

A STUDY ON SOLID WASTE MANAGEMENT IN KHULNA CITY

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A thesis submitted to the Department of Governance and Development in partial fulfillment of the requirements for the degree of Master of Art in Governance and Development (MAGD)

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Declaration

It is hereby declared that

1. The thesis submitted is my own original work while completing degree at BRAC University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

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Approval

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My Parents

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Abstract

As a populous and rapidly growing country, Bangladesh has been facing major environmental crises over the years. Ineffective management of solid wastes especially in the context of urban landscapes constitutes one of the most pressing problems that contributes to systematic deterioration of the environment. As a representative of rapidly expanding urban area of the country, Khulna city faces full brunt of this problem. So the problem needs to be carefully studied and observed. Major objectives of the study are: (1) To review the current status of SWM in Khulna city (2) To assess the major problems and limitations (3) To explore ways of improvement in SWM in the study area. Major methods that have been used in the study are Key Informant Interview (KII), Focused Group Discussion (FGD), Secondary Literature Review, Official Documents Review and Personal Observation (PO). Key Informant Interview and Focused Group Discussion were held in Khulna city area with the participation of the relevant stakeholders to be aware of the present situation of solid waste management, existing problems and to find out probable solution of the problems. With a view to doing the research, the review of relevant circular, office orders, manuals, regulations related to solid waste management have been done. Selected major findings of the study include the following: (1) The current status of solid waste management in Khulna city shows that the present waste management system is not a satisfactory one rather it is environmentally harmful and hazardous to public health and safe human living. Thereby it requires an improvement from the perspective of environment and sustainable development. (2) The major policy and operational level problems of solid waste management can be summed up as Organizational constraints, Lack of community participation, Non integration from informal sectors activity, Inefficient collection and disposal practices, Absence of resource recovery component and Lack of human resources and vehicles. Besides, this research generates some recommendations on the basis of the exploratory analyses and explanations. These include the following: Organizational Capacity building, recruiting skilled human resources and introducing of modern vehicles, Local level recycling, introducing of resource recovery process, Sanitary landfill can bring fruitful changes to existing solid waste management system in KCC area.

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List of Acronyms

SWM Solid Waste Management

KCC Khulna City Corporation

MSW Municipal Solid Waste

NGO Non-Government Organization

FGD Focused Group Discussion

KDA Khulna Development Authority

KU Khulna University

STS Secondary Transfer Station

Chapter One: Setting the Scene

Introduction:

Solid waste management refers to collecting, acquiring and disposing of components that are of no use to any circumstance. The waste normally loses its value to the proper usage. In this sense, solid waste can create unhealthy and improper situation if it is not managed properly in that area. With the increased paced of population in Bangladesh, solid waste has been burgeoning and leading to serious pollution to the environment. This has already led to many severe diseases by rodents and insects. The challenge to resolve sold waste in such urban and rural areas has become a major concern and created a big threat to society and people simultaneously. Many studies and research have been done to solve the problem with the immediate strategy and techniques. Both developed and underdeveloped countries are suffering from the issue of solid waste.

In the above backdrop, this study focuses on the status and challenges of solid waste management in the Khulna city. In this introductory chapter the following discussion is organized in the following sections: Statement of the Problems, The objectives of the Research, Justification and Selection of the study area, Literature Review, Methodology, Scope and Limitations

Statement of the problem:

Solid waste management poses serious challenges for many developing countries including Bangladesh. Khulna, the third largest metropolitan city of Bangladesh is struggling in managing the solid waste to large extent. Khulna City Corporation (KCC) is responsible for managing the solid waste that is produced every day in the city from different sources. Khulna city normally produces 500 tons of solid waste every day. Approximately 270 to 300 tons of wastes are collected and dumped at Rajbandh landfill dumping station of Batiaghata upazila (Golder and Alamgir, 2018). The rest that lies uncollected hither and thither in the city creates big threat for healthier environment. Since wastes have the potential to pollute the key components of the living environment, it results the following.

- ✓ Burning of waste leads to air pollution.
- ✓ Dumping of solid waste leads to soil contamination.
- ✓ Mismanagement to the wastes and garbage by the municipality results human diseases like headache, vomiting, nervous disorder etc.

If proper planning and its implementation is not done, it will cause severe degradation of urban environment as well as it will create sufferings of the people.

The objectives of the research:

The Major objectives of the research include the following

- i. To review the current status of solid waste management in the study area
- ii. To assess the major problems and limitations of solid waste management in Khulna city
- iii. To explore ways of improvement in solid waste management based on the overall observation and lessons of the study.

Table 1.1: An articulation (Nexus between Objectives, Questions and Chapter) of the thesis

SL	Objectives	Research Questions	Title of the Chapter
1	To review the current status of solid waste management in the study area	(Q-1): How solid waste is managed in Khulna city By Khulna City Corporation?	Current Status of Solid Waste Management in Khulna City
		(Q-2): What are the relevant institutional structure and policy to address the solid waste problem?	
2	To assess the major problems and limitations of solid waste management in Khulna city	(Q-1): What are the major policy level problems in SWM?	The major problems and limitations of the present solid waste management system in Khulna city.
		(Q-2): What are the major operational level problems in SWM?	

3	To explore ways of improvement in solid waste management based on the overall observation and lessons of the study.	(Q1): How solid waste problem can be managed by KCC authority?	The ways of improvements in solid waste management based on the overall observation and lessons of the study.
		(Q2): What are the opinions of major stakeholders regarding the importance of addressing the problem?	

Source: Developed by Author

Justification and Selection of the study area:

Solid waste management has become a major concern in KCC area. It is creating enormous environmental and social problems. With a view to improving the present system of solid waste management in KCC area, the problem needs to be carefully studied and observed

A limited research has been done on the solid waste management in KCC like the other city corporation areas. The most suitable way of finding sustainable and environment friendly solutions of solid waste are mostly absent in most of the researches conducted earlier in Khulna city area. There lies a gap in the research work. Thereby, sufficient research is necessary in this regard.

