unplanned is also polluting the ground water source intrusion of leachate from waste and which is more dangerous.

The Dhaka City Corporation (DCC) is responsible for solid waste management. DCC is facing serious problems in providing a satisfactory service to the city dwellers with its limited resources and a poor management plan. An inadequate information base (regarding quantity, type and characteristics of wastes), poor operation and maintenance of service facilities and above all lack of civic awareness on the part of a section of the population are adding up to the deteriorating environmental situation. Municipal corporations of the developing countries are not able to handle increasing quantities of waste and a significant portion of wastes are not properly stored, collected or disposed in the proper places for ultimate disposal due to lack of enthusiasm, consciousness, loyalty, as well as money. There is a need to work towards a sustainable waste management system, which requires environmental, institutional, financial, economic and social sustainability.

In less/under developed Asian countries integrated management and safe disposal of solid waste can be found in reference. Most appropriate systems for collection, storage, separation/recycling, transportation and choice of a suitable method for treatment and final disposal, sustainable management programs and proper planning is entirely depends on the characteristics of municipal solid waste.

Objectives

1. To evaluate the present system of Solid Waste Management (SWM) of Dhaka City Corporation.
2. To characterize the composition of the wastes.
3. To find out the sustainable Solid Waste Management system of Dhaka City Corporation.

II. LITERATURE REVIEW

Trends of Urban Waste Creation in Bangladesh Waste generation were estimated at 5,650 tons per day or 2.06 million tons per annum in 2003. The daily waste generation is projected to be 8,280 tons and the annual generation 3.02 million tons by 2010. By 2021, the daily and annual generation will amount to 15,110 tons per day and 5.52 million tons per year. There is an increasing rate of waste generation in Bangladesh and it is projected to reach 47, 064 tons per day by 2025. The Waste Generation Rate (kg/cap/day) is expected to increase to 0.6 in 2025. A significant percentage of the population has zero access to proper waste disposal services, which will in effect lead to the problem of waste mismanagement. The total waste collection rate in major cities of Bangladesh such as Dhaka is only 37%. When waste is not properly collected, it will be illegally disposed of and this will pose serious environmental and health hazards to the Bangladeshis. Four types of waste streams i.e. Domestic (49%), commercial (21%), industrial (24%), and hospital (6%) constitute the total solid wastes of Dhaka city.

III. METHODOLOGY

Methods of Data Collection

Methodology shows the approach by which the study is accomplished. It includes some sequential steps that are required for performing the study effectively. This study is mainly based on primary and secondary data through which the study is completed.

Researcher conducted the face to face interview with the respondents of the study areas. As per the plan for data collection the researcher communicated the concerned officials by emails, telephone/ mobile phone for appointment with the respective respondents. The researcher took help of his colleagues and friends during conducting data collection. Data were collected from the capital and the field level conducting interview, discussion and observation using primary source i.e. interview with the respondents from the selected study areas. Primary data were collected through interview. Data were also collected from secondary source through literature review i.e. reference books, newspapers, periodicals, articles from concern journals of national and international level. Internet sources have been used for research. An attempt was made to include the latest informations whenever available.

Study Area

The study area was Dhaka City (capital of Bangladesh). It's one of the largest cities in the world.

Research Design and Data Collection

This study mainly focused on the present status of solid waste management practice in Dhaka city. Data collection included solid waste collection, transportation, and storage and disposal system. These studies identify the lacking of waste management and the authority future management plan. Both qualitative and quantities data were collected through direct field observation, focus group discussion with the stakeholders, secondary information were also collected for proper documentation, like research articles, books, periodicals. Both primary and secondary sources were used to collect data as fulfillment of the study.

Primary Data Collection through Questionnaire Survey

To find out the solid waste management practice in Dhaka city, the primary data was collected from various classes of people and the respondents were selected randomly. The primary data was collected through questionnaire survey from day labor, rickshaw and van puller, business man, student, job holder and housewife to assess the exact situation of solid waste management with direct field observation. Primary data was also collected by visited the waste collection process and the selected dumping area. For assessing expert opinion the key informant interview was conducted with the various stakeholders who were expert and associated with solid waste management practice in this city.

Secondary Data Collection

Secondary data about population, volume of waste generation, activities exiting on solid waste management in Dhaka City was collected.

