The Annual Report

On

The Economics of Solid Waste Management: A Study on Sylhet City Corporation

Under the project –

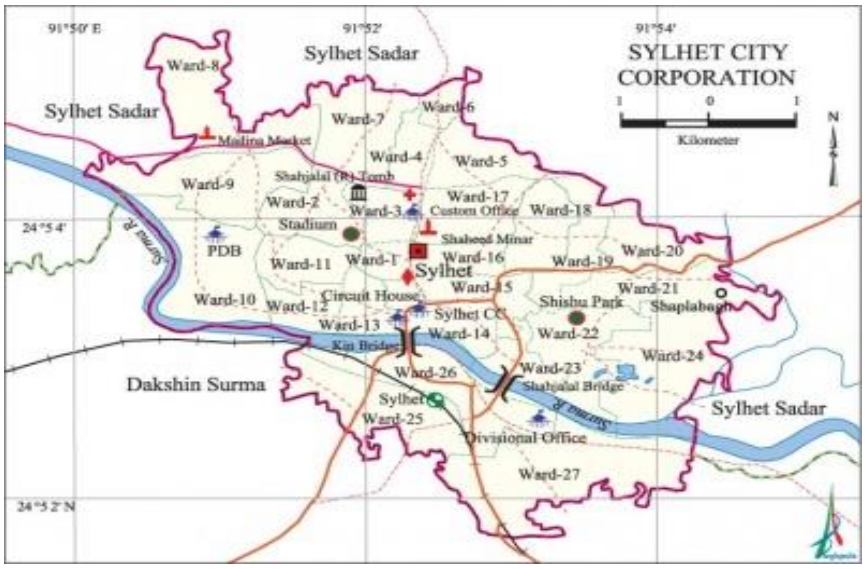
The Economics of Solid Waste Management and Drainage: Sustainable Approach of Making South Asian Cities Climate Resilient

1.1 Introduction

Cities in low-income countries are facing increasing threats of waterlogging and water contamination from improperly managed solid waste. Increased urban growth of population, climate change and indiscriminate dumping of untreated solid waste are among the several factors responsible for increasing threats of waterlogging and water contamination. Among the possible solutions - development or creation of market for recycling; creating conditions for reusing of waste; developing strategies for reducing the volume of waste and finally; proper disposal of solid wastes etc. need consideration. Urban dwellers are needed to be involved to find a strategy to improve their current behavior of solid waste disposal in terms of reduction and disposal of household wastes.

Sylhet is one of the most important cities for both trade and business in the economy of Bangladesh after the capital Dhaka and port city Chittagong. It is also a well-known tourist destination, with soothing greeneries and holy burial sites of Muslim saints and is surrounded by tea states and rain forest.

Figure 1: Geographical location of Sylhet City Corporation (With Wards)



Sylhet City Corporation is located at the bank of "Surma River" where annual rain fall is 3334 mm. Approximately 500000 residents are now living in the city. Sylhet municipal was established in 1867 and in 2001 it developed into City Corporation from municipality. It consists of 27 wards with total area of 26.50 km2. The City Corporation is responsible for the services that are provided within the city including collecting and managing waste. As Sylhet is not an industrialized city, the solid wastes are mostly domestic, commercial and clinical type.

Against this background, the first phase of the study focused on two major goals of the project. A household survey (baseline) of solid waste management in Sylhet City Corporation was planned on the residents of the Ward 1, 11, 18 and 22 which includes a total of 723 households and is summarized in the first part of the following section. And a survey on market chain and value chain of recyclable products to investigate the recycling market of solid wastes is presented in the later part of the section.

1.2 Highlights

1.2.1 The Household Survey on solid waste management in Sylhet City Corporation

This section presents the summary findings of the socioeconomic survey on solid waste management in Sylhet City Corporation. The study examines the types and methods of solid waste generation and their disposing; possibility of segregation; level of awareness and knowledge of solid waste disposal and management; causes, problems and solution of illegal disposal; the gender perspective of household waste management, the willingness of households to pay for solid waste management in the study area.

The Sampling Plan

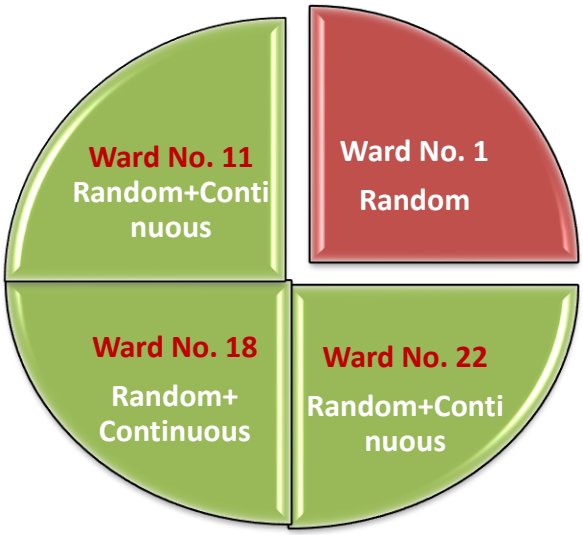
According to the project plan, to conduct controlled trials randomized at the neighborhood level, 4 Wards (listed above) were selected to survey after consulting with the Mayor, CEO and Chief Executive Engineer of Sylhet City Corporation (SCC). The ward numbers are - 1, 11, 18 and 22 among which Ward number 1 was the control ward. From the list of clubs of the selected wards, one club from each ward (11, 18, and 22) was randomly selected. The names of the clubs are Kolokakoli Club (Ward no. 11), Jhorna Torun Songho (Ward no. 18) and F-Block Unnaya Songstha (Ward no. 22). 100 data were randomly collected from the control ward while both random and continuous data were collected from the treatment Wards.

Data collection method

Enumerators were engaged in the survey since September 22 to 27, 2017. A total of 723 households provided responses to the elaborate questionnaire which consists of detail question on solid waste management and segregation, willingness to pay, perception and household and individual specific questions. The questionnaires were administered using 15 field enumerators, who were trained on collection of data using mobile devices. For continuous sampling, enumerators went to first 100 households under the randomly selected club. On an average a club consists of 100 to 130 households. For random sampling, Rosters were maintained among the enumerators and they went to the selected wards and used systematic random sampling framework to select the household for the

random survey. Every tenth houses in a locality on one side of the road was selected for the survey. In some cases, more than one households bearing same house number were surveyed and therefore 723 households were surveyed in total.

Figure 2: The Sample Plan



Descriptive statistics is presented to identify the types of waste generated, the methods of disposing solid waste in SCC, awareness and willingness of households' to pay for solid waste disposal and relation to waste management behavior with major socioeconomic indicators.

Profile of the sample households

Table 1, 2 and figure 3, 4, 5 present household and individual specific characteristic of the sample households.

