

PLASTIC WASTE MANAGEMENT IN CHATTOGRAM CITY USING MATERIALS FLOW ANALYSIS



By

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Approval Statement

The thesis titled “**Plastic Waste Management in Chattogram City using Materials Flow Analysis**” Submitted by **Md. Nour Hossain**, Roll No: **20MCE017P**, Session: **2020-21** has been accepted as satisfactory in partial fulfillment of the requirement for the degree of **MASTER OF SCIENCE IN CIVIL ENGINEERING** on 06 March, 2025.

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Dedicated to my family, friends,

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Journal Article

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Md. Nour Hossain, Asiful Hoque, Md Bashirul Islam, Md. Arif Hossen

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- Enhancing Plastic Waste Management in Alkaran Ward of Chattogram City through Materials Flow Analysis

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Abstract

Plastic waste management has become a critical issue in developing countries, largely due to increasing economic prosperity, population growth, and changing consumption patterns. This study employs Material Flow Analysis (MFA) to evaluate plastic waste generation, composition, and management practices in the Chattogram City Corporation (CCC), Bangladesh. Using STAN software, the MFA tool was applied to estimate unaccounted plastic waste flows from industrial, other institutional source (e.g., schools), which were quantified at 55.54 tons/day. Additionally, the study visualizes the complete material flow of plastic waste within CCC, addressing a critical gap left unexplored in prior research. Using the guidelines of the Waste Wise Cities Tool (WaCT), field surveys were conducted across 150 households, 15 markets, 15 hotels and restaurants, 15 offices, and 15 streets to quantify waste generation and composition. The study reveals that CCC generates 1630.91 tons of solid waste daily, of which 204.99 tons (12.57%) are plastic waste. Per capita plastic waste generation varies significantly across income groups, with high-income individuals producing 40.60 grams per day, which is 1.13 and 2.24 times higher than the middle- and low-income individuals, respectively. Low-density polyethylene (LDPE) dominates plastic waste in households (46.30%), markets (47.42%), and streets (59.41%), while polyethylene terephthalate (PET) is prevalent in offices (75.84%) and hotels and restaurants (81.17%). Single-use plastic bags, packaging materials, and food wrappers are identified as major contributors to plastic waste. The study highlights that only 65% of solid waste is collected, with approximately 24.49% of plastic waste recycled through formal and informal channels. However, 543.23 tons of solid waste, including 154.79 tons of plastic, are mismanaged, leading to environmental pollution. This study could provide valuable insights for policymakers and city officials to design effective plastic waste management systems.