Literature Review:

Solid waste, a non-liquid material is a much used term now days all over the world. It comprises countless different constituents including metals, plastics, glass, factory byproducts, medical or pathological wastes etc. Solid waste emerges from the discarded components, commercial mining and operation, community actions and agricultural materials. To define solid waste precisely, it is nothing but used materials or garbage or any refuse of waste stuff produced from any treatment plant or any kind of factory in any residential or industrial area.

Solid waste management is nothing but a technique or process by which the whole activity of treating the harmful solid materials derived from different sources is done. In another word we can say that solid waste management involves collection of wastes from primary and secondary sources, transportation of the collected wastes to the secondary storage stations and final disposal of it at the disposal site effectively and in an efficient manner. Solid waste management means to maintain a healthy management system with a view to saving the environment from any improper waste management system. The following terminology is closely related to Solid Waste Management. A short description is given here

Recovery- The term represents the removal or rescue of post-used materials. Example- Recycling. It also refers to waste separation from the primary or secondary sources and processing of it for further use.

Recycling – The term is used to mean the transformation of recovered and stored materials into products so that people can get the utility of such transferred products such as the modification of plastic raw materials after refining from the used one, Organic waste can be reused as fuel after composting.

Organic Materials: It is derived after the segregation of any waste materials at the source. It is normally originated from vegetable waste, kitchen waste, fruit leftovers etc

Inorganic materials: refers to recyclable materials, such as plastics, paper and metals that pose potential and utility.

There are many kinds of solid wastes in both urban and rural areas. The kind of solid waste affecting the environment has different impacts on human health. The kinds of solid wastes are:

- ✓ Household Hazardous Waste (HHW)
- ✓ Construction and Demolition Debris.
- ✓ Industrial/Commercial Waste.
- ✓ Fluorescent and HID Lamps.
- ✓ Regulated Medical Waste.
- ✓ Used Electronic Equipment.
- ✓ Used Oil.
- ✓ Waste Tires.

Solid waste has led Bangladesh to a critical condition. The improper solid waste management system of Bangladesh has polluted the environment of Dhaka and Khulna respectively. If we keep an eye to the waste management scenario of Dhaka city then we will see that the Dhaka City waste management authority is facing lot of difficulties in overcoming waste problems in city area. For instance, the authority has scarcity of land to dispose solid waste and to recycle it properly.

Like Dhaka City Corporation, The Khulna City Corporation (KCC) is also struggling with the same problem in managing the solid waste. The authority of KCC is trying to manage its solid waste from the selected areas. The key challenge of the corporation is the rapid urbanization, industrialization, increased growth of people and so on. In case of solid waste management, it is seen that people have different views and opinions regarding the problems. The sustainable way of solid waste management cannot be found and established overnight but it can give a light of hope for the people of Khulna City area since there are numerous studies on Dhaka, Khulna and other cities in Bangladesh.

Adhikary *et al.*(2012) has explicated that Khulna City Corporation needs to have a socio-ecological balance to keep a continuous development in that area. They added that ecological footprint must be preserved to protect the wild nature and to strengthen sustainable development for the welfare of the country.

Hossen *et al.* (2018) illustrated that Khulna has been producing more than 450 to 520 tons of solid waste in a single year and the amount is burgeoning day after day. They also said that 270 tons, on the whole, are dumped into at Rajbari landfills of Batiaghata upazilla in Khulna

city. Due to improper management system of KCC, the rest of the solid waste is uncollected that eventually leads to severe environmental pollution and causes a lot of health hazards of people.

Bari *et al.* (2012) demonstrated that KCC is supposed to playing particularly major role to increase health risks and diseases to the people. The also added that even though KCC has funds to refill any solid waste management gap such as as- dustbins, mobile public toilets, drains etc., they do not pay attention to meet public demands.

Sharma *et al.* (2020) said that wastes are normally collected from public bins or community bins as well as are transferred to the disposal area accordingly.

With a view to presenting the current solid waste management scenario of the Macao city, Jin *et al.* (2006) illustrated that because of the high cost of land in the city, landfilling has been given lowest priority for waste disposal, on the other hand incineration gets top priority among the other disposal methods although the process is more expensive

If we site the present waste management scenario of the Southeast Asian country Vietnam, we will see that the waste management system in Vietnam is burdened with a big number of challenges including inadequate management, lack of efficient human resources, shortage of transportation vehicles, scarce funding, public awareness etc. Vietnam provides a big number of composting facilities, but this system does not bring fruitful output in waste management because of the shortage of experienced personnel in this regard. Although incineration is practiced in few hospitals of Vietnam, overall health care industries waste is primarily disposed in landfills. There is a significant shortage of facilities to treat and dispose of many hazardous waste. With the increased SW generation and leachate coming from improperly constructed and unmanaged landfills, SWM has become top priority of the government (Omran & Gavrilescu, 2008)

Methodology:

This research is explanatory and quantitative in nature. Major research method includes the following

Key Informant Interview (KII):

As an important and powerful tool of the research, key informant interview have been conducted with a view to gathering relevant information, opinions, suggestions of the respondents. Important primary information related to the waste management in KCC has been collected from the key informants through this interview. During this interview it was found that some respondents provided limited information about solid waste management of KCC whereas an in depth information was gathered from the other respondents. A total of 34 KII were carried out for the purpose.

