

SOLID WASTE MANAGEMENT SYSTEM: A CASE STUDY BASED ON SAVAR, DHAKA, BANGLADESH

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Abstract: Waste management is one of the most concerned topics nowadays. The present study aimed to understand the wastes which are generated mostly by the urban people of Savar, Dhaka. It has unveiled a very depressing scenario of Solid Waste Management in savar. In Savar, wastes are generated from multifarious sources, stored and collected in an unplanned manner, carried in the same way. The most devastating situation is that these wastes are dumped in open places without considering health, hygiene, and environmental issues. Everywhere in the waste management system and the community, proper planning and care are mostly required to reshape the waste management system. The collection, dumping, and disposal capacity of the Pourashava should be increased. Moreover, city dwellers 'awareness should be built and developed to reduce waste generation at the sources. The authority should develop a recycling mechanism to ensure the reuse of a particular thing. Finally, a two-way communication, cooperation, contribution, and partnership of both the authority and community people can ensure very delicate and proper management of waste management of Savar.

Keywords: Public health, environmental pollution, waste management, Sustainability, Dhaka city

1. INTRODUCTION

Bangladesh, a country situated in the South-East part of Asia which is ranked 8th in the world in terms of the population according to the 2011 census[1]. A country with a huge population can either lead to prosperity or a massive collapse[2]. This huge population often has a significant impact on our environment[3]. Dhaka, the capital city of Bangladesh is one of the most crowded cities on this planet[4]. Since independence, Dhaka has played a vital role in terms of giving people the opportunities to fulfill their needs. As a result, people started to move towards Dhaka and other cities as urban areas are the zone with better facilities[5]. The overgrowth of the population means more and more urban solid waste produced by them and without having proper plans to mitigate and manage those, the places become more dirty, unhygienic, and decrease the beauties. Which makes Dhaka one of the least livable cities in this

world[6]. To solve these problems regarding waste, proper solid waste disposal systems and waste management is highly required[7]. But due to many circumstances the available methods, strategies, and technologies are not enough. Without taking proper steps the condition of this city will deteriorate more rapidly and soon it will be hard for the people to live and breathe there[6]. About six thousand tons of urban solid waste is generated every day in Dhaka City and the figure is very high with the little amount of managing facilities[8]. The developed countries have applied proper waste management strategies regarding the urban solid waste for themselves, added laws and orders which are monitored and maintained properly. The reason behind their success is the efforts of the people living there and the strict laws and orders from the authorities[9].

This study intended to find out the typical waste management system of an urban local government institution named Savar Pourashava municipality. Savar municipality is equipped with the responsibility of collecting and disposing waste in an efficient way under the mandate from "The Pourashava Ordinance 1977". The municipality is also responsible for keeping the savar area clean. Savar area is a rapidly growing industrial area that is frequently producing a huge amount of waste that needs a responsible way of disposing of [10]. In savar actually, the waste management system is run by a community that puts the garbage on street but at the individual level, residents are responsible as users[11]. Savar municipality is showing massive urbanization from the beginning of the 1990s. According to the census report of (BBS 2021) population density is about 7,435 persons per square kilometer. About 51,016 kg per day is the regular waste production of savar area which makes waste management is the prime criteria for savar municipality. But the authority has a very small number of Trucks (5 trucks) and only a few amount of waste collecting vans (50 vans) which can only collect about 50% of the total waste of savar area[12].

If the people and authorities start controlling and cleaning the cities, the changes will be seen throughout the country in no time[13]. Current eras have experienced immigration of huge inhabitants from the countryside to city regions because of swift industrial

development round the world. Meanwhile Bangladesh is a emerging country, its manufacturing are developing over time. Because of this hasty industrial development, metropolitan zones are facing countless stress of enormous inhabitants who has transferred for enhanced civic facilities, career chances and upgraded quality of life[14]. Alongside with population outburst, metropolitan expansion, financial expansion and progress of people's living criteria, the magnitude of municipal solid waste has been aggregate rapidly and its configuration has become a lot of dimensional and refined[15]. Therefore, this study needs to look at the state of solid waste management during a semi urban municipal as in like Savar that is located close to Dhaka metropolitan city.