বিমূর্ত

উন্নয়নশীল দেশগুলিতে ক্রমবর্ধমান অর্থনৈতিক সমৃদ্ধি, জনসংখ্যা বৃদ্ধি এবং ভোগের ধরনের কারণে প্লাস্টিক বর্জ্য ব্যবস্থাপনা একটি গুরুত্বপূর্ণ সমস্যা হয়ে দাঁড়িয়েছে। এই গবেষণায় বাংলাদেশের চট্টগ্রাম সিটি কর্পোরেশনে (CCC) প্লাস্টিক বর্জ্য উৎপাদন, সংযুক্তি এবং ব্যবস্থাপনা পদ্ধতি মূল্যায়নের জন্য ম্যাটেরিয়াল ফ্লো অ্যানালাইসিস (MFA) পদ্ধতি প্রয়োগ করা হয়েছে। STAN সফটওয়্যার ব্যবহার করে, শিল্প ও অন্যান্য প্রাতিষ্ঠানিক উৎস (যেমন-স্কুল) থেকে অপরিমিত প্লাস্টিক বর্জ্যের প্রবাহ বের করা হয়েছে, যার পরিমাণ দৈনিক ৫৫.৫৪ টন। এছাড়াও, এই গবেষণায় CCC-এর মধ্যে প্লাস্টিক বর্জ্যের সম্পূর্ণ ম্যাটেরিয়াল ফ্লো ভিজ্যুয়ালাইজ করা হয়েছে, যা পূর্ববর্তী গবেষণাগুলিতে করা হয়নি। Waste Wise Cities Tool (WaCT) এর গাইডলাইন ব্যবহার করে, ১৫০টি পরিবার, ১৫টি বাজার, ১৫টি হোটেল ও রেস্টোরাঁ, ১৫টি অফিস এবং ১৫টি রাস্তায় বর্জ্য উৎপাদন এবং সংমিশ্রণ পরিমাপের জন্য ফিল্ড সার্ভে করা হয়েছে। গবেষণায় দেখা গেছে যে, CCC প্রতিদিন ১৬৩০.৯১ টন কঠিন বর্জ্য উৎপন্ন করে, যার মধ্যে ২০৪.৯৯ টন (১২.৫৭%) প্লাস্টিক বর্জ্য। আয়ের স্তর অনুযায়ী মাথাপিছু প্লাস্টিক বর্জ্য উৎপাদন উল্লেখযোগ্যভাবে পরিবর্তিত হয়, উচ্চ-আয়ের ব্যক্তির প্রতিদিন ৪০.৬০ গ্রাম প্লাস্টিক বর্জ্য উৎপন্ন করে, যা মধ্য-আয় এবং নিম্ন-আয়ের ব্যক্তিদের তুলনায় যথাক্রমে ১.১৩ এবং ২.২৪ গুণ বেশি। প্লাস্টিক বর্জ্যের মধ্যে LDPE এর ব্যবহারের প্রাধান্য পরিলক্ষিত হয় পরিবার (৪৬.৩০%), বাজার (৪৭.৪২%) এবং রাস্তায় (৫৯.৪১%), অন্যদিকে PET অফিস (৭৫.৮৪%) এবং হোটেল ও রেস্টোরাঁয় (৮১.১৭%) বেশি দেখা যায়। একবার ব্যবহারযোগ্য প্লাস্টিক ব্যাগ, প্যাকেজিং সামগ্রী এবং খাবারের মোড়ক প্লাস্টিক বর্জ্যের প্রধান উৎস হিসেবে চিহ্নিত হয়েছে। গবেষণায় আরও দেখা গেছে যে মাত্র ৬৫% কঠিন বর্জ্য সংগ্রহ করা হয়, যার মধ্যে প্রায় ২৪.৪৯% প্লাস্টিক বর্জ্য আনুষ্ঠানিক এবং অনানুষ্ঠানিক চ্যানেলের মাধ্যমে পুনর্ব্যবহার করা হয়। তবে, ৫৪৩.২৩ টন কঠিন বর্জ্য, যার মধ্যে ১৫৪.৭৯ টন প্লাস্টিক বর্জ্য রয়েছে, যা সঠিকভাবে ব্যবস্থাপনা করা হয় না, ফলে তা পরিবেশ দূষণের কারণ হয়ে দাঁড়িয়েছে। এই গবেষণা নীতিনির্ধারক এবং শহর কর্মকর্তাদের জন্য কার্যকর প্লাস্টিক বর্জ্য ব্যবস্থাপনা পদ্ধতি ডিজাইনে মূল্যবান পরিকল্পনা তৈরিতে সহায়তা করতে পারে।

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GLOSSARY OF TERMS

CBOs	Community-based organizations
DCM	Data Collection Manual
EHS	Environment, Health, and Safety
FAO	Food and Agriculture Organization
GHG	Greenhouse Gases
HDPE	High-Density Polyethylene
HH	Household
LDPE	Low-Density Polyethylene
MBT	Mechanical Biological Treatment
MLP	Multi-Layered Plastic
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NGO	Non-Governmental Organization
PET	Polyethylene Terephthalate
PP	Polypropylene
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
SDGs	Sustainable Development Goals
UN-Habitat	United Nations Human Settlements Programme
WACS	Waste Amounts and Composition Survey
WaCT	Waste Wise Cities Tool
WFD	Waste Flow Diagram
WHO	World Health Organization

Chapter 1. INTRODUCTION

1.1 BACKGROUND

Solid waste management is a significant global issue due to rapid urbanization and population growth, leading to an overwhelming increase in waste generation. The global population is estimated to reach 11 billion by the end of this century, with around 8.5 billion people residing in urban regions (Drangert & Kjerstadius, 2023). By 2025, the daily solid waste generated by the global urban population will be projected to exceed 6 million metric tons (Hoornweg et al., 2013). Inadequate solid waste management practices result in severe environmental pollution, health hazards, and economic costs (Arteaga et al., 2023). The widespread use of plastic in a variety of applications has played a crucial role in the advancement of modern society (Napper & Thompson, 2020). The significant production of plastics only began after World War II, reaching an annual output of 359 million tons in 2018 (Leal Filho et al., 2019). The advantages of plastics became apparent rapidly due to their strong, lightweight, affordable, long-lasting, and corrosion-resistant qualities (R. Siddique et al., 2008). However, the wide range of plastic applications contributes to the ever-increasing amount of solid waste in various ways, posing a threat to the environment and public health (Shin et al., 2020).