Table 1: Household and individual specific characteristics of the respondents

Variable	Random sample	Continuous sample	Unit
Male headed Household	89	90	Percent
Age of HHH	51.54	50.87	Years
Establishment of HH	1.49	1.45	Years
House owner	52	54	Percent
Household size	6	6	Number
Number of male per HH	2.87	2.89	Number
Number of female per HH	3.04	3.08	Number
Number of male income earner	92.65	91.45	Percent
Number of female income earner	14.93	13.49	Percent
Monthly expenditure of HH	34753	29642	BDT

Average monthly rent per HH	10304	8772	BDT

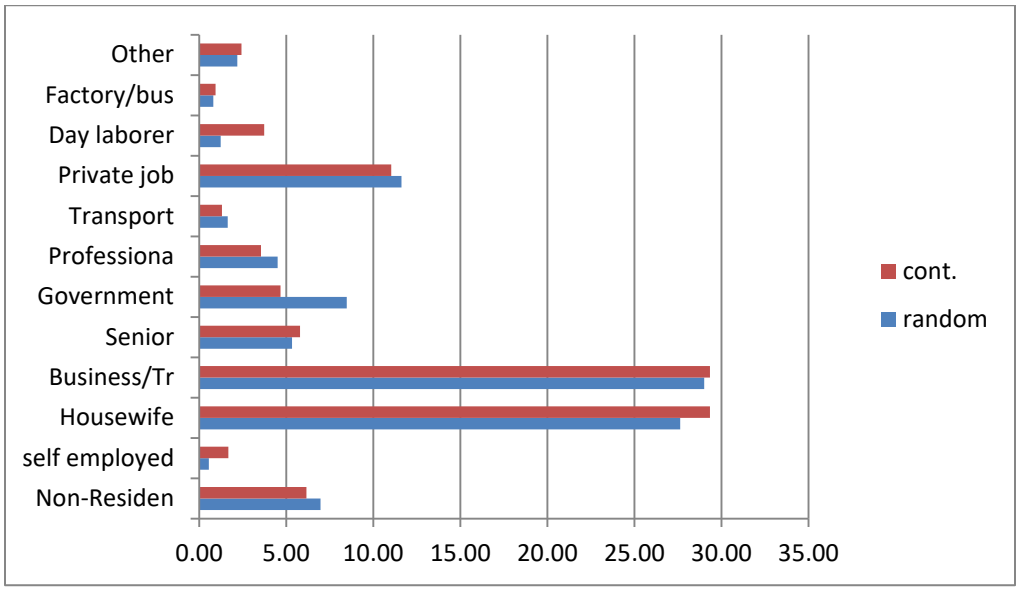
Table 1 shows that only 11 percent and 10 percent of the households are headed by a female in random and continues sample respectively while no female income earner exists in around 84% of the families in the survey. Average monthly expenditure for the households in random sample is 34753 taka and 29642 taka in continuous sample. Average monthly rent is around 10304 taka and 8772 taka respectively for the sample types shown in Table 1.

Table 2: Income distribution of household members by sample type

Family income/earning (monthly)	Random	Continuous
Less than 5000	0.24	0
5001 - 10000	1.43	5.61
10001-20000	11.67	15.18
20001-40000	38.33	40.59
40001-50000	25.95	19.8
50001-100000	18.33	15.84
100001 and above	4.05	2.97
Total	100	100
n	420	303

Average monthly income is about 20,000 taka to 50,000 taka for near about 64% of the randomly selected households while around 60% for the continuous sample (Table 2).

Figure 3: Occupational distribution of household members by sample type



In terms of the occupation of the members of the household, majority is engaged in business and trade and housewives irrespective of the sample type presented in figure 3.

Figure 4 Highest educational distribution of adult male and female members

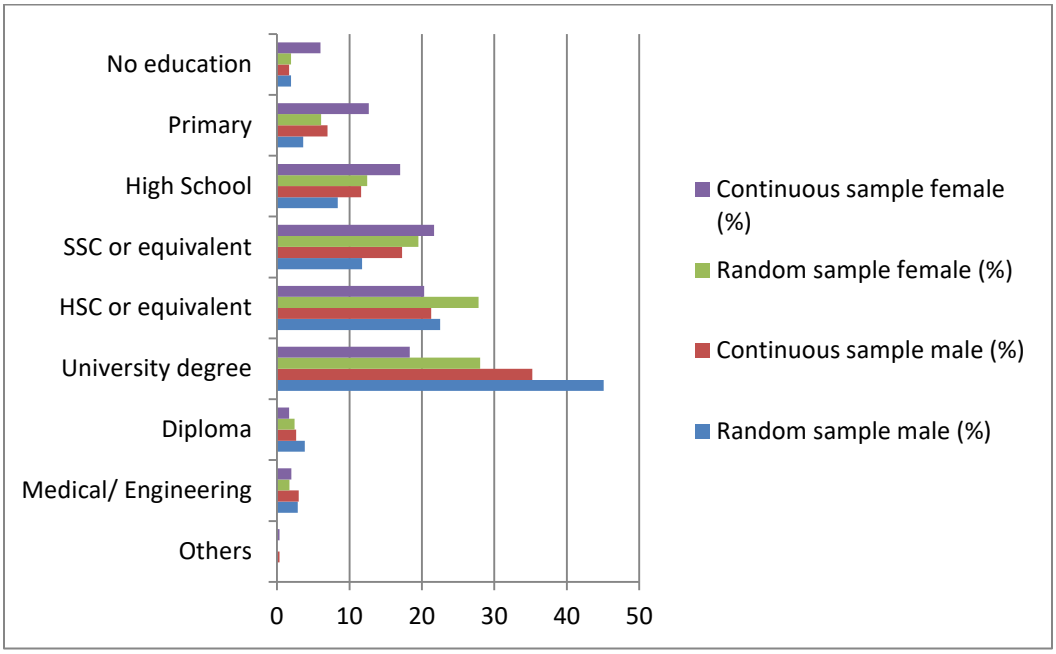
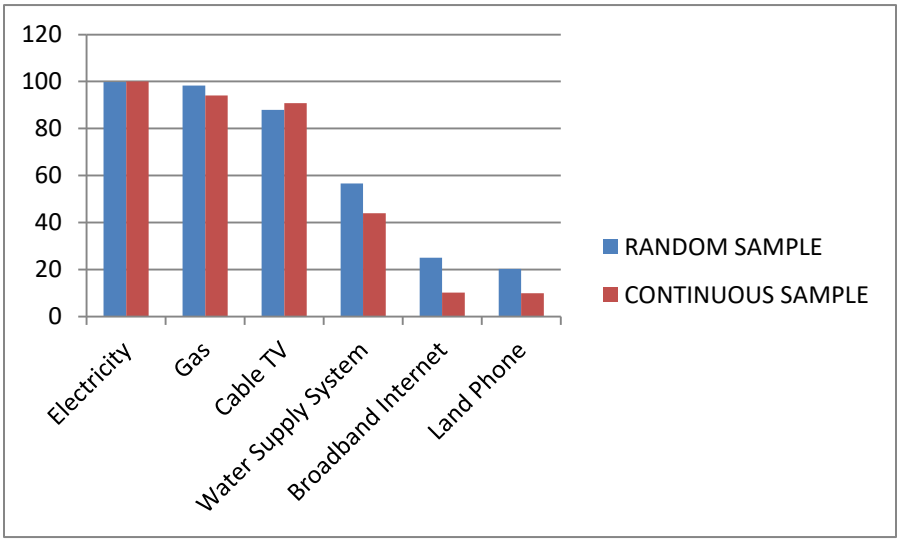


Figure 4 shows educational qualification of adult (above 18 years) members of the households. Male members mostly have HSC or university level degree while majority of female passed SSC or HSC level education. Nonetheless, a good proportion of female also have university level degree.

Figure 5: Amenities connected to the household



Survey results also shows that 100 percent of the houses are connected to electric supply from the government in both random and continuous sample. Among them, 98 percent of

the houses are connected to piped gas supply in random sample while 94 percent of households in continuous sample. Access to land phone is quite low in all cases. Access to water supply system is also much lower for houses in continuous sample compared others (Figure 5). Access to broadband internet is very low in these houses.

Solid Waste Management in Sylhet

Like many other cities in Bangladesh, households pay directly to the garbage collector for their service to collect daily garbage from their doors to a secondary collection point. From the secondary collection points, SCC uses their dump trucks to transport them to the city dumpsites which are located outside the city. Total collection mechanism is illustrated in the following schematic diagram.