Proper waste disposal methods and waste management is one of the most important topics trending in this world [16]and researching, applying such methods and technologies in Bangladesh can make the place better. There are several objectives behind this research regarding the waste disposal. They are:

- To assess the present status of waste generation in Savar Paurashava, Dhaka.
- To identify the challenges of solid waste management system of Savar Paurashava, Dhaka.

- To get the better ideas to make a clean and waste managed Savar Paurashava, Dhaka.

2. METHODOLOGY

The Data collection area, Savar Paurashava

The survey area is mainly Savar Pourashava, which is a fast-growing town center in Savar Upazila of Dhaka district. It is positioned at about 26 km to the northwest of Dhaka city. Savar Pourashava is recognized in 1991 in the Pourashava regulation,1977. It is an A-2 class Pourashava including of 9 wards, 57 mohallas [17]. Data collected from the selected important places or areas of Savar thana. According tothe general information book o f Savar Pourashava, the total area of Savar Pourashava is 14.08 km2 and the population is 1,40,300 [17]. But the population is increased, and the present estimated population is 2, 96, 851 and the total holdings are 75, 902. The male and female ratio of Savar Pourashava is about 53.03% and 46.97% respectively (BBS, 2011). The usual growth rate of this area is about 2.2% but the total population growth rate is about 5%. According to the Census Report 2001, the population density of the Savar Pourashava is about 1, 000 per square kilometers.

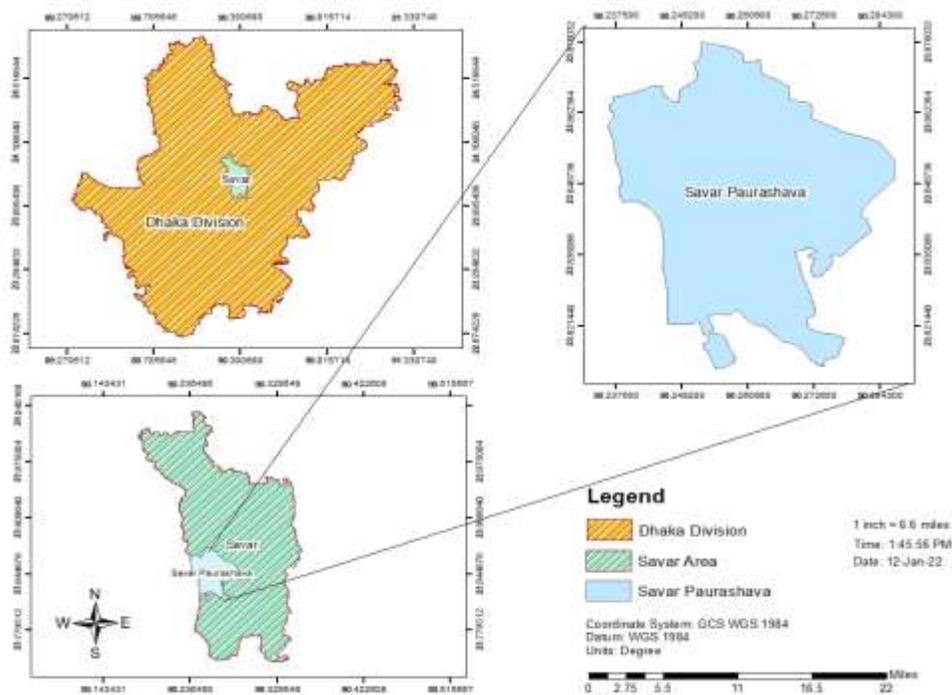


Figure 1: The Data collection area Savar Paurashava, Dhaka, Bangladesh.

Data Collection Procedures

A well-structured questionnaire was used for the survey and questionnaire survey. Digital voice recorder, camera etc. were used for data collection. It is worthy to mention that, a well-organized experience workforce helped to conduct the study.

Direct Observation

During the study two hospital, several landfills, various kitchen markets and two export processing zone (EPZ) of Savar was observed to understand the present status and situation of waste management system of those places or zones. The study tried to see the whole waste management system (from production to dumping) of those places by routing around the places.