Solid waste management poses a significant challenge in Bangladesh, similar to other developing countries. By 2025, waste generation per person in Bangladesh is expected to rise to 0.75 kg per day, leading to an annual total of 21.07 million tons of waste (M. J. Ahmed et al., 2023). The country has about 5,000 plastic industries, ranked as the 12th greatest source of income from export trade in 2018. However, due to poor solid waste management practices, the country has become one of the most plastic-polluted nations. Massive

accumulations of improperly disposed plastic waste pose a major threat to the Bay of Bengal's marine ecosystem and human health. The estimated yearly (FY2019–2020) plastic consumption in Bangladesh is 1,710,296 metric tons, with the packaging industry consuming the most at 937,242 metric tons. On average, 10.13 kilograms of plastic products are used per person, resulting in 7.9 kilograms of waste produced (S. Siddique et al., 2022). From 3 kg in 2005 to 9 kg in 2020, there has been a significant increase in the amount of plastic consumed per person, and the COVID-19 situation exacerbated the problem with the rise of single-use plastic products like masks, gloves, and personal protective equipment (PPE) (Haque et al., 2023). Currently, the country recycles 28% of its waste (362,332 metric tons), mainly through robust informal recycling sectors, while the rest remains uncollected and goes to disposal sites (S. Siddique et al., 2022).

Conventional solid waste disposal methods like landfill and incineration result in inefficient use of resources and give rise to significant issues of secondary pollution (Pan et al., 2020). Disposing of solid waste in existing landfills, which are often mismanaged, causes environmental contamination and risks human health (Pan et al., 2020). Concern regarding the scope, origins, and consequences of solid plastic pollution is growing, elevating it to a prominent research focus on sustainable plastic waste management for environmental matters and human well-being. Sustainable plastic waste management is crucial for the circular economy. The principles of a circular economy—reuse, reduction, recycling, and recovery of materials—have gained attention among governments worldwide (Haq & Alam, 2023). Countries like China, the European Union, and Japan have embraced these principles in their policies. In the United Kingdom, initiatives like the Plastics Pact aim to transition from a linear plastics economy (take, make, and dispose)

to a circular one that keeps plastic within the economy and prevents it from entering the natural environment. To identify opportunities for reducing, reusing, and recycling materials, it is essential to have a comprehensive understanding of the stocks and flows of these materials. This understanding can be achieved using material flow analysis (MFA) (Velenturf & Purnell, 2021).

MFA is essential for evaluating the input and output of materials to comprehend how different materials move through the entire system (Bao et al., 2010). It helps uncover the composition and alterations in the materials, revealing both the prosperity and the environmental stress arising from various activities (Machado et al., 2004). By identifying opportunities for more efficient material use and environmental enhancement, MFA serves as a valuable tool for guiding effective regulation (Azizi et al., 2023a). To enhance the efficiency of resource utilization and consumption while minimizing waste material discharges, MFA is crucial for conserving resources and achieving the objectives of a circular economy and sustainable development (P. H. Brunner & Rechberger, 2017). Typically represented by the Sankey Diagram, MFA provides a rapid assessment methodology for mapping waste flows in municipal solid plastic waste management systems (Chaudhari et al., 2024; Schneider et al., 2022). Moreover, it identifies the sources and outcomes of plastic pollution, offering a quick evaluation and visualization of a city's waste management, thereby supporting Sustainable Development Goals (SDG) objectives. By prioritizing speed and minimal data over detailed accuracy, the diagram serves as a first-level approximation tool that aids in managing municipal solid plastic waste.

Properly managing municipal solid plastic waste (MSPW) aligns with several sustainable development goals (SDGs), specifically 11.6 (sustainable

cities managing municipal solid waste in controlled facilities), 12.5 (emphasizing the reduction, reuse, and recycling of waste), 14.1 (protecting marine life and oceans), and 7 (affordable and clean energy). To achieve these SDG targets, it is crucial to understand waste generation and its flows for a circular economy and sustainability, mitigating environmental and health hazards.

1.2 PROBLEM STATEMENT

Chattogram City Corporation, Bangladesh's second-largest urban center, faces escalating challenges in managing plastic waste due to rapid urbanization, population growth, and increased reliance on plastic products. Despite this importance, no comprehensive study has been conducted regarding the material flow of plastic waste at the regional level. The absence of MFA at the regional level presents a significant obstacle to evidence-based policymaking. To address this gap, the main objective of this study is to analyze the generation and collection of plastic waste in Chattogram City Corporation and to visualize the estimated flow of waste using MFA. The results of this study are expected to be valuable for relevant authorities who need to make informed planning decisions regarding waste management strategies.

1.3 RESEARCH QUESTIONS

This study addresses the critical issue of plastic waste management in the Chattogram City Corporation through some primary research questions. What is the daily generation of plastic waste within the ward level of Chattogram City Corporation from September 2023 to March 2024? How are different plastic types (PP, PVC, PE, PET, and LDPE) distributed across residential, commercial, and institutional waste sources?

1.4 OBJECTIVES

This study aims to assess the plastic waste flow within the Chattogram City Corporation using MFA towards the best possible waste management practices. The specific objectives are as follows:

- To quantify the amount of plastic waste in the solid waste.
- To categorize the different types of plastic components (e.g., PP, PVC, PE, PET, etc.) in the identified plastic waste.
- To estimate and visualize plastic waste flows within CCC using MFA, with specific emphasis on estimating unmeasured industrial and others (e.g., schools) waste streams through STAN software.