The household respondents have been selected purposely based on such criteria as duration of residence (Minimum 2 years), age (Between 25-45). In the case of KCC employees, the respondents were selected in consultation with departmental managers mainly based on the direct relevance and experience on the subject matter (SWM). KII were conducted to know the opinions of major stakeholders regarding the importance of addressing the problem of solid waste. The Respondents have been asked about the present situation of solid waste management in Khulna city area, the root causes of poor waste situation, major problems and limitations in the waste management system, the managerial activity of KCC authority, Expectation of the inhabitants in case of waste management, the ways of improving the situation etc. A summary of KII has been presented in the following table 1.2

Table 1.2 : Composition of Key Informant Interview(KII)

SL No	Respondents	Organization	Numbers of KII
1	Mayor	KCC	1
2	Chief Executive Officer (CEO)	KCC	1
3	Chief Conservancy Officer,	Conservancy dept, KCC	1
4	Exen (Mechanical)	Mechanical dept.KCC	1
5	Conservancy Officers	Conservancy dept,KCC	2
6	Conservancy Inspectors	Conservancy dept,KCC	2
7	Conservancy Supervisors	Conservancy dept,KCC	2
8	Chief Health Officer,	Health dept,KCC	1
9	Secretary	KDA	1
10	Subject Matter Specialist	Head of Environmental Science, KU	1
11	NGO personnel	Asha, Prodipon	2
12	Ward Councillor	KCC	1
13	Cleaners	KCCEmployees/Outsourcin g	2
14	Vanmen	KCCEmployees	2
15	Recycle related informants (recycle market, scavenger, whole seller, Hawker),		3
16	Landfilling Staff	Conservancy dept,KCC	1
17	Waste Collector	Conservancy dept,KCC	2
18	Waste Transporter	Mechanical dept, KCC	1
19	Householders	Study Area	5
20	Community Workers	Study Area	2

Source: Developed by author based on the field survey

Focused Group Discussion (FGD):

As defined by Cornwall & Jewkes, 1995, Focused Group Discussion (FGD) used in my study is a technique where a researcher assembles a group of individuals to discuss a specific topic, aiming to draw from the complex personal experiences, beliefs, perceptions and attitudes of the participants through a moderated interaction.

A total of two Focused Group Discussions with the relevant stakeholders including the collector of waste, transporter, Householders, Conservancy field inspectors, NGO personnel were held. Discussion was conducted on the present situation of solid waste management in KCC, problems in waste management and probable solution to the existing problems. It helps to get the opinion of the different stakeholders about the problems.

Official Documents Review (ODR)

As an important part of the research, Official documents review have been conducted. It includes the review of relevant circular, office orders, manuals, regulations which are related to solid waste management and on the basis of which the whole activity of solid waste management is done. The study has helped to know the organogram of the Conservancy department, work distribution of conservancy department and sanitary departments, Numbers of personnel involved in solid waste management, Budget for this works etc. Consequently, the gap between the official instructions of performing the management work of solid waste based on rules and regulations and the common practice in the field have been identified.

Secondary Literature Review:

According to Aveyard, 2010, A literature review is a comprehensive study and interpretation of literature that addresses a specific topic. In this case, the researcher must systematically search, critique and combine the literature to demonstrate a gap in the existing research base. With a view to doing the research. Books and Journals have been reviewed here.

Personal Observation (PO)

As a part of civil service I have had the opportunity to observe the solid waste management system of KCC. While working as executive magistrate in KCC, the opportunity of observing solid waste collection, transportation, disposal has helped to know the total solid waste management done in Khulna city Corporation area.

Scope and Limitations:

- ✓ Due to time and resource constraints the whole of Khulna city corporation area could not be covered. One or two wards of KCC have been covered.
- ✓ Many officials working in KCC were reluctant providing accurate information regarding KCC activities in recent times.

Conclusion

This study thus focuses on selected dimensions of SWM in the context of KCC. This introductory chapter has set the scene of the study by discussing the statement of the problems, the objectives of the research, Justification and Selection of the study area, Methodology, Scope and Limitations. In the next chapter, we focus on the Current status of solid waste management in Khulna City. So to say, an attempt will be taken to analyze the existing situation of Municipal Solid Waste Management in Khulna city.

Chapter Two: Current Status of Solid Waste Management in Khulna City

Introduction

This chapter contains brief description of waste scenario and the process of solid waste management run by KCC. In addition to that an analytical overview of the Relevant Institutional Structure of KCC, Manpower, logistics, Existing Policies/Legislation related to Solid Waste Management will be done in the discussion.

Process of Solid Waste Management run by KCC:

There are several departments in KCC that determine the roles and actions of solid waste management. Conservancy division of KCC plays a vital role in collecting, disposing and removing wastes from Khulna City. In this department, more than 356 workers along with more than 50 officials are endeavoring to resolve the solid waste crisis in Khulna City. They are collecting, removing and disposing waste from around 114,000 households and 790 various small and medium-size manufacturing industries. These workers are removing 220 tons of solid waste each day and keeping the environmental balance particularly. A study says that, on average, a single person is producing 0.3 Kg of solid waste in Khulna City. But the scenario is different from the practical illustration. Only 0.2 Kg of solid waste is being transferred to the disposal area. The rest of the solid waste is not treated with care and managed by KCC. They are left out in the public dustbin, open streets and fields. Rahman *et al.* (2019).

The KCC has been playing the key role in disposing wastes from 1200 roadside city corporation masonry bins. The households or residents are well informed that they must use roadside masonry bins according to the instructions of KCC authority. The transport vehicles of KCC are assigned in acquiring those solid wastes from the masonry bins and dump them out at Rajbandh landfill area that is 9 km far away from the centre of the Khulna City. It is therefore said that these 462 cleaners and 25 transport vehicles along with 504.31 Crores taka budget of 2020-2021 fiscal year are not adequate to support solid waste management of KCC (Talukdar, 2020).