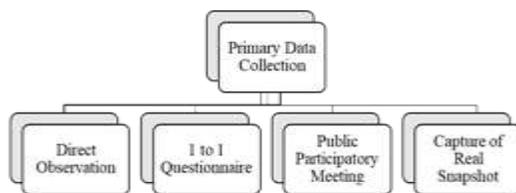


Figure 2: Data collection methods

One to one Questionnaire

The study was conducted to those places for the direct observation, The study tried to interact with the waste workers in the landfills, businessman's in the kitchen markets, officials in the EPZ's and hospitals also tried to talk with the general people of the Savar about there thinking of existing waste management system and its development.

Public Participatory Meeting

In every place, The study tried to interact with the people by forming of a team or group. Different questions were asked to them and was discussed with them on that issue and tried to explore some information and facts.

Capture of Real Snapshot

In every place, Some snapshots were captured of the waste related facts and factors.

Secondary Data Collection

Secondary data was collected by following various research articles, books, newspaper articles, reports, scientific reports etc.

Sample Size for Questionnaire

Absolute taster dimensions is 40 (forty) counting both the specialist organizations (Savar Pourashava) and

Table 1: Educational Qualification of the Respondents

Name Degree	Number	Percentage
Below S.S.C.	2	5%
S.S.C.	6	15%
H.S.C.	3	7.5%
B.A.	10	25%
B.S.C.	1	2.5%
B.A.M.A.	6	15%
M.A.	5	12.5%
M.Com	3	7.5%
M.S.C.	1	2.5%
Dip. Eng.	2	5%
B.S.C. Eng.	1	2.5%

administration beneficiaries (residents' of the Pourashava). Out of 40 respondents, 30 are chosen together with both male and female from the concern side (administration beneficiaries) to thinking about the problems. In the inspecting technique basic comfort examining strategy is followed. Then again, 10 respondents are measured including administrators and chose authorities of the Pourashava from the gracefully side as indicated by their jobs and obligations of the SWM arrangement of Savar.

Statistical Analysis

During the research work, some statistical software (SPSS, MS Excel) was used to do the various statistical analysis[18], mapping software (Google Earth Pro, ArcGIS10.4) also used for area mapping.

3. RESULT AND DISCUSSION

Representation of Study Findings

Information are gathered from 30 family units and 10 representatives and authorities (both chosen and delegated) of Savar Pourashava. From the information, answer to the exploration questions are inspected and broke down in this manner. Certain boundaries are utilized for every marker. These boundaries mirror the current and anticipated circumstance of strong waste administration of the chose territory by the respondents from the two sides.

Informations of the Respondents

The all out respondents are 40 (Male 33, Female 7) from the two sides. The accompanying figures and tables are demonstrated the absolute respondent's fundamental highlights.

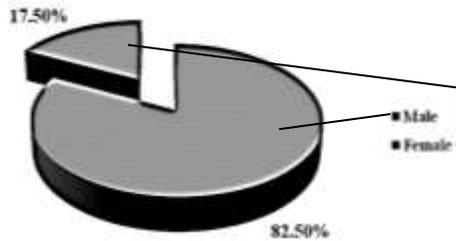


Figure 3: Male-Female Ratio of the Respondents.

Table 2: Occupation of the Respondents

Occupation	Number	Percentage
Housewife	4	10%
Business	6	15%
Private Service	12	30%
Teacher	3	7.5%
Govt. Service	9	22.5%
Rtd.	3	7.5%
Others	3	7.5%

Table 3: Age of the Respondents

Age Limit	Number	Percentage
30 and Below	1	2.5%
31-40	13	32.5%
41-50	15	37.5%
51-60	8	20%
61>	3	7.5%

Respondent’s knowledge on legal frameworks

The figure shows that only 20 percentage of the respondents have usually excellent thought regarding lawful systems of SWM. Around 27 percent have reasonable and the huge number 40 percent individuals have next to no thought regarding strong waste administration related legitimate and strategy system created and rehearsed by the legislature.

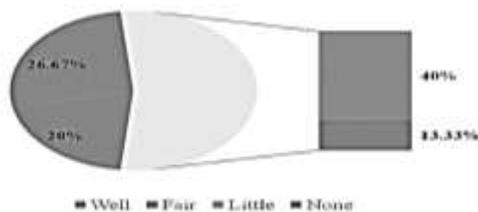


Figure 4: Knowledge about Legal Framework of SWM.