Figure 6: Garbage Management System in Sylhet

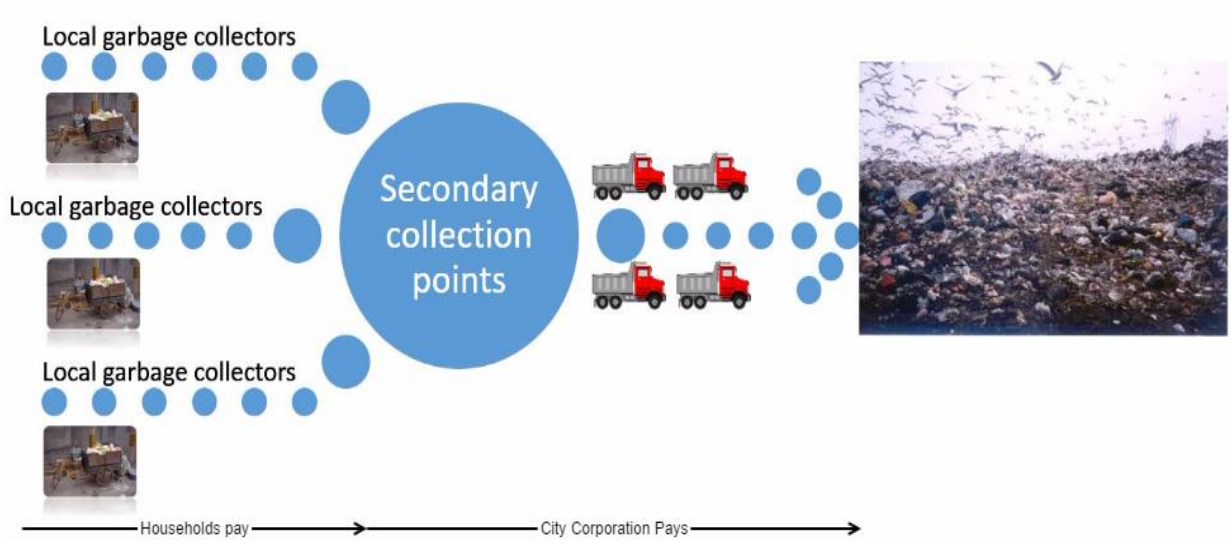


Figure 6 illustrates the process through which household garbage ultimately reach its final destination, the garbage site. However, at each stage there are leakages because of which a large portion of the city solid waste ends up in the city drains causing water-logging during heavy rainfalls. In order to understand how the city dwellers understand this and how they manage the waste within the household, the survey questionnaire had detailed questions on garbage and its disposal process. The result is summarized below.

Table 4 shows the possible segregation of the types of solid waste by the respondents. Randomly selected households are more responsive to segregate different types of wastes in general. Sweeping waste, sanitary and medical waste and glasses are lowest possible to segregate according to the respondents.

Table 4: Possible Segregation by the HH

	RANDOM (%)	CONTINUOUS (%)
None	2.38	6.27
Dry waste of sweeping	25.48	17.82
Sanitary and medical	45.00	39.60
Glasses/Bulb	45.48	42.57
Metal	64.52	62.05
Bottle	79.52	78.88
Organic or food waste	87.38	82.51
Paper	87.38	84.16
Plastic	89.29	87.46

Disposal of solid wastes

Error! Reference source not found. summarizes the garbage disposal behavior of the city dwellers. It shows that about 89% of the randomly selected respondents give their daily regular waste to the local garbage collector which is 84% for continuous sample., about 48% sell part of their garbage, 11% and 14% (in random and continuous sample respectively) throw some of their garbage. Composting and burning as a dumping method is only around 8% and 3% respectively in both sample type.

Table 5: Pattern of Disposal System of Daily Garbage

Disposal System of Daily Garbage	RANDOM SAMPLING	CONTINUOUS SAMPLING
Give to garbage collectors	**89.29**	**84.16**
Sell aluminum/iron/glass/bottle	**47.86**	**47.52**
Throw Away	**10.71**	**13.53**
Compost it in my compound	**8.33**	**7.92**
Burn	**3.10**	**2.64**
Donate to someone	**0.95**	**0.33**
Others	**0.48**	**0.33**

In Sylhet as well as in many parts of Bangladesh market for certain wastes exist. This is true for plastics, bottles, and metals. Therefore, there is likelihood that households might sell some of their solid wastes that have a ready-made market.

Table 6: Monthly income and expenditure related to solid waste at the household

	RANDOM SAMPLING		CONTINUOUS SAMPLING	
	Mean	SD	Mean	SD
Average monthly payment to garbage collector	64.73	41.10	56.71	41.09
Income from selling paper, metals etc.				
Paper	35.99	33.49	29.21	24.40
Metal and others	37.15	46.30	30.84	29.09

Table 5 shows that almost half of the households sell part of their solid wastes on a regular monthly basis. It is presented in Table 6 that selling paper they earn nearly 36 taka and 29 taka per month while from selling metal and others they receive 37 taka and 31 taka by sample type. At the same time, they pay to the collectors for the rest of their solid wastes so that they can dispose it to the municipality bins. It shows that average payment per month for 90% of the households is about 65 taka per household for random sampling and 57 taka for 84% of the households of continuous sampling.

Behavioral solutions

Of the behavioral solutions, the survey also asked questions on segregating wastes. One of the solutions to reduce garbage load at the dumpsite and to ensure maximum recycle and reuse of garbage is to segregate them at source. This has been always a challenge for municipalities across the world. Therefore, the study wanted to find out a general acceptability of segregating at source strategy. Table 7 shows behavior of waste segregation by economic status. Willingness of the households to segregate at home does not vary much by sampling types while households practicing segregation change pattern by income level.

Table 7: Relationship between income and segregation

Family income/earning (monthly)	RANDOM SAMPLING		CONTINUOUS SAMPLING	
	Practicing segregation at home (%)	Willing to segregate at home (%)	Practicing segregation at home (%)	Willing to segregate at home (%)
Less than 10000	16.66	66.66	35.29	76.47
10001-20000	18.36	75.51	36.95	73.91
20001-40000	27.32	86.95	29.26	86.17
40001-50000	38.53	90.82	36.66	81.66
50001-100000	25.00	89.61	35.41	89.58
100001 and above	23.52	76.47	55.55	77.77

In particular, households in low income group (up to 20000 taka) and higher income group (above 50000 taka) in continuous sample practice segregation at home more than households of same income groups in random sample. While practicing behavior of middle income group households (20000 to 50000 taka) does not vary by sample type. However, with higher level of education of male member of the household, both practicing behavior and willingness to segregate increase in general irrespective of sample type.

Table 10: Practicing segregation and willing to segregate by education of adult male

	RANDOM SAMPLING		CONTINUOUS SAMPLING	
Highest educational attainment of male members (18+ years)	**Practicing Segregation (%)**	**Willing to Segregate (%)**	**Practicing Segregation (%)**	**Willing to Segregate (%)**
No education	00.00	75.00	20.00	40.00
Primary	20.00	86.66	42.85	80.95
High School	22.85	74.28	34.28	77.14
SSC or equivalent	32.65	85.71	28.84	82.69
HSC or equivalent	27.95	86.17	28.12	81.25
University degree	29.25	87.23	37.73	88.67
Diploma	25.00	100.00	25.00	75.00
Medical / Engineering	58.33	100.00	55.55	88.88

Gender perspective of waste segregation

It is expected that female are involved with waste management and segregation by tradition. Besides, a good proportion of female in our sample are housewives. Table 11 shows the role of male and female within the household in managing waste, throwing waste, managing compost and segregating waste. All through the sample female are more involved with all types of garbage management than other members.