1.5 SCOPE AND LIMITATIONS OF THE STUDY

The scope of this study is to examine the plastic waste generation, collection, and recycling process in Chattogram City Corporation, including the current practices, challenges, and opportunities for improvement. The study focused on the major stakeholders involved in the recycling process, such as plastic waste collectors, NGOs, local recyclers, and local manufacturers. The study also covers the environmental impact (GHG emission) of solid waste and the potential benefits of effective recycling practices. The study is conducted through a combination of fieldwork for primary data collection, and a literature review for secondary data collection.

Several limitations to this study should be acknowledged. First, the study is limited to the specific context of Chattogram City Corporation and may not be generalizable to other cities or regions due to people's living patterns, income groups, waste generation patterns, and geographical conditions. Second, the study relies on self-reported data from stakeholders in the plastic waste recycling process, which may be subject to bias or inaccuracies. Finally,

the study is limited by time and resource constraints, which may affect the depth and breadth of the data collected.

1.6 ORGANIZATION OF THE THESIS

This thesis is presented in five chapters. The first chapter provides a brief background as well as the objectives, and the scope of the study.

Following the introduction of Chapter 1, Chapter 2 combines the findings of relevant published literature, providing the effects of plastic waste, the current scenario, and the management strategy of plastic waste.

Chapter 3 outlines the methodology used for the study, including a description of the study area, Waste Management System of Chattogram City Corporation, Sample Size, Sample Collection Process and Generation Assessment, Materials Flow Analysis, and Calculation process of GHG Emissions that were used to conduct this research.

Chapters 4 portray the results and discussion that describe Solid Waste and Plastic Waste Generation, Current Recycling Practices in CCC, Municipal Solid Wastes Flow, Plastic waste flow, Current Status of GHG Emission in CCC, and focus on Suggestions and future directions for Municipal solid plastic waste management of Chattogram City Corporation.

Finally, Chapter 5 provides the conclusions and implications of this study based on the findings of Chapter 4.

References cited in the thesis's text are listed as a list of references. In addition to the main text, there are a few appendices that include significant supporting data and information.

Chapter 2. LITERATURE REVIEW

2.1 GENERAL

This chapter presents an in-depth analysis of the composition of plastic waste, examining its environmental impacts and the challenges posed by plastic pollution. It explores existing strategies for managing plastic waste and identifies key obstacles to their implementation. Furthermore, the chapter highlights the significance of Material Flow Analysis (MFA) in enhancing plastic waste management practices. Comparative evaluations of related studies are conducted to identify effective solutions and optimize waste management strategies.

2.2 PLASTIC WASTE AND ITS IMPACT

Due to the properties of plastic, such as its inertness, longevity, flexibility, and versatility, people are depending on it more and more every day. Plastic has become a vital element of society worldwide since it can be used for a variety of purposes, including packaging, agriculture, car parts, electronics, medical equipment, etc. (P. Singh & Sharma, 2016a). They are a popular choice in a variety of industries, making up 15% of cars and 50% of dream ships due to their qualities of light, heat, and corrosion resistance, low cost, strength, and toughness. The global production of plastics has witnessed a substantial rise, surging from 1.5 million tons in the 1950s to surpassing 390.7 million tons by 2021 (Mušič, 2023). While plastic usage offers numerous advantages, it simultaneously gives rise to various environmental concerns throughout its life cycle (**Fig. 2.1**). Plastic wastes are now widely acknowledged to be a major source of environmental pollution (Cm et al., 2013; Koehler et al., 2015), particularly in aquatic environments where plastics degrade slowly (Derraik, 2002; Thompson et al., 2004), pose a threat to wildlife (Wilcox et al., 2015), and have few options for removal (Jambeck et al., 2015a; Thompson et al., 2004; Wilcox et al., 2015).



Fig. 2.1 Plastic waste, its impact and management policy (Pilapitiya & Ratnayake, 2024a).

Every year, around 500 billion plastic bags are utilized, and an estimated 13 million tonnes of them find their way into the ocean, resulting in the loss of

approximately 100,000 marine lives (Alabi et al., 2019). The Pacific Ocean is expected to become a massive waste dump due to the rapid expansion in the use of plastic items, with 33 billion tons of plastic expected to be generated by 2050 (Rochman et al., 2013). It is strongly discouraged to burn plastics due to the emission of harmful gases, including Furans, Mercury, Dioxins, and Polychlorinated Biphenyls, into the atmosphere (Verma et al., 2016a). Across the world, particularly in Bangladesh, one of the most significant problems is plastic waste. Although the handling and management of plastic waste are periodically updated in Bangladesh, efficient management of plastic waste remains a significant challenge.

2.3 PLASTIC WASTE COMPOSITION

Plastics are artificial organic polymers, primarily sourced from petrochemical raw materials, and are sorted based on their resin type. Plastics are generally divided into two significant groups.