The chart shows that 40 percent of the complete

respondents think about the system though the rest 60 percent don’t have a lot of thought regarding the national 3R methodology.

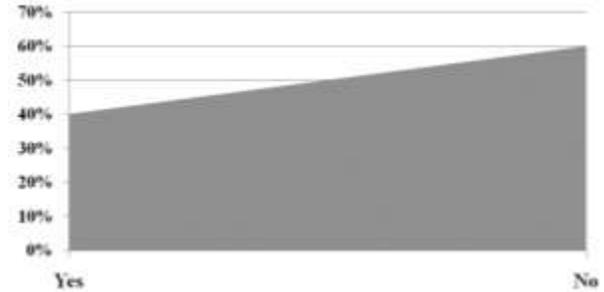


Figure 5: Knowledge about 3Rs Strategy.

From among the 40 percent of the individuals who think about the methodology, they have the accompanying degree of thought regarding the procedure:

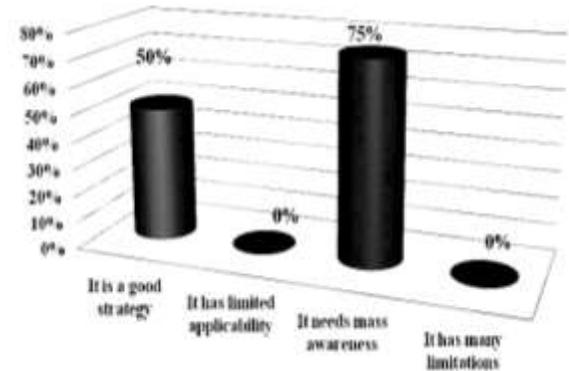


Figure 6: Observation about 3Rs Strategy.

Respondent’s opinion on financing in SWM

It is discovered that the majority of the respondents know that it needs a gigantic measure of budgetary assets to deal with the metropolitan strong waste appropriately. The accompanying figure:

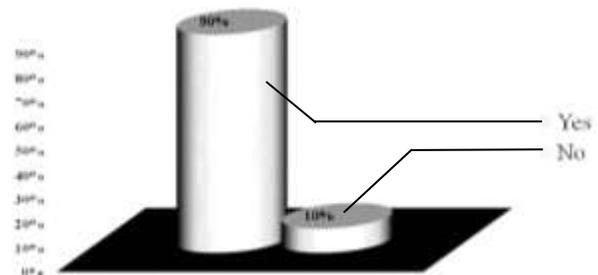


Figure 7: Need of Financial Resources for SWM.

The figure shows that around 90 percent of the respondents know about the association of money related assets in SWM. Of them 63 percent imagine that legislature ought to mastermind more awards from benefactors and improvement accomplices for

overseeing strong waste. Nonetheless, 57 percent of the respondents imagine that normal assortment expense can be another alternative for orchestrating fund for SWM. Thus a decent number of respondents have decided on organizing open private organization to mastermind account for strong waste administration in their zones. This is appeared in the accompanying figure:

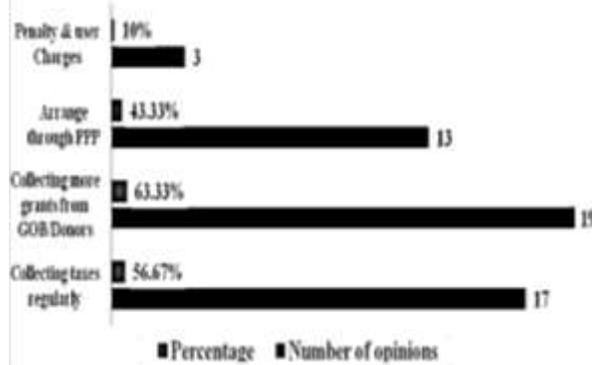


Figure 8: Financial Resources Arrangement Options.

Respondents opinion on transparency and accountability

The respondents are approached to offer their input as respects to the straightforwardness and responsibility of the district expert in asset usage. Since legitimate use of money related and different assets can assume a significant job in overseeing strong waste, individuals' reserve the option to think about the component of asset use. The accompanying figure shows their supposition:



Figure 9: Transparency and Accountability of Resource Utilization.