Table 11: Gender role in household waste management

	Waste manage		Throws waste		Compost manage		Segregation	
	Random	**Cont.**	**Random**	**Cont.**	**Random**	**Cont.**	**Random**	**Cont.**
Female member	44.76	48.18	53.81	64.36	68.57	75	63.03	76.47
Maid	46.19	37.95	51.9	40.59	42.86	37.5	58.82	40.20
Male member	28.33	32.67	33.57	32.67	37.14	54.17	39.50	30.39
Boy/ Security	1.67	0.33	5.24	2.97	2.86	0	8.40	2.94
Every member	17.14	13.2	-	-	--	-		

Awareness about 'at home' segregation

In most of the developed countries households segregate their garbage at home. This reduces the cost of transportation of garbage to dumpsites, reduces health hazards of rat pickers because garbage is not mixed up with organic wastes, and also improve recycling of many wastes. **Error! Reference source not found.**12 shows that nearly 53% and 57% of the households are aware of segregation, among which 28% and 34% are practicing segregation at home by sample type while more than 80% are willing to segregate waste at home.

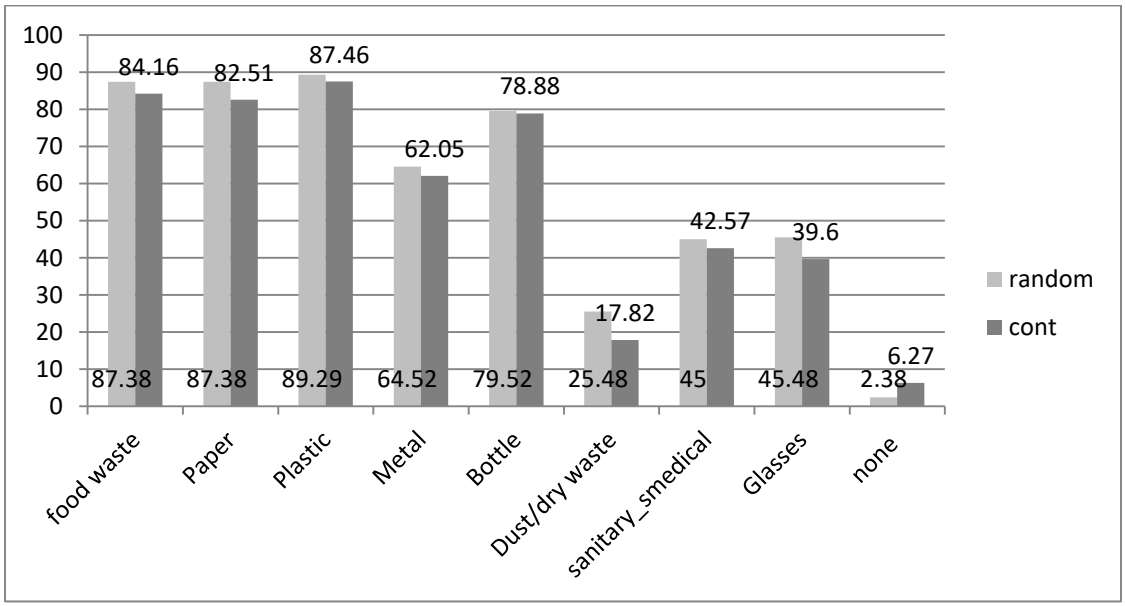
Table 12: Aware, practice and willing to segregate waste at home

	Aware of Segregation	Practice Segregation	Willing to segregate
Random	53.33	28.4	86.43
Continuous	56.77	33.99	83.17

Types of 'at source' segregation of garbage

Error! Reference source not found. shows acceptance of segregation at source is quite high in Sylhet. Nearly 87% in random sample and 84% in continuous sample would agree to segregate organic/food wastes and almost similar proportion of households agree to separate papers and plastic. Nearly 80% agree to separate bottle. Relatively lower proportion of households are agree to segregate dry waste and medical and sanitary waste and glass.

Figure 7: Possible segregation at home



Willingness to pay for a cleaner city

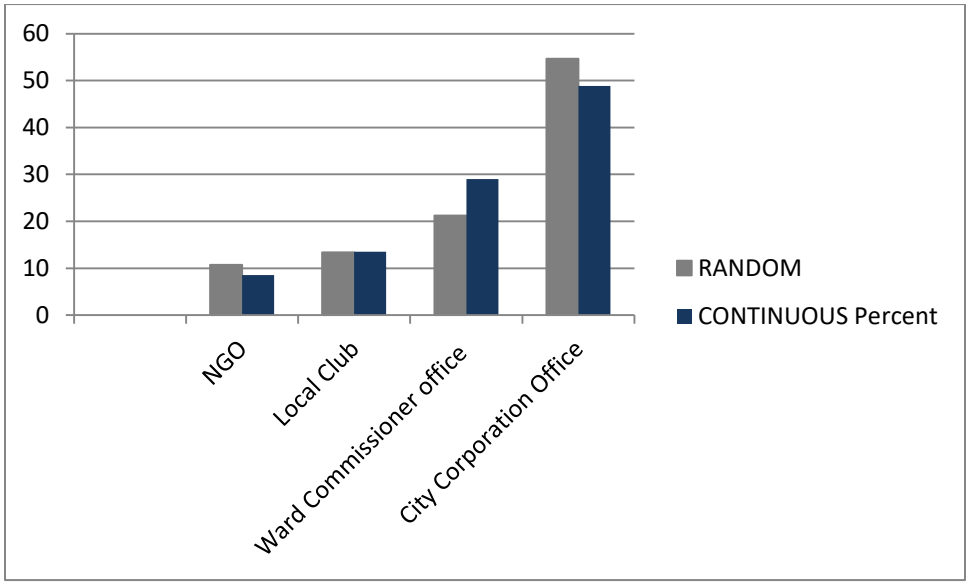
On the question related to willing to pay, households in both type of sample are willing to pay on an average of 190 taka to 195 taka. When asked about the reason for their willingness to pay (a higher amount), the prime reason the households responded is to have 'Clean Sylhet' (Table 13). Besides, removing water logging and efficiently managing garbage are also reasons to pay higher amount to waste management purpose.

Table 13: Reasons for willingness to pay

	RANDOM	CONTINUOUS
It is cheaper to do this	23.18	25.95
It is an efficient way to manage garbage	45.00	48.73
Sylhet city will be true model city	52.73	58.23
Will remove water logging	72.27	71.52
Will clean up the city	96.82	95.57
Total	290.00	300.00

Households in general responded City Corporation as the best waste management option. People prefer Government officials rather than private organization to manage waste which is reflected from figure 7.

Figure 7: Best option for solid waste management



Green household indicators

Two third of the roads in Sylhet city are reported clean while plantation is not very common in the households. In the random sample 38% households have green in their

compound which is 26% for continuous sample while only 25% to 30% households are decorated with plants and flowers shown in table 14.

Table 14: Indicators for green household

Indicators for Green Household	RANDOM	CONTINUOUS
Road clean	75.95	72.94
Compound green	38.33	26.40
House decorated with plants (inside or around)	30.24	26.07
Flowers/trees/plants of the House are visible from outside	27.14	24.75

Conclusion

Results from the socio-economic survey on the 4 wards in Sylhet City Corporation shows that the citizens are willing to segregate at home to reduce waste load into the dumpsites. Role of women is important in waste management, segregation and composting as mostly women participate in these activities. Citizens are willing to pay more to ensure that garbage is managed efficiently and the city is clean.

Under the circumstances, Sylhet City Corporation should consider composter using modern techniques. Therefore, possibility of piloting segregation in some selected areas as a test case to measure their effectiveness and to develop a most efficient model for segregation, composting and disposal of household garbage is crucial.

1.2.2 Market chain and value chain to investigate the market for recyclable product of solid wastes

Research design and Data Collection

This study mainly focused on the present status of recyclable waste in Sylhet city. Both qualitative and quantities data is collected through field observation, FGD with stakeholders and market survey. Secondary information has been collected from various researches, Journal, Articles. Information includes amount of inorganic waste, market and value chain, transportation system, storage system, stock duration. Primarily the study identifies the recycle product market in Sylhet City Corporation.