(a) Thermoplastics: This specific kind of plastic can be melted and reshaped easily, displaying a soft and malleable texture upon cooling, and there is no cross-link between chains (**Fig. 2.2**). Thermoplastics such as HDPE, LDPE, PVC, polypropylene, and polystyrene belong to this classification.

(b) Thermoset: It typically consists of long-chain polymers formed by cross-linking with other long chains (**Fig. 2.2**). Once it takes a specific shape, it cannot be remelted or reshaped. Examples of thermosetting plastics include Polystyrene (PS) or Styrofoam, PVC, and Mixed Plastics.

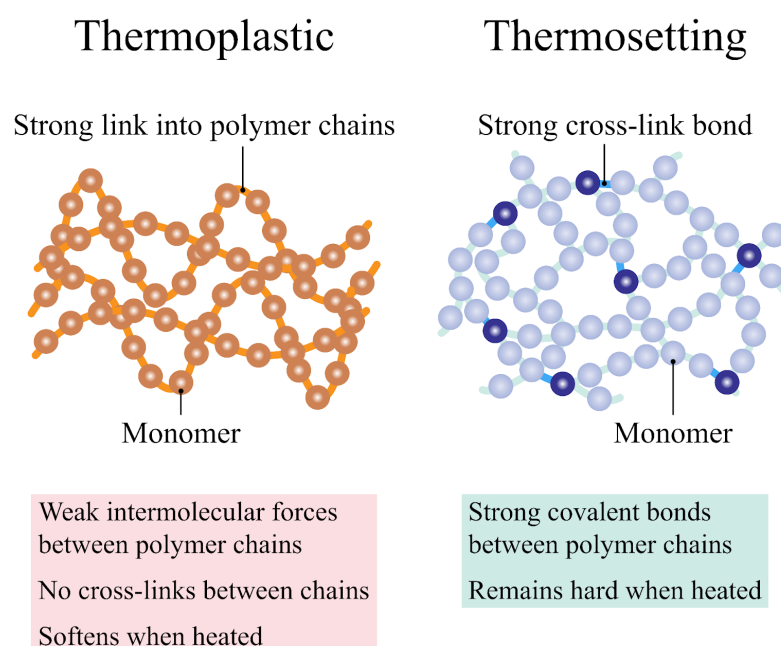


Fig. 2.2 Composition of plastic (Melito, 2016).

2.4 EFFECTS OF PLASTIC POLLUTION

Currently, plastic waste is widely acknowledged as a major source of environmental pollution. (Liu & Nowack, 2022). The effects of plastics extend beyond the pollution phase at the end of their life cycle. The increasing production and application of conventional plastics endanger not only human health but also the major living elements (**Fig. 2.4**) such as air, water, and land (Shaibur et al., 2024).

2.4.1 EFFECT OF PLASTIC WASTE ON LAND

The increasing production and application of conventional plastics, including in agricultural contexts, have resulted in an excess of 6,500 million metric tonnes of plastic waste in the last 70 years. Approximately two-thirds of this waste has been disposed of in landfills and the surrounding natural environment, including soils (Huo et al., 2022). Large plastic waste in the soil can mechanically disturb root systems and impact the integrity of the soil structure. Plastics have the potential to release harmful chemicals and additives into the

soil, which can alter its composition and quality. Plastics, being non-biodegradable, can disrupt natural decomposition processes in soil, leading to disturbances in nutrient cycling and microbial functions. As a result, this can diminish soil fertility and have adverse effects on agricultural output. Ultimately, these pollutants might enter the food chain and endanger human health.

2.4.2 EFFECT OF PLASTIC WASTE ON THE MARINE ENVIRONMENT

Over the past half-century or so, there has been a continual and mounting issue with contamination and pollution of the planet's enclosed seas, coastal waters, and expansive open oceans due to the increasing presence of plastics and other synthetic materials that do not naturally decompose (Gregory, 2009). Plastic contamination is recognized as a significant human-induced problem in coastal and marine environments worldwide. These contaminants primarily originate from both land-based and sea-based sources which enter the ocean through various pathways (Thushari & Senevirathna, 2020a). Annually, the world produces nearly 280 million tons of plastic items, and a substantial amount of this ends up either in landfills or the oceans. Approximately 267 species worldwide are affected, including 86% of sea turtle species, 44% of seabird species, and 43% of marine mammal species (Isangedighi et al., 2018). Besides, according to Stamper et al. worldwide, a minimum of 23% of marine mammal species, 36% of seabird species, and 86% of sea turtle species are recognized to be impacted by plastic waste (Stamper et al., 2009). The impact of plastic pollution on biodiversity is most severe in certain marine environments, and it's recognized as one of the primary threats to biota.