Khulna City Corporation constructed concrete masonry bins at the roadside at frequent intervals. The waste is deposited in these concrete masonry bins after collecting from different sources. Recently Khulna City Corporation has introduced house-to-house waste collection services in some areas. These collected wastes are deposited in the nearby concrete masonry bins or in the Secondary Transfer station (KCC Conservancy Department,2019)

Wastes are generally deposited in the community bins and secondary transfer stations (STS) either by the dwellers themselves or community based organizations or non-government organizations (NGO) through their door to door collection system (Alamin and Hassan, 2013)

Wastes are collected by KCC trucks from primary dustbins and deposited in the secondary transfer station (STS). The KCC conservancy employees do not collect waste from household. They collect waste from STS and transport it to Rajbandh landfill site which is 7 km away from the main city (Moniruzzaman *et al.*, 2011)

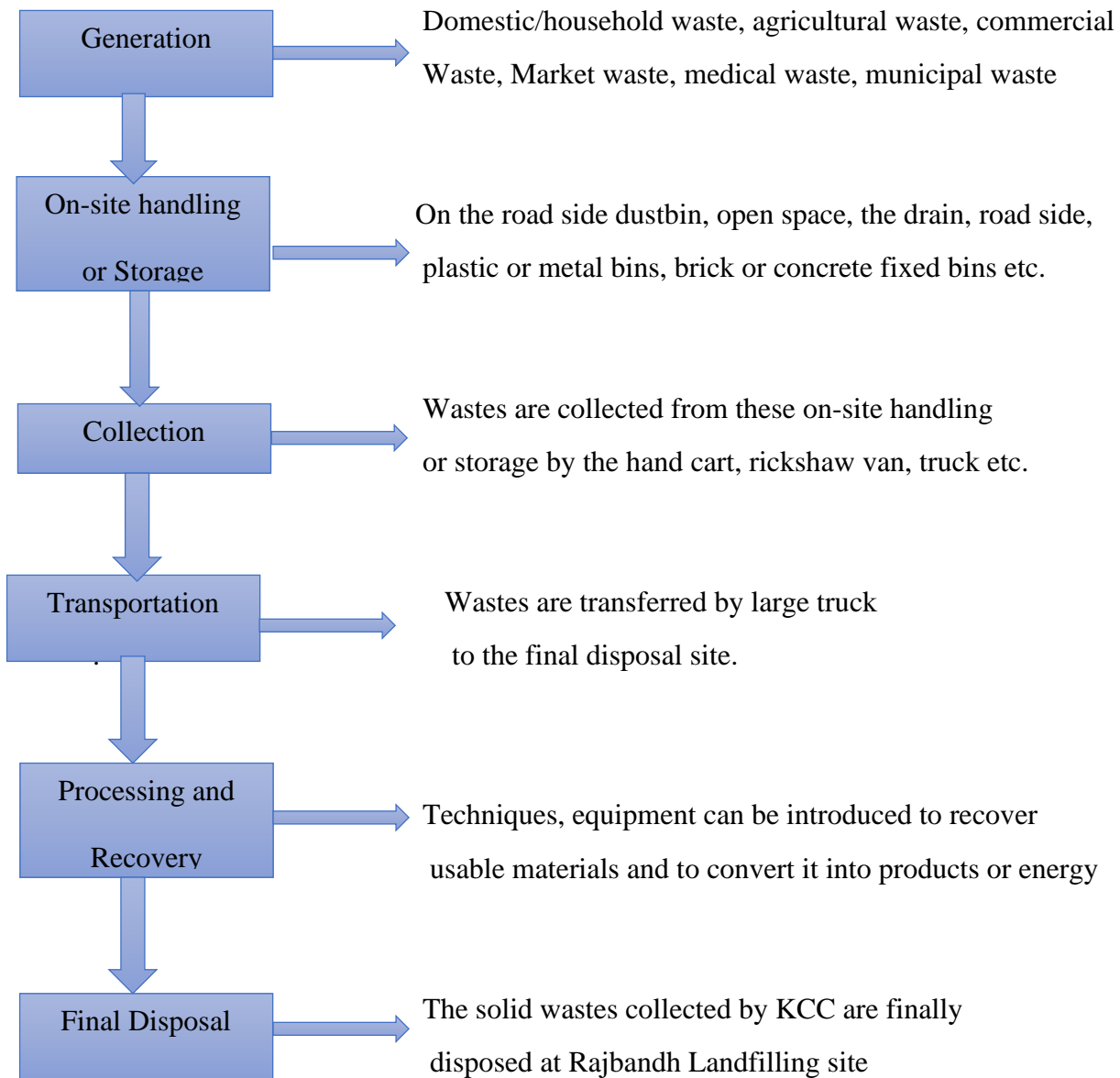
The types of vehicles and equipment and the number of such equipment that KCC authority uses for conservancy action is given in the following table 2.1

Table 2.1: Vehicles and Equipment used for Conservancy Operation

Types of Vehicle/Equipment	Numbers
Big Truck	11
Medium Truck	12
Small/Mini Truck	12
Van/wheel cart	211
Trolley	5
Fogger Machine/hand spray machine	38
Demountable container	62
Skavitor	7
Bulldozer	2
Garbage Loader	5
Wheel dozer	1
Road Sweeper m/c	1

Source: Office records from Conservancy department, KCC

Figure 2.1: The Solid Waste Management Practice in the study area:



Source: (Golder and Alamgir,2018)

Relevant Institutional Structure of KCC:

Local government institutions have been formed with a view to mobilizing resources and providing citizen services at the local level. As an important unit of local government institutions, The Municipal Corporations are working with a certain degree of independence and autonomy

KCC is headed by a Mayor. Mayor, an elected representative of the people performs all the activities being the head of the organization. A Chief Executive Officer (CEO) is deputed by the government to assist executing the functions of the corporation. Like many other functions, it is a major responsibility of KCC to perform the functions of waste management for the betterment of the inhabitants. The activity of solid waste management is done mainly by the conservancy department.