Objective of this study

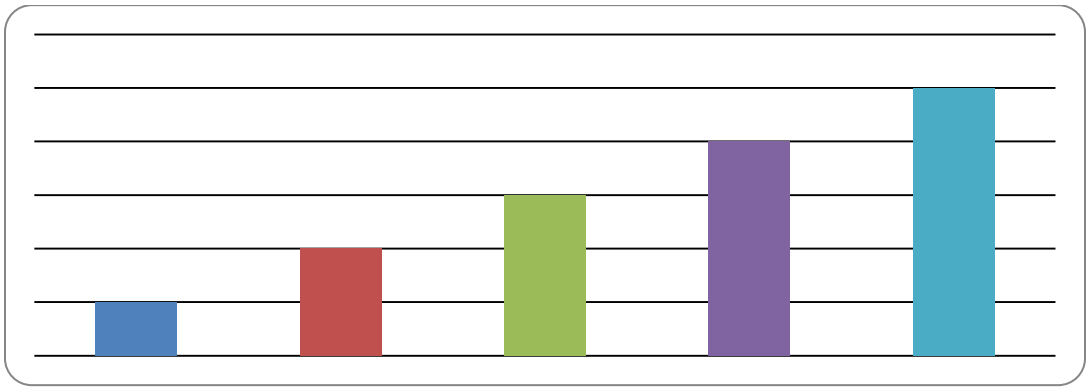
The primary objective of this research is to develop solid waste management and recycling process on Sylhet City Corporation, through this study we are going to comprehend;

1. To identify the source and market of recyclable products
2. To investigate the stake holders, market chain and value chain of recyclable product
3. To discuss about the public perception and participation in recyclable waste

Solid waste management and recyclable garbage in Sylhet City

Solid waste management is one of the major challenges of city management. Every day Sylhet city produced 220 metric ton waste from various source (Household, business clinical etc)[1]. Among these, 67% of the solid waste is organic waste and rest of the wastes are inorganic includes plastic, paper plastic bottles, polyethylene, metal.[2] Solid wastes are generated from 27 wards of different sources like residential, commercial, construction, clinical and municipal. There is only one dumping ground for Sylhet City Corporation which is located in Lalmatia (parirchokh) with 1 vacuum tanker, 4 water tanker, 150 van which collect waste from different points of the city.[3]

Figure 8: Waste generation increasing with time. ([Ifterkhar Enayetullah et. Al.,2005)

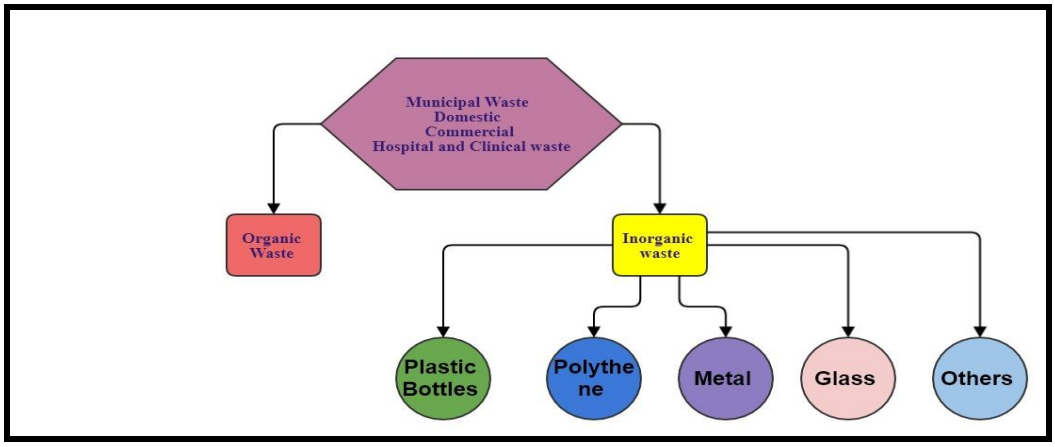


The pattern of solid waste generation shows that its number has doubled from last 10 years as we can see the figure 8. In 2004, it was 100 ton per day and in 2016 the number has more than doubled to 250 ton waste per day.

[1] Presentation-On-Sylhet-City-Corporation-Solid-Waste.
[2] Municipal Solid Waste Management In Sylhet City, Bangladesh, Md. Ashraful Islam.
[3] Municipal Solid Waste Management In Sylhet City Bangladesh

The present findings suggest that multi-stored buildings generate more waste than any other types of building. Where two stored building generate 2.2 kg waste per day, 6+ stored buildings generate double waste which is 4.9 kg per day. Particularly, multi-storied building generates more organic waste than 2 stored buildings.[4]

Figure 9: Category of Municipal waste



Municipal wastes are categorized in two major types - organic waste and inorganic waste. The major categories of inorganic wastes are– i) paper and cardboard, ii) Plastics and rubber, PET bottles, UPVC/PVC materials and LDPE/HDPE materials. iii) Metals iv) Glass - clear glass, green glass, brown glass and other colored glass etc.

Market Chain of Recyclable Product

A market chain is a chain of the linked entities that bring a specific product from production to consumer sales. Longer market chains often result in a lower share of revenue generated by the product as the work and the reward are spread out among many. Recycling has always been a major priority for waste management. Not only does recycling help save valuable landfill space, it also helps protect the health of the environment and surrounding community. Hence, market chain for recyclable product is as important for the environment and as it is for the business or economy. In Sylhet City Corporation, there are more than 12 types of recyclable product we found from our FGD survey.

[4]The Economics Of Solid Waste Management And Drainage : Sustainable Approach To Making South Asian Cities Climate- Resilient