Data Analysis

Though the data had been collected from various sources so it transcribed. The data was classified according to the contents. The organized data was then overviewed to get a general sense of emerging trends, patterns and concepts. The data was divided into broad categories like waste generation, waste collection and transportation, waste decision making process, public involvement in the decision making process and so on.

Sources of Data

Data were collected from primary and secondary sources: Sources of primary data: Primary data were collected from the study area. Valuable information was gathered by interviewing DCC officials and workers in this study.

Sources of Secondary Data

Secondary data, mainly from research papers and study reports on solid waste management. This study focuses mainly on domestic solid waste management under the jurisdiction of DCC. The collected information was analyzed to develop an understanding the problems and prospects of existing solid waste management system in Dhaka City.

IV. RESULTS AND DISCUSSION

Primary Data Collection

There is planning of collection waste every day from every house. But some time it is not collected every day and it is also found that from few houses wastes were not collected for 2 or 3 days. After collection of waste from household the waste was dumped into local open.
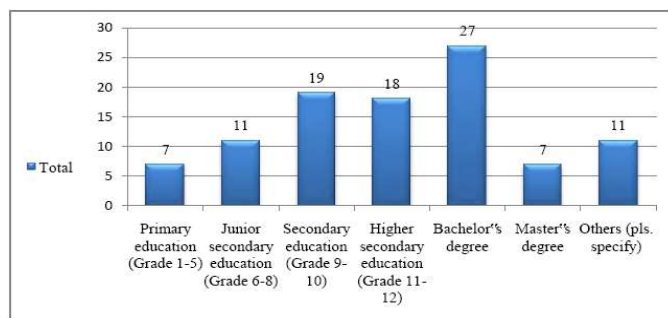

Figure 4.1: Level of education of the most educated member of household

7% of sampled population did only Primary education (Grade 1-5), 11% ended education at the level of junior secondary education (Grade 6-8), 19% attended Secondary education (Grade 9-10), 18% did Higher secondary education (Grade 11-12), 34% have been to the University and 11% have diploma or others degree. The overwhelming majority of 56% is an indication that people' in Ashkona can get

environmental ideas thorough little awareness and print media.

Solid Waste Generation

Per capita solid waste generation is significantly depends on the different income level with different living standard of cities. Figure 4.2 shows that the monthly income level of the people living in Ashkona Dakkinkhan area. 29% people in the study area which have monthly income greater than BDT 30000, on the other hand a major group of people (43%) having monthly income between BDT 11000-30000. Fig 4.1 shows the variation of the per capita solid waste generation in residential areas in study area with respect to different income level.

Figure 4.2: Monthly Income level of the people in survey area

Waste Generation (Per Family/Day)

Higher income level family produces higher amounts of waste (1.18 Kg/day) whereas the lower income level family produces 0.78 Kg solid waste per day.
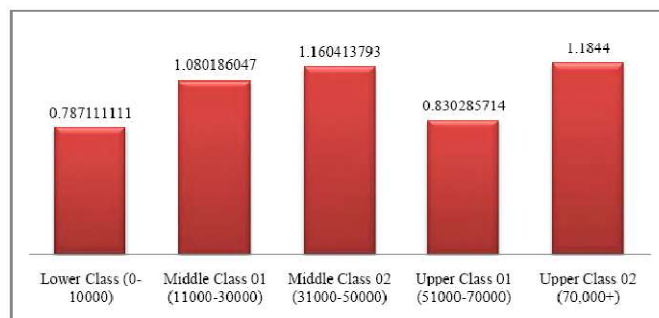

Figure 4.3: Waste Generation with respect to Income level (kg/family/day)

On basis of education level from figure 4.3 it can say that family having less education are producing more waste than others. 1.52 kg waste generated by family having primary education level where a university attended family is producing waste of around .96 kg per day. During study it was also noted that people with higher educational qualification spend most of the day time in office or outside of home that's how generated waste by the concern the family waste in day time.
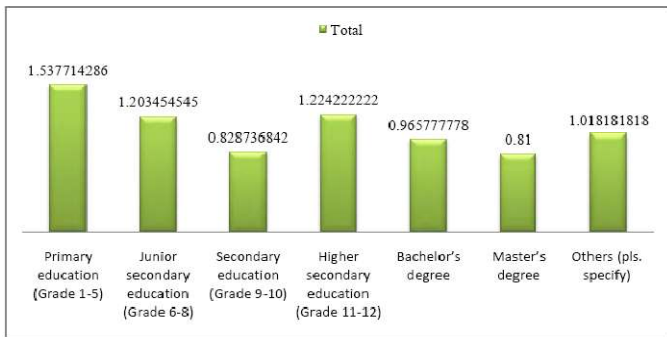
Figure 4.3: Waste Generation with respect to Educational level (kg/family/day)