2.4.3 EFFECT OF PLASTIC WASTE ON WATER

Plastic pollution enters aquatic environments and oceans primarily through stormwater runoff, which flows into watercourses or is directly released into coastal waters. The increase of plastic pollution in aquatic environments is an

emerging environmental threat that has the potential to adversely affect ecosystems, endanger aquatic species, and lead to economic losses. Rivers have a critical function in transporting plastic waste from land to the world's oceans, but it's important to note that riverine ecosystems are also directly influenced by plastic pollution (Emmerik & Schwarz, 2020). The world's oceans were expected to have 165 million metric tons of plastic waste in 2012, at the same time, an average of 8 million metric tons of plastic is discharged into the ocean every year, with roughly 5 trillion plastic fragments afloat on the surface of the ocean (Jambeck et al., 2015b). In general, plastics in the ocean can experience partial degradation within a year but not complete breakdown. During the plastic degradation process, there is the potential for the release of toxic chemicals like polystyrene and BPA into the water, resulting in water pollution (Knight, 2013). It is predicted that between 70-80% percent of plastic pollution comes from sources on land and enters the seas and oceans through river transportation (Andrady, 2011; Avio et al., 2017; da Costa et al., 2016; Jambeck et al., 2015c).



Fig. 2. 3 Throwing plastic waste into canals increases riverbed waste load, raising dredging costs in the Karnaphuli River.

Throwaway plastic and other discarded items make Chaktai khal look like a stream of garbage in Chattogram's Chawkbazar. In the monsoon, some of the

non-degradable objects will end up in the Karnaphuli river while others will impede water flow in the canal, leading to waterlogging (**Fig. 2.3**).

2.4.4 EFFECT OF PLASTIC WASTE ON AIR

The practice of burning plastic waste in an open area contributes significantly to air pollution. Frequently, Municipal Solid waste is incinerated, emitting harmful substances such as Dioxins, Furans, Mercury, and Polychlorinated Biphenyls into the air. Moreover, the combustion of Poly polyvinyl chloride results in the release of harmful halogens, causing air pollution and contributing to climate change (Verma et al., 2016b). While the public may not be aware, most scientists believe that plastics harm our ecosystem. Throughout the plastic production process, the extraction and drilling of fuels release harmful chemicals such as H₂S, benzene, methane, and volatile organic compounds. Similarly, burning or incinerating plastic waste results in the emission of dangerous substances such as furans, volatile organic compounds, heavy metals, and more. These plastics release microplastics in various forms that can become airborne and easily enter the body, leading to harmful effects (Sarkingobir et al., 2021). Moreover, it can facilitate the spread of airborne diseases, such as COVID-19, which is currently affecting the world, as well as tuberculosis and pneumonia. Carbon dioxide and methane are released into the air during the decomposition of plastic waste that has been buried in landfills. Their effects on the quality of urban air and the transportation of these particles to pristine locations have grown into a major concern (Sridharan et al., 2021).

2.4.5 EFFECT OF PLASTIC WASTE ON ANIMAL LIFE

Plastics contribute significantly to the overall volume of municipal solid waste, causing conspicuous pollution and posing a major threat to the environment, including the air, oceans, soil, livestock, wildlife, and marine

ecosystems (Brinton, 2005; Didyk et al., 2000; Moore, 2008; B. Singh, 2005). Inadequate waste management can lead to diverse impacts on wildlife, including the spread of diseases and parasites as well as chemical toxicity (Vanapalli et al., 2021). Diseases originating from plastic pollution have been documented as a significant factor in the local extinction of various wild animal species (Sengar et al., 2017). The human food supply can suffer adverse consequences if animals are negatively affected by consuming or becoming ensnared in plastic waste. Many animals in the oceans frequently consume plastic waste unintentionally, leading to harm or potential death among these aquatic creatures (Manam, 2022). Research findings have shown that the consumption of plastic materials by over 260 distinct animal species has resulted in the death of more than 400,000 marine mammals (Chiras, 2001). Most urban stray cattle in India, approximately 95%, suffer from a range of ailments due to hazardous materials, with plastic bags being the primary culprits in their stomachs.

2.4.6 EFFECT OF PLASTIC WASTE ON PUBLIC HEALTH

The modern packaging industry extensively utilizes plastic materials. Improper disposal of these materials can result in significant public health issues. Plastics contain a range of harmful elements, including phthalates, polyfluorinated chemicals, bisphenol-A, brominated flame retardants, and antimony trioxide, all of which have the potential to impact both the environment and human well-being (Yadav et al., 2020). Being consumed by a variety of freshwater and marine species, microplastics can accumulate in the food chain and endanger human health (Galloway, 2015). Multiple studies have a link between different phthalates and a variety of adverse effects, including increased adiposity, insulin resistance, decreased anogenital distance in male infants, reduced levels of sex hormones, and other effects on the human reproductive system, impacting both men and women (Fernandez et al., 2013). The impacts on health from plastic usually start with the circulatory, lymphatic, and respiratory

systems and ultimately end up in the kidney, liver, and gastrointestinal tract (Deng et al., 2017). It has been discovered that micro- and nano-plastics significantly impact human health, causing physical stress and injury, cellular death, fibrosis, oxidative stress, and immunological responses (Almeida, 2019). Overall, plastic pollution is a significant environmental issue.