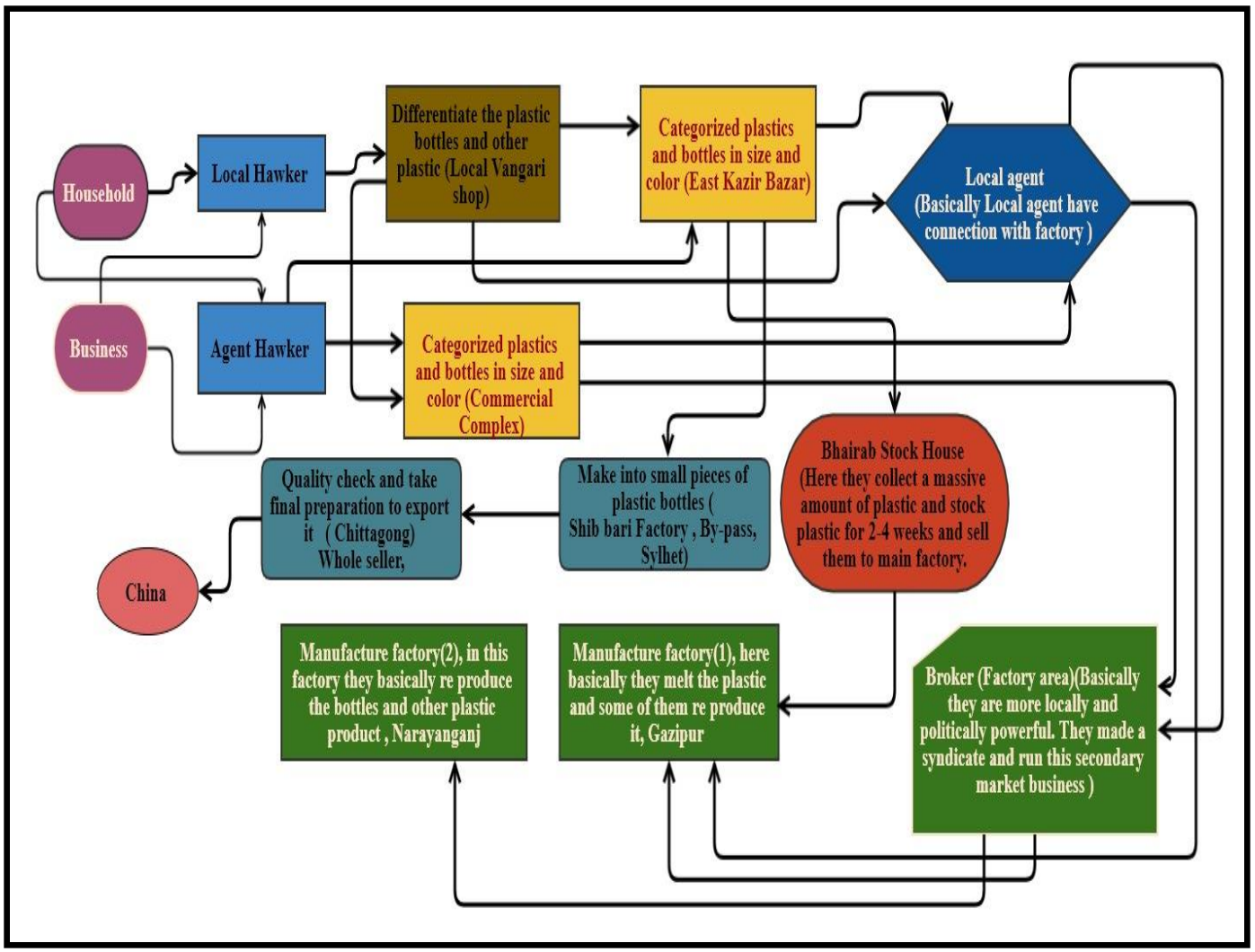
Table 15: Type of recyclable product

SL	Product Name	SL	Product Name
1	Plastic(Bottles)	7	Poultry Feed Bag
2	Metal	8	Oil Container
3	Polythene	9	Carton
4	Paper	10	Cement Bag
5	Glass	11	Drum
6	Cement Bag	12	Plastic(broken)

Major products are polythene, plastic bottles, paper (different kinds), metal, glass bottles. These products are usually collected from household and business and some part of recyclable products are also collected from clinical waste (like Injection and saline bag which amount is very low).

Figure-10 demonstrates the market chain of waste produced by house hold and business in Sylhet City Corporation. Households and business sell their waste to local hawkers or agent hawkers, sometimes to both hawkers. Local hawkers primarily prefer to sell their product to local Vangari shop and in this particular section they differentiate the amalgamate waste and others plastic. Local Vangri shop collect products from various source including local hawker and then categorized plastic bottles and sell them to whole seller. However, some agent hawkers are basically permanent employee for whole seller and they only collect recyclable product for their own whole seller. They differentiate the recyclable waste by themselves.

Figure 10: Market Chain for Recyclable product (Plastic bottle)



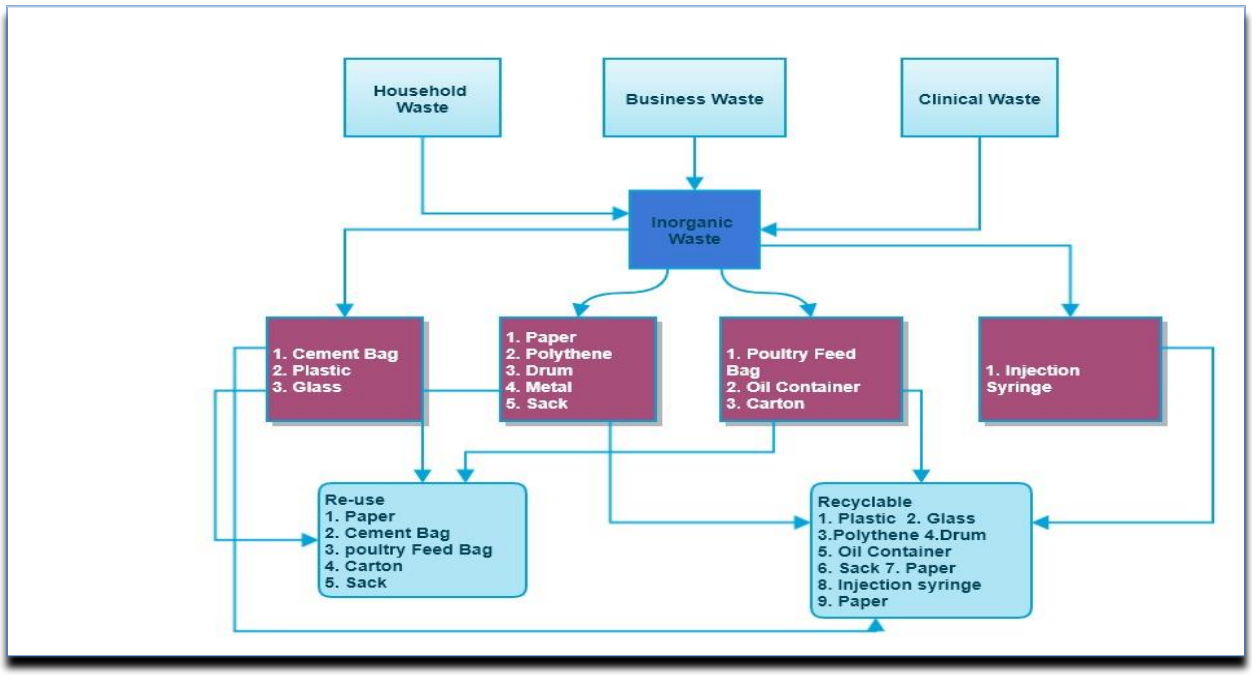
Local agents buy the waste from local Vangri Shop and whole sellers. Brokers also buy the waste from whole seller. Brokers, then sell them to manufacturing factory (1 & 2). Bhairab Stock House collects categorized plastic from whole sellers and sells them to manufacturing factory. In Sylhet there are some small factories collecting plastic bottles from whole sellers and cut the plastics into small pieces and sell them to exporters at Chittagong. Exporters check the quality of waste and process the final operation to export them to china.

Value Chain of Recyclable Product

Value chain analysis examines the full range of activities required to bring a product or service from its conception to its end use, actors that perform those activities along the

value chain and final consumers for the product or service (Vermeulen et al. 2008)[5]. To analyze, inorganic waste recycling process, this report uses Value Chain Method (VCM). VCM is a multilevel structural framework, explains every single business entity in an interlinked framework including their business functions, interrelation and supply chain position.

Figure 11: Classification of recycle waste by household and business (Re-Use and Recycle)



VCM also used as an analytical tool for the deep study of price mechanism, product process & collection period including amount, market influence, information passing and exploring different value addition by entities. From the field survey and FGD almost 12 recyclable products have identified in SCC. This can be classified into three major sections in terms of source. Household, Business and Clinical inorganic wastes are the major sections. Cement bags and plastic are clustered as household inorganic waste. Poultry feed bag, Oil container and carton are business wastes. But mostly a major share of these waste reaches at local market from the outside of SSC. In clinical waste section, only injection syringe comes in

[5] Value Chain Analysis: The Insight Of Aluminium Recycling

local market for recycling. Paper, Polythene, Drum, Metal and Sack are considered as a joint inorganic waste of business and household.

The core objective of this report is to explain SSC inorganic waste recycling process with the line detailing the price mechanism, collection method, duration, transportation, stakeholders and final processing of recyclable products. The components of value chain are explained in figure 12 in a simple diagram.

Primary Source Primary source basically indicates major sources of waste (household, business, clinical). Either they store it at their place for short period for selling or dump it.

Medium: These are the small business entity or individuals that collect waste from door to door or dumping zone and sell it to wholesaler. Usually they do not hold the waste. They are fast sellers and regular buyers.