From the figure 4.4 it is found that in people from rented house generate more waste that the owner himself. Average amount generated are 0.80 kg & 0.89 kg to the owned pucca and semi pucca house respectively. Whether in rented houses waste produces 1.1 kg & 1.05 kg respectively to the rented pucca and semi pucca houses.
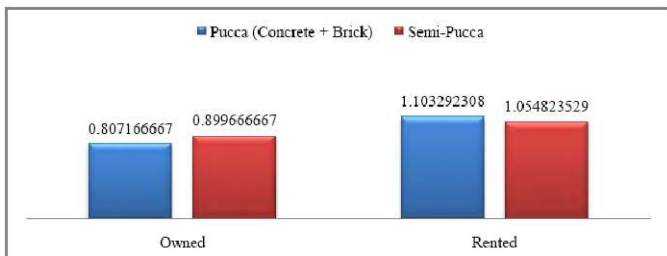

Figure 4.4: Waste generation (KG) based on house type & ownership
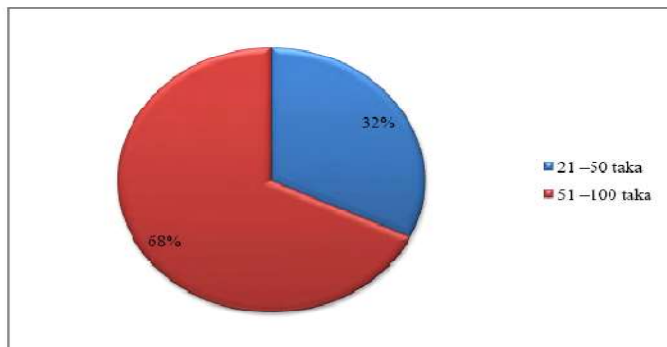
Present Cost of Collection

Figure 4.5: Monthly cost/Family

In the survey area 68% family paid between 51-100 taka per month and 32% family paid between 21-50 Takas. Generally the cost of collection varies on type of house. Generally from pucca house waste collection rate is higher.

Monthly salary of the persons working for collecting the waste is varies between 6000-15000 TK depending on the experience. In Ashkona the local community has 8 van and 3 persons for each van to collect the waste from houses and the collection starts from 08:00 am to 03:00 pm.

Segregation of Waste

During the study it was also found that no house has any segregation system. All the wastes are dumped into one drum or bucket and waste picker collect the waste from that common space.
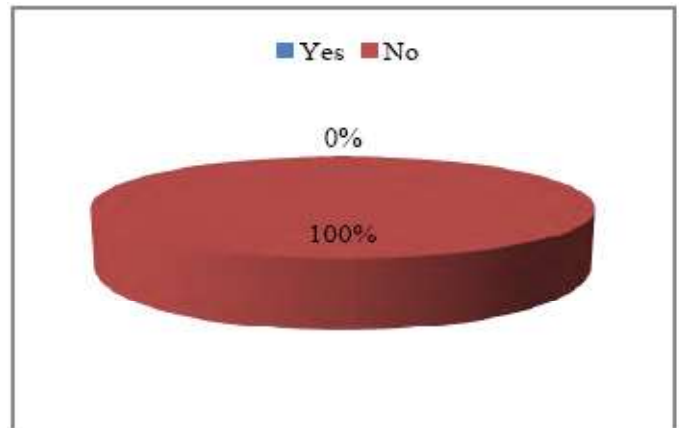

Figure 4.6: Waste Segregation Percentages
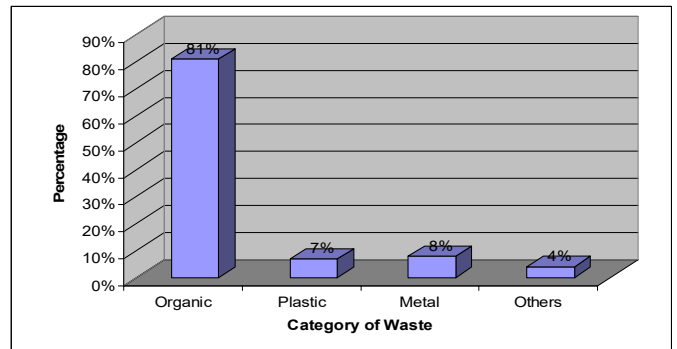
Category of Waste