The Chief Conservancy Officer performs the whole waste management in the corporation area with the help of a number of supporting staff including Conservancy Officer , Assistant Conservancy Officers (ACO), Conservancy Supervising Inspectors (CSI), Cleaning Inspectors (CI) and Cleaners. The mechanical department of KCC also assists the conservancy department maintaining the garbage vehicles, bulldozers, excavators used in the dumping site.

Manpower

It is the responsibility of the conservancy department to do the collection and disposal of waste from KCC area. The Chief Conservancy Officer (CCO) is the key person who leads to perform the waste management with the support of a number of departments. The major departments engaged in solid waste management, manpower and the key responsibilities are depicted here bellow in the table 2.2

Table 2.2: Working Staff in KCC Conservancy Department

SL No	Department	Staff Position	Number	Major Responsibility/Comment
01	Conservancy Department	Chief Conservancy Officer	1	Overall monitoring and management of conservancy activities
02		Conservancy Officer	1	Monitoring and supervision of conservancy activities
03		Assistant Conservancy officer	2(approved) 6 persons are working now	Performing conservancy activities
04		Conservancy Supervisor	36	
05		Road Cleaners	1100 Persons Regular-300 MasterRoll-700 Outsourcing-100	Waste Management
06		Waste handler	65	
07		Driver	28	

Source: Developed by Author

Existing Policies/Legislation related to Solid Waste Management:

A legal framework is a must for the implementation of SWM. The Government of Bangladesh has promulgated some laws and regulations for the effective functioning of the local government institutions including the city corporations. Solid waste management that has been structured under a legal framework is presented in the following table 2.3.

Table 2.3: Legal framework related to SWM

SL	Title of Legislation	Framework for SWM
1	1983, Dhaka City Corporation Ordinance	DCC is literally accountable to perform the function of waste management(Collection, Transportation, Final Disposal) in the Dhaka city area
2	1984, Khulna City Corporation Ordinance	KCC is literally accountable to perform the function of waste management(Collection, Transportation, Final Disposal) in the Khulna city area
3	1995, National Environmental Management Action Plan (NEMAP)	The concept of Waste recycling has been encouraged and more importance is given to minimize the activity of land filling
4	1997, Environmental rules and regulation	The framework is taken only for highlighting critical industrial waste but there is no specific guideline to meet solid waste policy.
5	1998, National Policy for Water Supply and sanitation	This framework has given suitable guidelines for more waste recycling and maximum utilization of organic materials for the purpose of compost and bio gas system.
6	2004, Dhaka Declaration on	This framework mainly highlights on the 4R

	Waste Management by SAARC countries	principles. They are reduction, reuse, recycling and recover. The framework focuses on separation of solid waste at the source, composting and recover the material that have recyclable values
7	2006, Draft National Urban Policy	In this policy, CDM and recycling has been given importance to covert the recyclable elements into valued products
	2010, National 3R Strategy	In this policy, 3R principle has importantly taken place in national and local government action plan and procedure.
8	2011, City Corporation Act 2009 (amendment)	Such amendment measurement has been added to reform DCC control and distribution resources and abilities.

Source: BIGD,2015

Khulna City Corporation functions on the basis of The Khulna City Corporation Ordinance, 1984. This law includes the provision of collection, removal and disposal of solid waste from all public places for an environmentally sound and sustainable environment and living. The relevant sections for removal, collection and disposal of refuse in this law is as follows

Removal, collection and disposal of refuse

75. (1) The City Corporation is held responsible for eliminating all kinds of wastes from public places, toilets, drains, slums, households or lands. It is also bound to collect the refuse and to make efficient disposal of it

(2) The landlords or the residential people shall be liable to the elimination of the wastes from their area. The whole activity shall be done under close monitoring and supervision of the City Corporation.

(3) The City Corporation shall provide adequate dustbins and receptacles at certain convenient places for refuse accumulation in order to keep environment safe and secure from pollution. The corporation authority by public notice shall compel owner of land or the householders to deposit waste in a certain time in those dustbins and receptacles

(4) The staff or workers involved in refuse removal and collection shall be under the strict monitoring and control of the City Corporation authority. Moreover, dust-bins with refuse and the receptacles set by the City Corporation for the purposes of waste management shall be the property of the corporation

Conclusion:

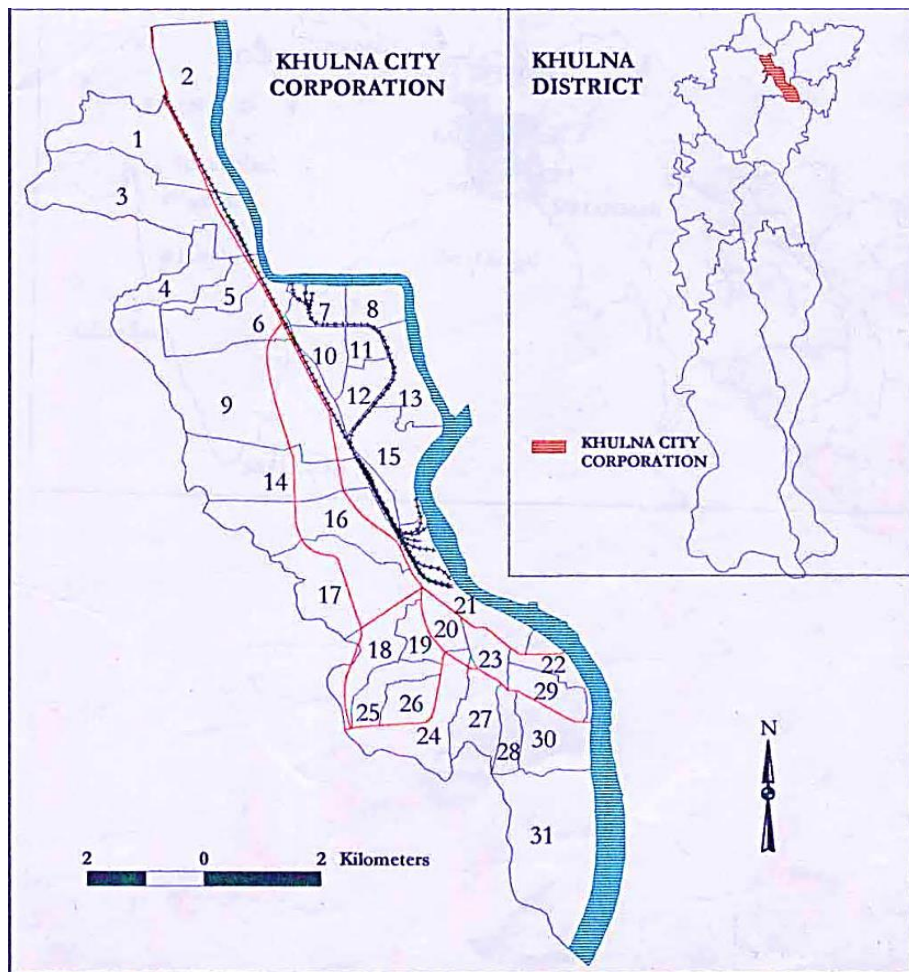
In this chapter the current waste scenario of KCC has been presented. Besides, an attempt has been taken to describe the existing solid waste management practice in the study area as well as the process of solid waste management system run by KCC. In addition to that an attempt also been taken to provide an analytical overview of the Relevant Institutional Structure of KCC, Manpower, logistics, Existing Policies/Legislation related to Solid Waste Management. In the following chapter we will focus on identifying the problems and limitations of solid waste management in the Khulna City Corporation area

Chapter Three: Major Problems and Limitations of Solid Waste
Management in Khulna City

Introduction:

This chapter will mainly discuss on identifying the major problems and limitations of solid waste management in Khulna city. Problems and limitations regarding solid waste management will be organized here in two categories: Policy Level Problems, Operational level problems.

Figure 3.2: Location of Khulna City Corporation area



Major problems and limitations of solid waste management in Khulna city area can be categorized into the following two types

- 1) **Policy Level Problems**
- 2) **Operational level problems**

Policy Level Problems:

The policy level problems and limitations in solid waste management include the following:

i. Organizational constraints

In KCC, there are many limitations or constraints that are mostly related to the organizational issue. The organizational constraints include the lack of adequate resources and materials inside the organization, lack of professional skills, lack of fruitful planning and its execution in the field of waste management that can lead to an ineffective consequence of the environment. Moreover, the negligence of the KCC conservancy workers and officials in doing their respective duties and responsibilities has led KCCs solid waste situation worse compared to other areas in Bangladesh. Moreover, Lacks of monitoring and inadequate financial supports from the government have also created an unscaled balance between environment and system

ii. Lack of Community based Participation

In Bangladesh, it is still visible that the majority of the people including educated and uneducated are remaining under awareness. Many people are not still aware of modern solid waste management. Even though, they do not know how to segregate recyclable waste, dispose of solid waste and recycle them for sustainable development (Christens *et al*, 2016). Besides, a high scale of awareness is barely seen in the community or locality due to lack of proper education or mass campaign. There is still a poor community involvement in most of the study areas in Khulna city in case of managing the waste.. Lack of sufficient awareness raising program is a major cause of this poor situation. Successful community accomplishment is a time befitting option for better waste management in Khulna city

iii. Non-Integration of Informal Sector's Activities

In the study area, it is found that many external factors are liable to create environmental pollution. The representatives of Informal sector including the scavengers, street hawkers, street-beggars, rickshaw pullers, slum people are living in congested areas and do not have access to sufficient public sanitation although they are playing important role in the waste resource recovery chain. Their contribution in waste management has not yet been evaluated. They have not been integrated to the formal waste management system. KCC did not manage to integrate adequate measurement to provide efficacious sanitations for them. A study says that KCC workers are barely seen to provide regular monitoring at vulnerable sites and play fewer roles in minimizing hygienic conditions. In consequence of this situation a functional reliable market for waste reuses or recycling has not been structured in KCC area

Operational Level Problems:

The policy level problems and limitations in solid waste management include the following:

i. Inefficient Collection & disposal Practices

In Bangladesh, there are still traditional practices of collecting and disposing wastes from the localities. KCC, the apex body of performing waste management is not an exception to this. At present, KCC authority is collecting solid waste in the most traditional way. The amount of this collection is less than half of the total waste produced daily in the area. No step is taken actually by KCC to minimize waste by segregating or other means at the source. Waste has become a burden for sustainable environment as half of the waste keeps untreated. Apart from that, there are also several problems behind the scene. The waste collecting trucks do not have access to many clogged zones. It restricts collecting solid waste in many areas on time. Henceforth, uncollected waste leads to acute pollution to the environment. It is also observed that KCC officials have lack of sincerity and adequate coordination in doing their activities that eventually lead to a huge amount of dumping out of waste or garbage at open-street in Khulna City (Eisenberg *et al.* (2017).