Whole Seller: They usually collect, stock and classify waste and hold for a short period. The time-period is based on the demand and collection of product. They maintain the price of medium with recycling factories. Often, they sell it in local market with or without any modification. They sell it either by brokers or directly to the recycling factories.

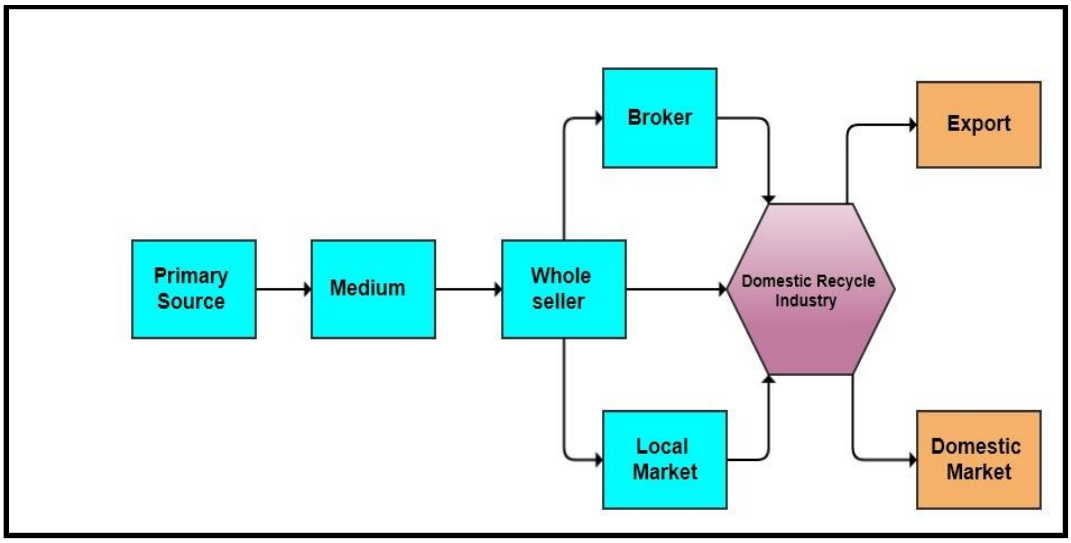
Broker: The work in this chain is mostly for commission. They are the intermediary person who works as an agent of factory.

Recycle Industry: They collect waste from all over Bangladesh. Their main purposes are bulk collection, process and send it to local or international market.

Local Market: The geographical location of this market is near and inside of SSC or all over Bangladesh.

Export: Exporting product outside of country.

Figure 12: VCM Diagram of inorganic waste recycling

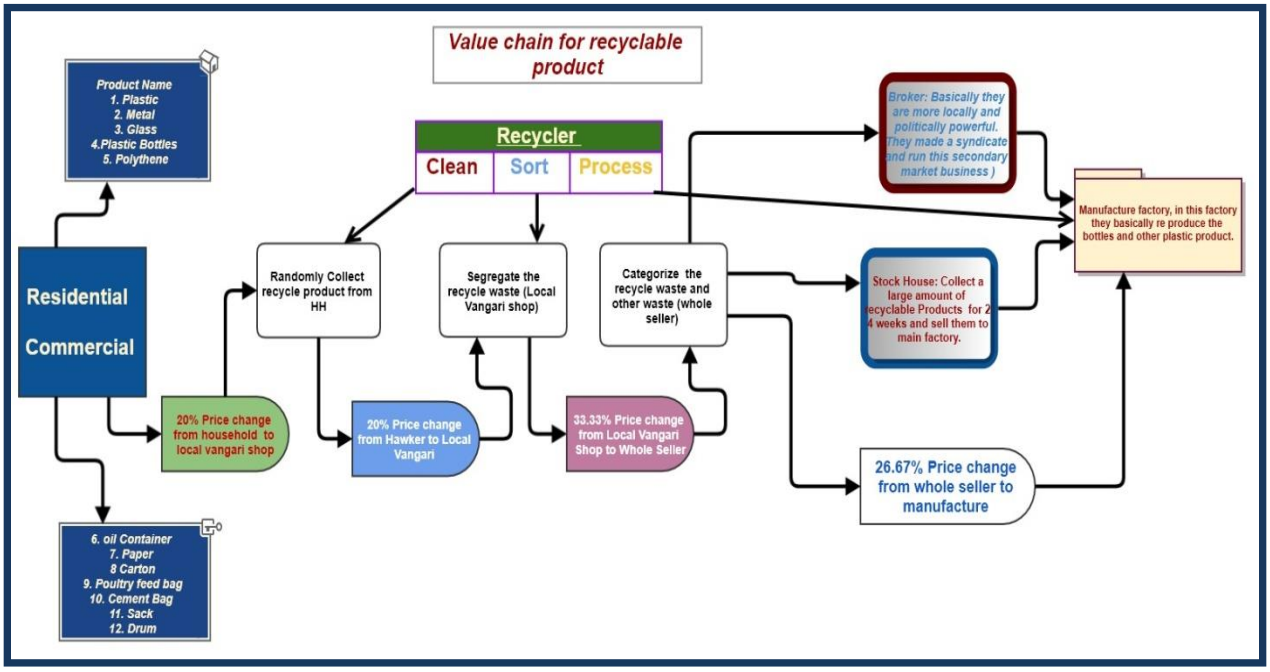


In market value chain management, the operation of 'RECYCLING' is an intricate process which starts with the disposal of waste items and ends with the re-use of a value-added material to deliver a set of customer benefits. The identical recyclable item, which changes from being a 'waste problem where it's a direct cost to the end-of-life disposer, has be re-produce as a 'product' which has a market value when fully recycled and re-used. The skill for the recycler is to be aware of how to preserve the value in the material as it moves through the whole, complex process[6]. Waste recycling is the process where recycle waste can be reused in products after its re-production. It has a number of key environmental and economic benefits.

In Figure we illustrate the value chain process in SCC (particularly is plastic product). Initially recyclable products are coming from residential and commercial sector. Then local/agent hawker purchases it where we can see that 20% value change and in this section they collect recyclable product randomly. The local/agent hawker sells it to the local vangari shop where the value change by 20% again and their work is to identify the product and segregate them.

[6] Understanding The Plastics Recycling Industry Value Chain By *Keith Freegard, Axion Recycling Ltd*

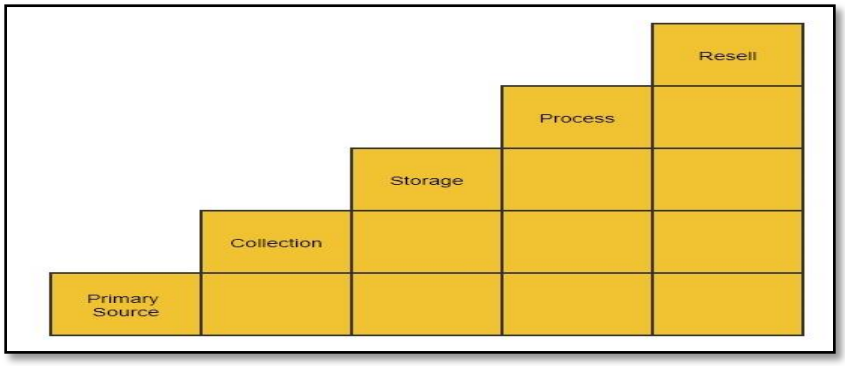
Figure 13: Value chain change in percentage for recyclable product



Whole seller purchase product from local vangari shop and also collect it from agent hawker. In this section whole seller categorize the recycle product into major categories (plastic, plastic bottles etc.) and value change by 33.33%. Finally manufacturing industry purchase it and convert this waste to re-useable product and the total value change is 26.6% change here. So from this diagram we can see that from household to manufacture the value of recycle product change exactly 100%. The waste which has a cost and also a mass problem for SCC , it covert into product and it has a market value now.