Figure 4.7: Category of Solid Waste

Category of solid waste has described in the graph. From the result it was found that the organic waste is the maximum which is 81% and other categories waste is the minimum which is 4%.
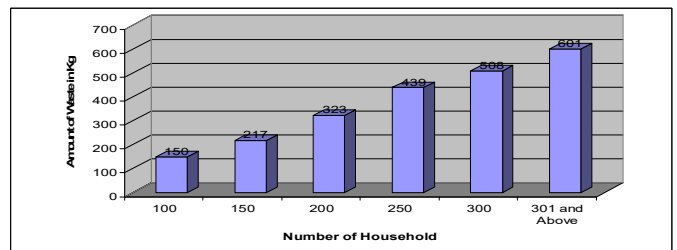
Number of Household

Figure 4.8: Amount of Solid Waste

Amount of solid waste has described in the graph. From the result it reveals that amount of waste increased proportionately with the number of household. In case of 100

households, waste is minimum which 150 Kg is and in case of 301 and above household, waste is 601 Kg.

Waste Generation

The waste generation rate generally varies between the dry and the wet season in Dhaka. In the rainy season, organic and perishable wastes contain more moisture so the bulk of waste contains more weight than in the dry season. Besides, the rate of solid waste generation also differs between different income groups. According to the latest Report (Table-4.1) the highest income group produces almost double as much household waste as the lowest income group in Dhaka.

Table 4.1: Waste generation rate (1 USD=80 Taka)

Domestic Waste				
Source	Income level (Tk/month	dry	wet	average
High income group	>=20,000	0.588	0.438	0.513
Middle income group	20,000>, >=10,000	0.371	0.428	0.400
Middle-low income group	10,000>, >=5,000	0.279	0.346	0.313
Low income group	5,000>, >=3,000	0.326	0.345	0.336
Lowest income group	3,000>	0.314	0.205	0.260
weighted average	kg/ person/ day			0.340

Source: DCC-JICA report, 2005

Table 4.3: General distribution of solid waste in Dhaka city

Waste Composition	1994	2000 (Dhaka, % by weight)
Food and vegetable	35-80%	70%
Paper	01-08%	04%
Plastic	00-02%	05%
Polythene	0.5-03%	-
Textile	00-03%	0.13%
Glass and Ceramics	0.4-01%	0.25%
Garden Trimming	00-05%	11%
Tin-can/metals	00-03%	0.13%
Wood	00-04%	0.16%
Ferrous materials	00-10%	-
Ash-brick, stone	00-10%	01-10%
Others (stone, durt)	01-10%	5%
Moisture		65%

Note: Assessments of Generation of Household Solid Waste in Dhaka City of Bangladesh

V. SUMMARY AND RECOMMENDATIONS

Urban development on the municipal solid waste management of Dhaka city is in typical problem considering inadequate service coverage of concern authority, operational inefficiency of services, lacking of management of household hazardous wastes, deficiency of finance, insufficient recycling activities, inadequate treatment and landfill disposal. In many cases, "good governance" is supposed to be a good approach of urban development, but it requires also accountability, transparency and coordination of all stakeholders, decentralization as well as public participation through a bottom-up approach but those approaches are relatively absent in Bangladesh (Rana M., 2010). DCC should be fulfill their responsibility regarding community based SWM according to the rules and regulation of the Environmental Department of Bangladesh.

Though MSWM of Stockholm and Dhaka are absolutely different from characteristics of waste and its composition, technological as well as financial capability of waste treatment facility. Besides integrated SWM in Stockholm focusing to achieve more sustainability in a 4R (reduce, reuse, recycling and resource recovery) approach.

Recommendations

The recommendations of the study are as follows:

a) Waste materials should put in respective places.
b) Waste materials should not throw in drain or sewerage space.
c) Facilities to be provided to every household to dispose their different categories waste to different bins.
d) Initiatives for 100% collection both are DCC area and also adjacent areas in the Dhaka Metropolitan area.
e) Initiatives to be taken for value adding the organic waste which is 81% of total waste by using those for compost and Bio-gas etc.

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BIOGRAPHY

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