Khulna City Corporation is still using open space to dispose of wastes from households. Waste collected by KCC is accumulated and disposed traditionally at the final disposal centre of Rajbandh landfilling site. Such landfill does not cover up environmental losses and to

prevent the environment from contamination. As a result, the residents of the surrounding area are suffering with soil, water and air contamination. Thereby, the final disposal system has been producing a large amount of environmental pollution and creating risks for the local people.

ii. Absence of Resource Recovery Component

It is determined that effective use of resources recovery component can reduce environmental hazards and risks and can improve the current atmosphere of KCC. Moreover, it is seen that KCC does not have a proper guidelines or framework of scaling up such initiatives to discriminate the household wastes to an organic system. Resource recovery component or system can lead to the improvement of solid waste management if the people are particularly informed of converting organic wastes into compost for fertilizer purpose (Teke, 2010). In KCC, the scarcity of proper sanitation is creating mass problems and limitations to collect solid wastes from the locality

A resource recovery process is to be considered as an important tool for modern waste management, it is a matter of disappointment that a functional and reliable market for waste reuses or recycling has not been structured in KCC area. The representatives of Informal sector including the scavengers, street hawkers, street-beggars, rickshaw pullers, slum people are living are playing important role in the waste resource recovery chain. Their contribution in waste management has not yet been properly evaluated and integrated to the formal waste management system

iii. Lack of human resources and vehicles

In the study area, it is also found that there is a lack of human resources. The local people complain against the KCC that the workers assigned to accomplish their duties and responsibilities do not go for regular visits in their area. As a result, the gap between reduction in wastes and disposal system always remain significantly high. Besides, KCC also do not have sufficient large-sized vehicles or trucks that can take a lower amount of solid wastes and keep the rest in that area (Hoque and Parker, 2015).

Apart from that, lack of technical staff or personnel is also a significant cause to an increased amount of solid waste in Khulna City. In KCC, conservancy division has been suffering with lack of scientific or technical personnel who can resolve the problem. Based on the fieldwork report, it is seen that the Conservancy division has no sufficient relevant professionals who have an engineering background. The lack of technical personnel has led KCC performing the functions of solid waste management effectively and efficiently.

Conclusion

Problems and limitations in solid waste arise as many household people are not aware of utilizing the systematic process of solid waste management. Since the household wastes are thrown out the open street not knowing the solid waste process, the situation is being multiplied and leading to a worse state

In this chapter, major problems and limitations of solid waste management in Khulna city have been identified. The Problems and limitations regarding solid waste management have been organized here in two categories: Policy Level Problems, Operational level problems. In the next chapter, we will focus on exploring Ways of Improvement in Solid Waste Management in Khulna city. In another sense some implementable solutions will be provided for the improvement of Solid Waste Management (SWM) in Khulna City. It will help the concerned authority and the policy makers to design a cost effective and socially acceptable future solid waste management plan

Chapter Four: Exploring Ways of Improvement in Solid Waste Management

Introduction

Systematic solution to the existing solid waste management problems in KCC is a must considering the sustainability of the environment and safe human living. In the following discussion, exploring ways of improvement in solid waste management in Khulna city will be taken place. This part will illustrate the key solutions to reduce the gap between waste and disposals of it. In another sense some implementable solutions will be discussed here for the improvement of Solid Waste Management (SWM) in Khulna City

Improvement in Policy level Problems of Solid Waste Management:

The KCC authority must focus on changes and improvement in policy level to enhance the actions of solid waste management. The following improvements need to be addressed for expected waste management

I. Organizational Capacity Building

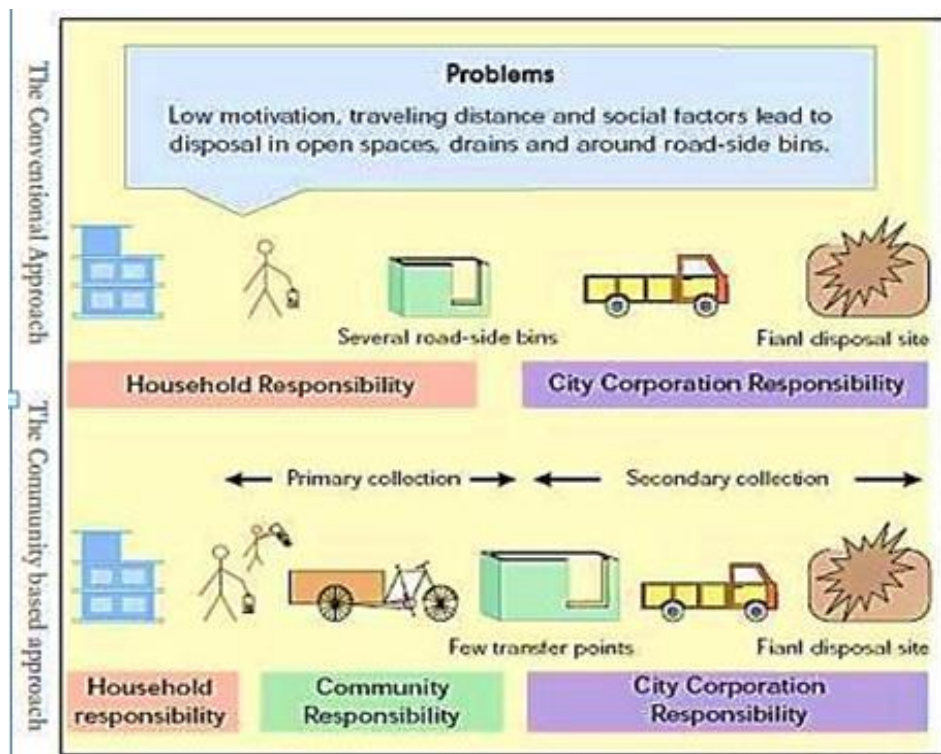
In maintaining SWM in KCC, the policymakers need to focus on increasing the organizational capacity to stimulate current actions of waste management. The organizational capacity depends on the individual work efficiency of the KCC employees involved in waste management. Besides, the KCC can focus on selecting the representatives who can help in minimizing wastes and directing the subordinates to work more effectively in KCC area (Abdusalyamova, *et al* ,2007).

To accelerate the action, KCC must recruit sufficient number of field staff and set to monitor key activities regularly. Apart from that, the KCC authority must motivate the workers to increase their performance and provide them with professional training and aptitude at regular interval. The KCC authority should mandatorily continue their attempts to aware mass people of the solid waste management and convince them through TV or community radio channels. So to promote the organizational capacity building, KCC policymakers must increase the basic skills and knowledge of the workers along with the officers and build strong mind-set upto encounter key challenges in Khulna City Corporation through proper training.