The above pie diagram shows that 70% of the complete respondents imagine that straightforwardness and responsibility are not guaranteed in using assets for Strong Waste Administration. In such manner respondents believed that the particular portions of the financial plan for SWM are not confirmed and straightforward. Additionally, the capable people for using the allotted spending plan are not open to the residents'. Along these lines great administration somewhat isn't existent the overseeing waste in Savar.

Respondent's opinion on the working efficiency of SWM department of Savar

The above visual chart shows that individuals have a

discouraging thought regarding the proficiency of waste office. The greater part of the respondents believe that the waste administration office is poor in playing out their undertakings appropriately. Indeed, even 30% imagines that the concerned office is exceptionally terrible in their working productivity. As indicated by their conclusion, strong waste administration office isn't at all proficient in the executives of SWM in their general vicinity.

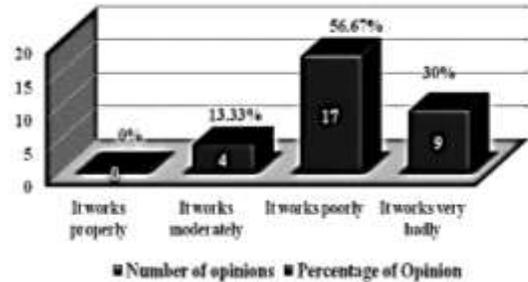


Figure 10: Working Efficiency of SWM Department of Savar Pourashava.

As indicated by their assessment, 80 percent believe that the quantity of worker is lacking to play out the tremendous assignment of strong waste administration productively. Just 20 percent imagine that there are satisfactory quantities of worker connected with for SWM in their territories.

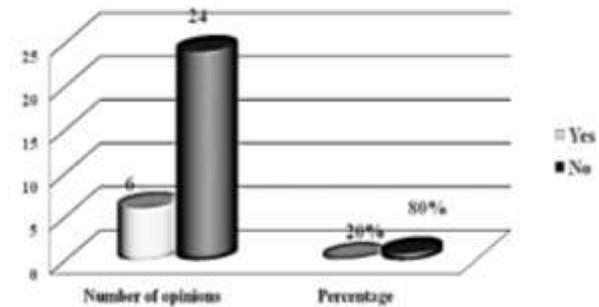


Figure 11: Adequacy of Employee for SWM.

Respondent's opinion on the frequency of waste collection service

The above chart shows that in Savar, by and large assortment isn't made as often as possible by the. Just 20 percent of the assortment happens threefold every week. The situation is very discouraging where in 76 percent cases no assortment is done by any means. Subsequently it makes risks on situations and human wellbeing.

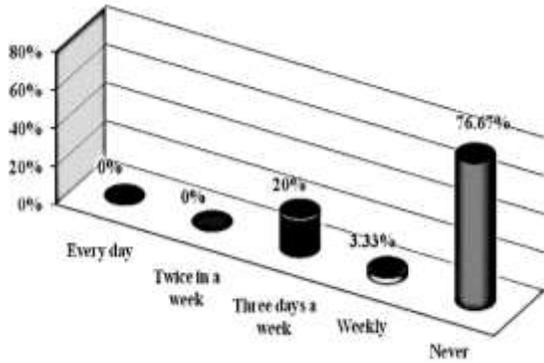


Figure 12: Frequency of SW Collection Service.

The accompanying figure shows that in Savar as a rule (20%) assortment is produced using side of the road containers and in different cases (80%) no assortment is truly made. In this manner squanders are dumped to a great extent and not gathered. Regularly this makes enormous natural perils and effect on human wellbeing.

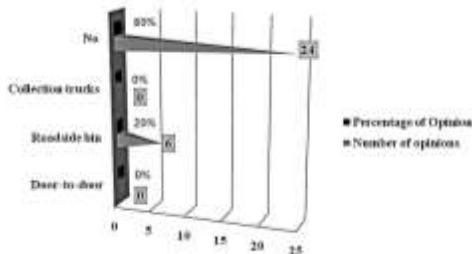


Figure 13: Type of Solid Waste Collection Service.

Respondents of the examination region feel that squander transportation exercises of Savar are not proficient. More than to 96 percent of the respondents think, district authority isn't proficient in gathering and moving squanders from entryway to entryway or family unit dumps. Indeed, even while they are shipping, they leave waste to a great extent in transit and utilize revealed van leaving terrible scent around the landfill.