Fig. 2.4 Environmental impact of plastic waste.

The following table (**Table 2.1.**) summarizes the effects of plastic waste on land, human health, air, water, and the marine environment. It underscores the widespread and interconnected impacts of plastic waste across multiple environmental and health sectors.

Table 2.1 Effects of plastic waste on the environment.

Effect	Description	Source
Land pollution	Plastic pollution on land is significantly higher than in oceans, with estimates of four to twenty-three times greater concentration. This affects soil health and biodiversity.	(Bodor et al., 2024)

Effect	Description	Source
Impacts on human health	Microplastics can harm cells, potentially resulting in severe health problems, including cancer, respiratory diseases, and reproductive disorders. Additionally, harmful additives found in plastics can interfere with hormonal functions.	(Zhao et al., 2024)
Airborne microplastics	Microplastics are found in the air, with studies showing significant deposition rates. Inhalation can lead to health risks, including respiratory issues.	(Saha & Saha, 2024)
Water contamination	Plastics in water bodies can carry harmful chemicals and pathogens, affecting aquatic life and human health through contaminated drinking water.	(Haleem et al., 2024)
Marine environment	Plastic waste in oceans harms marine life through ingestion and entanglement, while microplastics can accumulate in the food chain, impacting biodiversity.	(G. G. N. Thushari & Senevirathna, 2020b)
Economic costs	The global health costs associated with plastic pollution are estimated to be in the hundreds of billions annually, due to diseases linked to plastic exposure.	(Nayanathara Thathsarani Pilapitiya & Ratnayake, 2024b)
Climate change interaction	Plastic production and waste contribute to greenhouse gas emissions, exacerbating climate change and its health impacts.	(Sharma et al., 2023)

2.5 PLASTIC WASTE MANAGEMENT

Waste is material that may lack primary economic value but can possess secondary intrinsic value (*National_3R_Strategy*, 2010). To achieve environmental sustainability, addressing waste prevention, reduction, minimization, and treatment presents significant challenges. Municipal authorities play a crucial role

in waste management, which encompasses waste collection, storage, and transportation. This process is divided into two main categories: primary and secondary collection. Primary collection involves gathering waste directly from residential and commercial areas and transporting it to disposal sites. Secondary Collection involves collecting waste from community bins and storage depots, which is then transferred to processing sites for recycling or disposal.

The recycling of plastic waste is particularly complex due to the variety of plastic types and the high costs associated with separation. Statistics indicate that only 9% of plastics are recycled, while the majority end up in landfills or the natural environment. Recycling plastics is essential for reducing the demand for natural resources. It can also be economically viable, as recycled materials are often in high demand. Additionally, plastic waste recycling contributes to resource conservation and reduces greenhouse gas (GHG) emissions, such as through the production of fuel from plastic waste.

However, incinerating plastics can lead to the release of harmful pollutants like NO_x and HCl, which contribute to secondary pollution. On the other hand, oil produced from the pyrolysis of plastics has a high calorific value comparable to commercial fuels. Landfilling is another waste management strategy aimed at isolating waste from the environment, controlling moisture, and slowing decomposition to prevent groundwater contamination and protect human health. Waste in landfills is compacted to minimize volume and covered with soil. Since most plastics are non-biodegradable, they persist in landfills indefinitely, which also requires significant land space.

2.5.1 RECYCLING OF PLASTIC WASTE

The efficient recycling of plastic waste allows its use as essential components in composites, mortar, and concrete. Additionally, it can be incorporated into building materials, functioning as part of the cementitious

binder, filler, or aggregates (Saikia & Brito, 2012). Studies have shown the benefits of using recycled waste plastic as an ingredient in nanocomposite materials from PET, fiber applications, plastic chips, and earth bricks (Novák et al., 2023). Waste plastics are a major problem in developing countries such as Indonesia, Vietnam, India, Kenya, and Malaysia, where efficient collection and recycling systems often do not exist. For example, in Nairobi, Kenya, recycled plastic waste has been successfully used to produce eco-friendly construction bricks. Similarly, India has made strides in recycling PET for applications like triboelectric nanogenerators (TENG) (Lai et al., 2022). Malaysia imports plastic waste for recycling purposes and has developed infrastructure to process it. These examples highlight the potential of innovative recycling approaches in addressing the plastic waste challenge in developing nations (Lai et al., 2022). Plastic-bonded sand composites provide a low-cost recycling alternative for selected waste plastics. Recycling of multilayer plastic packaging materials is now done by solvent-targeted recovery and precipitation (**Fig: 2.5**) (Walker et al., 2020).