Identified recyclable product

Figure 14: Steps of recycling



The structural framework for the process of recycling is shown in figure 14. Every step causes some value addition by different business entities. This is how a scrap is transferred into a reusable product through the chain. Each step has different timeline, entities,

process, influence of other steps and quantity. Every inorganic waste does not face similar value chain for recycling, though the process is almost same. Sometimes unique inorganic waste may skip some steps or entities depend on the nature of market.

The details of inorganic products are -

Paper: Papers are classified in three sections. These sections are given below including their buying and selling price, price fluctuation level, collection amount, and stock duration in terms of whole selling market.

Table 16: Details of Paper Recycling

	Newspaper	Old Paper	Old Books
Purchase Price from HH	BDT 19	BDT 6	BDT 8
Purchase Price from local hawker	BDT 23	BDT 08 to BDT 10	BDT 10
Resell Price	BDT 26	BDT 13	BDT 14 to BDT 16
Price Fluctuation	BDT 03	BDT 03 to BDT 05	BDT 04 to BDT 06
Stock Duration	10 Days	10 Days	10 Days
Collection Amount	80KG to 150 KG	80 KG	60 KG
Collection Type	Daily Basis	Daily Basis	Daily Basis

During the analysis of the geographical position of buyer and seller, two paper recycling chains have been identified. One is direct chain from SCC to Dhaka. Other one goes to Dhaka through Narshingdhi. Prices are adjusted by whole seller in local market. Whole sellers always keep collecting information of price and demand from factories situated in Dhaka through phone.

Polythene: In the case of polythene whole seller collect it from household and business through medium. Usually wholesaler collects fresh polythene. The evidence of recycling of used polythene is not found in SCC.

Table 17: Details of Polythene and Cement Bag Recycling

	Polythene	Cement Bag	Glass
Purchase Price Local Hawker	BDT 55	BDT 3	BDT 5 to BDT 6
Resell Price	BDT 60	BDT 7.5	BDT 8 to BDT 9
Price Fluctuation	BDT 2 to BDT 3	-	BDT 2 to BDT 4
Stock Duration	-	90 Days	5 days to 8 days
Collection Amount	20 KG to 50 KG	1000 pies	100 KG to 150 KG
Collection Type	Daily	Daily	2 days to 3 days

Cement Bag: Cement bag is one of the recyclable products which does not complete entire value chain framework given in this report. Usually Whole seller gets the product from medium and processes it. After a little processing whole seller resell it at local market. Most demanded month is April to May due to using of Cement Bag in rice stock purpose. The processing cost is BDT 2.10 per bag. For cleaning BDT 0.60 and for sewing BDT 1.50 is needed per bag foe whole seller.

Glass: Glass items are usually collected in 2-3 days interval. 'Chandni Ghat' is the whole-seller market of this waste.

Plastic: This product can be divided into two segments. One is plastic bottle; whole seller collects it, and clusters it according to color. Another one is broken plastic or non-bottle plastic locally known as Mulam. Usually mulams are broken bucket, mug other plastic materials.

Table 18: Detail Information of Plastic bottles

	Plastic Bottle	Broken Plastic
Purchase Price from HH	BDT 18-BDT 22	BDT 20
Purchase Price from Local Hawker	BDT 25 to BDT 32	BDT 25
Resell Price	BDT 30 to BDT 35	BDT 28 to BDT 30
Price Fluctuation	BDT 2 to BDT 3	BDT 3 to BDT 5
Stock Duration	Rarely Reserved	7 days to 8 days

Collection Amount	20 KG to 120 KG	40 to 50 KG
Collection Type	Daily	Daily

Injection syringe: Injection syringe is the only clinical waste identified during our study. The amount recycled in this category is really low. It is identified that only few whole seller are involved with this recycling process due to less profitability.

Table 19: Detail Information of Clinical waste

	Injection	Metal	Carton Box
Purchase Price from Local Hawker	BDT 25 to BDT 30	BDT 22 to BDT 23	BDT 10 to BDT 12
Resell Price	BDT 40	BDT 25 to BDT 28	BDT 11 to BDT 14
Price Fluctuation	BDT 10 to BDT 15	-	BDT 2 to BDT 4
Stock Duration	3 month to 4 months	7 days	10 days to 15 days
Collection Amount	1 KG to 2 KG	150 KG	500-600 KG
Collection Type	Weekly	Daily	Daily

Metal: The metal waste process factory of SCC is in Dhaka. All brokering agents are highly influential in this waste market. To set price in market broker has the main dominating power.

Carton Box: These boxes are collected from SCC and nearby locality. Almost 500-600 kg is stored every day. These boxes are used again in the business purpose.

Table 20: Detail Information of Oil container

	Small Oil Container	Large Oil Container
Purchase Price from Local Hawker	BDT 35 and BDT 45	BDT 65
Resell Price	BDT 50	BDT 70
Price Fluctuation	BDT 5 and BDT 15	BDT 5
Stock Duration	2 months to 3 months	
Collection Amount	300-400 Pies	
Collection Type	Weekly	

Oil Container: Oil containers are divided in two sizes. Price and resale value depend on the size. Usually hawkers collect it from local areas and hotels. Whole sellers collect it from hawkers and forward it to the factories for reuse. Factories are situated in Bogra, Mymenshing and Bhairab. Price of small containers changes due to season.

Recycle and Employment

Recyclable wastes are not only sources of investment; it also can play a vital role in employment generation. In this particular sector we can create a mass amount of employment. To develop this specific sector we have to start it from micro or household level. Now a day's most of the develop and developing countries are thinking about waste management and developing their system to reduce the land fill , environmental hazard and last but not the least a cost effective solution for waste management. Already we know that Bangladesh is densely populated country, where unemployment is a curse for us. Therefore the recyclable market or wastage recycle may be another solution for unemployment problem. So this waste recycle can provides three solutions for us[7]: i) neat and clean city ii) employment generation and iii) recycle goods

Conclusion

The necessity of innovative waste management in these times is paramount. However, prior to addressing the growing concern, it is necessary to comprehend the existing market for waste and recyclable goods in a rapidly growing metropolitan city like Sylhet. Using the value chain method, the report provides a comprehensive picture of the manner through which inorganic waste is passed down in the market chain. Various forms of such inorganic waste currently exist, and the collection system and offered prices fluctuate according to the demands from factories, where the ultimate recycled goods are used. Recyclable products witness a seasonally fluctuating demand throughout the year. The steps that the products follow through; from collection to processing to resale, can be improved to lead to an increase in the volume and variety of recyclable products, thus creating a high value, competitive and profitable market for waste.

[7] Solid Waste Management System In Dhaka City Of Bangladesh.(F. A. Samiul Islam)

1.3 Waste to Compost

In order to create economic incentives for proper disposal of solid wastes, the study plans to pilot a 'waste to compost' plant for households of continuous sample under 2 clubs in Sylhet City Corporation. The study randomly selected two clubs among the 4 (Ward no. 11 and 18) for the composter bin and two clubs (Ward no. 11 and 22) for providing plastic bags to segregate waste at home. The cylinder shape composter is designed to prepare odor free compost for households under the selected club. The experiment is expected to result in actual cost and benefits information to develop a cost-benefit analysis for investment in such schemes for urban waste management.

1.4 Training/capacity building

A workshop program has been planned to organize for capacity building of stakeholders such as the club representatives and city corporation officials. The workshop will be useful for their awareness building and disseminating to the households of their locality. All material from these workshops and training courses will be made available on the project website for a wider dissemination. A mobile apps has been developed for building awareness and as a campaigning tools

1.5 Publications

- **Working papers**
- **Policy briefs**
- **Peer-reviewed articles**
- **Other publications**

Dissemination and policy outreach

Lessons learned

Any other project related issues

Activities are planned for the next period