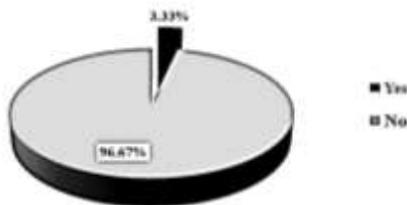


Figure 14: Solid Waste Transportation Efficiency.

The above figure shows that no isolation practice at the wellspring of waste age is finished by the residents' in the investigation zone. It appears that family unit squanders are assembled and dumped or gathered similarly. Individuals are not as yet mindful of that

and because of the explanation SW arranged unhygienically in the dumping zone or removal region.

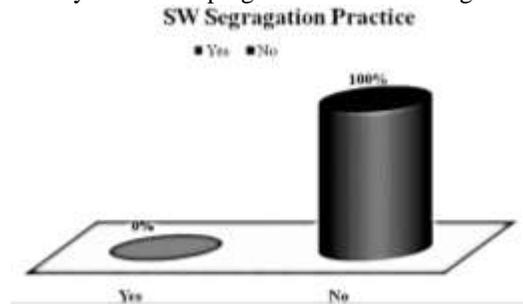


Figure 15: Solid Waste Segregation Practice by the Citizens.

Status of Solid Waste Management in Savar

According to 2011 census Savar Upazila consist of 13, 87, 426 people. According to Bangladesh Waste Database 2014, every person of Dhaka city produces 0.56 kg/day. By following that stats, we can estimate the waste generation of Savar Upazila,

Table 4: Generation of waste by year following the population growth.

Year	Population × Waste kg/day	Generation of Waste
2011	13, 87, 426 people × 0.50 kg/day	6, 93, 713 kg/day
2014	16, 00, 000 people × 0.56 kg/day	8, 96, 000 kg/day
2018	20, 00, 000 people × 0.64 kg/day	12, 80, 000 kg/day

The Savar Municipal Authority and Dhamrai Pourashava is the only two organization in the whole Savar, that are responsible for the management of solid waste in Savar. Savar municipal authority and Dhamrai Pourashava both has a small number of trucks and waste collecting vans for collecting less than 60% wastes, that are generated in the whole Savar[10].

Here we will try to discuss every element of the solid waste management cycle based on the present status and situation of the solid waste management system of Savar (survey area).

Solid Waste Generation

In the whole Savar, we generally identify four types of wastes that are mainly generated. These four types

1. Biodegradable waste
2. Plastic and polythene waste
3. Glass and ceramics
4. Metals

of wastes are:

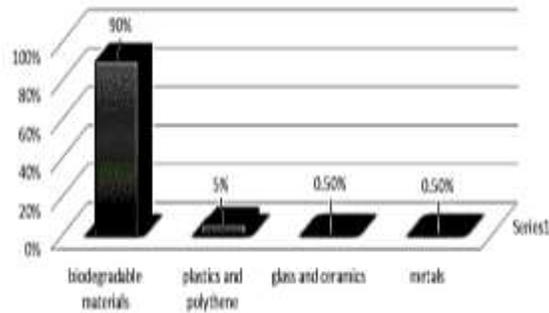


Figure 16: Percentage of various wastes that are generated in the Savar.

Solid Waste Handling and Storage

As the study mentioned, there are only two local government authority that are responsible for the solid waste management of Savar. Among the two, one is the municipal authority of Savar and another is the Dhamrai pourashava. But they are not that much equipped to handle the solid waste of the whole Savar. Also, lack of experts in that department of responsible authority is a reason of deficient solid waste management of Savar. In the whole Savar region the study didn't find any waste bin in the roads or roadside, public places and kitchen markets. Due to that, people left their waste here and there. The following places were identified, where people often dumped their waste without any cover or precautions-

1. Roadside
2. Water body
3. Under the bridge
4. Drains

In the area of Genda, Ulail Bazar, Bank Town, Savar Bus Stand and Savar Bazar, people mainly left their waste at the roadside of Dhaka-Aricha highway. In the Ashulia and Baipail area people left their waste in the roadside, as well as in the water bodies and under the bridge of Baipail Paikari Bazar.