II. Introducing Community-based Solid Waste Management Process

An expected sustainable community based waste management process has been depicted in the following figure 4.1

Figure 4.1: Sustainable waste management system



Source: Heidari *et al.* (2019)

The solution to the elimination of solid waste problems and limitations can particularly be done by accepting the concept of community-based solid waste management Process. The local community and KCC are inherently mutual towards solid waste management. We came to know from the experience of introducing community based waste management system of different countries that it has become popular in managing solid waste successfully and effectively. In Khulna city there is still poor community involvement in waste management. So KCC should take initiatives so that the concept of community based management can be introduced in the city area. Lack of sufficient awareness raising program is a major cause of this poor situation. Successful community accomplishment is a time befitting option for better waste management in Khulna city

III. Local Level Recycling

Figure 4.2: Waste Collection



Source: (Chandan,2019)

It is a common picture in any city area that the street hawkers, scavengers are involved in collecting or buying wastes items from households for the livelihood. Thus they play vital role in the process of recycling by collecting solid wastes from masonry bins that has recyclable values.(Wright and Boorse, 2017).

Resource recovery process specifically local level recycling has been a great means now a days for effective waste management. With a view to doing this job, emphasis should be given in segregating recyclable wastes at the household. Solid waste is a problem unless it is untreated or unmanaged. If proper steps to be adopted waste can be transferred into asset. Khulna city has lack of natural gas. The majority of the households are highly dependent on firewood. If biodegradable solid waste recycling system can be adopted in Khulna city, it could play a vital role in providing electricity, bio-gas and bio-fertilizer. Therefore KCC authority should make necessary arrangement in doing the local level recycling. The KCC can train up its workers with pertinent knowledge and ideas regarding the segregation of waste materials from the households.

Improvement in Operational level Problems Of Solid Waste Management:

In KCC, Improvement in the operational level problems in solid waste management can play crucial role in ensuring comfortable human living in the city area. The operational level solutions to solid waste have been demonstrated below.

i. Introducing Sanitary Landfill:

Khulna City Corporation (KCC) is struggling with the accumulated waste in the final disposal site of Rajbandh. They are using the conventional method in accumulating the wastes for waste disposal purposes. As a result the key elements of the environment including the air, water and the soil are being polluted day by day. The living environment beside the disposal site of Rajbandh is deteriorating. Considering the above facts, KCC should go for the Sanitary landfilling process at Rajbandh landfill site. The term sanitary landfill is nothing but an operation in which the waste to be disposed of are compacted and covered with layer of soil at the end of each days operation. So Immediate necessary initiatives must be taken to introduce sanitary landfilling system so that the collected wastes could be treated and disposed in the most scientific means.

ii. Initiative for Resource Recovery Process

Resource recovery has been a great means to any City Corporation in the modern world to ensure comfortable human living from the heinous impact of solid waste. The resource recovery process can reduce solid waste problem in the locality. It has become a common thought that cleaning and burning solid materials can eliminate solid waste problem. For instance, plastic component film in households can cut down total work pressure from selected area that eventually leaches into soil and ground water. There are also other ways to initiate the process Foa *et al.* (2006). This can be a great threat to sustainable environment as well as expected waste management.

The way to resolve this issue is to recover resources from the waste at the source and to make efficient conversion of it into potential products. For example- Biogas and organic fertilizer can be produced through efficient operation of waste i.e composting. Then compost fertilizer and the produced biogas can be used as a means of producing energy i.e electricity. Segregating of waste components from the primary sources so to say from households can be

the most suitable options in this regard. The KCC can train up its workers with pertinent knowledge and ideas regarding the segregation of waste components from the households, as well as the resource recovery system. With a view to doing the waste segregation as well as the waste recovery system, KCC employees need to be well trained for this job. Besides necessary actions need to be taken to make the people aware of the waste segregation which is a prerequisite for enhancing effective recycling. (Yasmin & Rahman, 2017)

iii. Recruiting skilled human resources and modern vehicles

For developing country like Bangladesh, human resource is a paramount part of any organization. The KCC needs sufficient manpower to stimulate its current initiatives in managing solid waste in the locality. In KCC, there is scarcely skilled human power that can contribute to the welfare of the city dwellers in solid waste management. The majority of the workers have no technical knowledge and idea regarding modern solid waste management system. The KCC also needs highly skilled trainer who has both technical and practical knowledge respectively. The KCC must emphasize efficient human resources to support solid waste management both internally and externally (Mateev *et al.*, 2020).

In KCC same person holds the top most position of conservancy department as well as the mechanical department for long time. The volume of work is high in both the departments, AS the same person has to perform both the responsibilities of Conservancy and mechanical department it does not be possible on his part to take care of all the matters related to solid waste management.

Although there is a close work relationship between these two departments considering waste management, separate technical persons should be recruited for smooth functioning of waste management system in KCC. This issue should be taken in consideration by the KCC authority. To resolve this issue, the KCC can recruit enough technical personnel for coordination and operation purposes. Apart from that, the KCC needs adequate modern vehicles to support the current actions. Sufficient number of modern vehicles can reduce the accumulated problems and enhance solid waste management in KCC.

Conclusion

Clean and sound environment is a prerequisite for safe living. If we want to provide a livable environment for our residents, it is an urgent need to take necessary initiatives to address the issue of solid waste. A massive consciousness raising program regarding the importance of sustainable solid waste management throughout the country, especially in the Khulna city area is badly needed. Print and electronic media can play crucial role in this regard. KCC must keep a wide spreading eye to cover up the environmental losses by formulating effective plans or framework and proper implementation of it to keep the environment safe and sound

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