During the study whole Savar region was divided into three main region and tried to identify the sites where people often left their wastes. In these three regions 13 waste disposal sites was identified. One main landfill (Amin Bazar) was also identified that is using for the dumping and disposal of the wastes that are generated from the Dhaka city. Any waste of Savar didn't dumped in that landfill of Amin Bazar.

The dumping sites of Savar Pourashava is mainly used by the Savar Municipality. The waste collection trucks of the municipality take the wastes from the roadside and any other open places and dump it to the

dumping sites of the Savar Pourashava. But, one big issue is that the sites are situated at riverbank of Dhalewshari river. So, the dumping of wastes on those places pollute the river and its surrounding environment.

So, in whole Savar there were no specific place or site from the responsible authorities for the storage of waste properly.



Figure 17: Waste-Dumping Station of Savar Pourashava

Solid Waste Collection and Transport

In Savar, waste collection is not made frequently. By the opinion of the respondents, 20% of wastes are collected twice or thrice in a week, mainly from the roadsides by the trucks of Municipal authorities[13]. Then the wastes are dumped into the river bank of the Dhalewshari. On the other hand, another 80% of wastes is not collected at all due to the unsuitable solid waste management system. In the circumstances, wastes are dumped or left here and there and not collected[19]. This problem often creates a huge environmental hazard and make a negative impact on the human health[20] of the whole Savar. The two responsible authorities of Savar is not efficient enough for waste transportation activities[11]. While the responsible authorities transporting the wastes, they

leave the wastes here and there on the way. The wastes are also transporting without any cover in almost every case, that uncovered truck of waste leaving the bad odor around the surrounding environment. Inadequate number of vehicles is the reason for improper waste collection and transport system[12]. Among the existing waste collection trucks, many of them are very old and outdated. Lack of monitoring and proper supervision is another reason for the inefficiency to the proper solid waste management system[21]. The supply of waste collection trucks and modern waste recycling vehicles may be able to solve this problem and improve the solid waste management system of the Savar as well[22]. Even some roadsides waste does not collect ever by the responsible authorities. Door to door waste collection process is only exist for the collection medical waste.

Major Challenges for Solid Waste Management System of Savar

Due to the present situation of Savar, some challenges are arisen that are responsible for many negative consequences. Such as,

1. Open dumping in roadside causes air pollution.
2. Dumping in water bodies causes water pollution.
3. Dumping in here and there also causes soil pollution.
4. There is a high possibility of health hazard due to that kind of pollution.
5. That kind of inappropriate solid waste management system contribute to the global climate change in a small scale.
6. Lacking skilled workforce in the solid waste management system.
7. Political interference is also a major constraint for a good solid waste management system in Savar.

4. CONCLUSION

Solid Waste Administration is a developing worry for all round the globe. In Bangladesh, this issue is as often as possible talked about and considered significant from hierarchical viewpoints. The exhibition of a specific association relies to a great extent upon the administrations it offers to the network. Both urban and neighborhood government associations in Bangladesh are totally liable for overseeing open administrations and waste administration is one of them. The executives of strong waste to a great extent relies upon a few intra and between hierarchical components. These elements play individual just as aggregate jobs in the administration framework. This examination investigated that Savar has its own hierar-

chical example, the board approach and practical gatherings to achieve the gigantic undertaking of waste administration. Regularly these players neglect to facilitate among themselves and neglect to offer essential types of assistance. Government has given solid legitimate premise to fortifying the guidelines and guideline to the specialist organizations just as to the administration beneficiaries. The administration Savar renders doesn't mirror the desire for network individuals because of insufficient human, money related and specialized and mechanical assets and supports. When the territory gets underpins as respects to the assets, some impermanent changes happen. This examination thusly centered around the food of waste administration benefits and chalked out for possible other options. These alternatives allude to the network individuals who are key elements for overseeing strong squanders appropriately. They can guarantee decrease of waste age, detachment and capacity instrument. In this manner these activities require solid coordination in the network. A possible component to quicken economical strong waste administration is the incorporation of both the intra and between hierarchical variables and their reasonable exhibitions. Government ought to create component for standard observing and oversight while nearby government authority should actualize government rules and guideline appropriately.

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