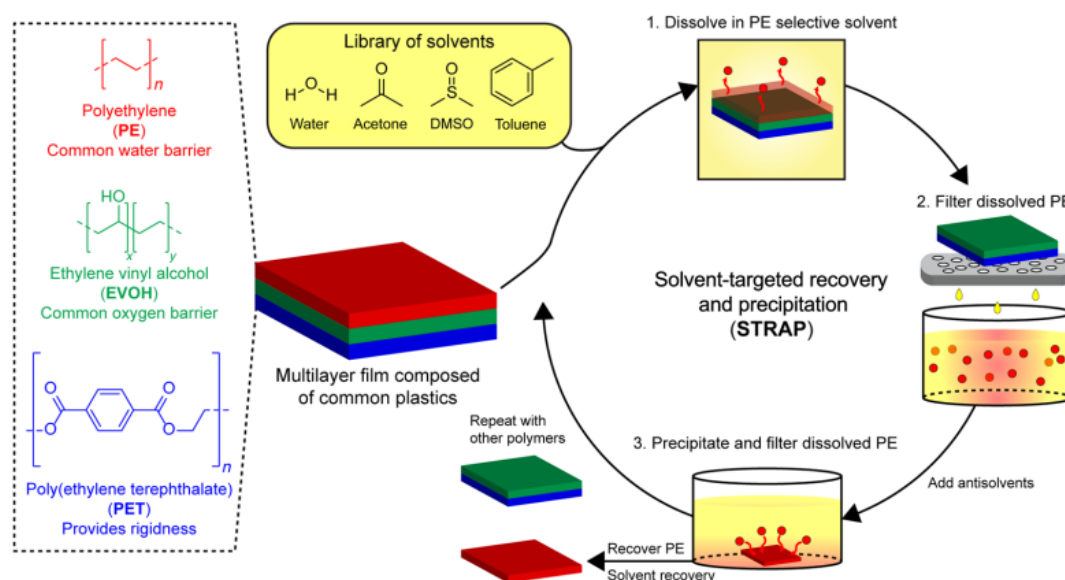


Fig. 2.5 Overview of the STRAP process. Schematic representation of a multilayer plastic process for segregating these component resins into pure, recyclable streams using a series of solvent washes (Walker et al., 2020).

The potential applications and implications of processing waste plastics in developing countries into plastic-bonded sand are discussed, concrete blocks, and other products. Waste plastics have been used as aggregate for manufacturing lightweight concrete (Gu & Ozbakkaloglu, 2016).

2.5.2 INCINERATION

The process of burning waste is now important in the production of clean energy from natural resources such as biomass. More than 450 times throughout Europe, incineration—including heat recovery—was applied in a separate region of the world. An effective strategy for reducing solid waste involves controlled combustion under well-designed and operated conditions through incineration. Municipal incinerators offer significant advantages, such as requiring less land and efficiently harnessing energy. Despite this recognition, waste incineration provides additional benefits, including volume reduction, swift disposal without slow biodegradation, decreased land necessity, elimination of toxic wastes, enhancement of waste value, and electricity generation. Burning waste to recover energy offers an alternative approach to the management of municipal solid waste (Matuana et al., 1998).

2.5.3 PYROLYSIS

Pyrolysis, also known as thermolysis, is an essential chemical recycling technology that involves the breakdown of organic compounds in the absence of oxygen and under the influence of heat. The use of pyrolysis technology offers a different strategy for upgrading plastic waste and maximizing its potential uses. Plastic residues undergo thermal degradation into smaller intermediate species in an inert atmosphere at moderate pressure and temperature (about 400°C and 3.5 MPa) (Wijayanti et al., 2022). Pyrolysis could serve as a viable option for recovering discarded streams of waste from sorting facilities, especially in cases where there is a separation and classification of packing and packaging plastic

waste (Adrados et al., 2012). To prevent environmental pollution and address energy crisis concerns simultaneously, there is a need for a sustainable and dependable plastic waste management plan in the long term. Pyrolyzing plastic waste is a thermochemical disposal technique that not only tackles these challenges but also recycles valuable resources, including oil and gas (Maqsood et al., 2021). Pyrolysis, as a thermochemical approach for managing plastic waste, provides a promising solution to various issues associated with plastic waste pollution and generates valuable energy products such as gas and oil. Due to the cumulative advantages of PSW pyrolysis over combustion and gasification in terms of lowering carbon emissions and environmental pollution, as well as the reduction of plastic product carbon footprint, this process has gained popularity (Kunwar et al., 2016). Worldwide, the research on producing fuel from plastic waste is highly challenging. Among the various methods such as thermochemical, hydrocracking, and catalytic conversion, thermochemical/pyrolysis stands out as the dominant approach. Thermochemical recycling methods, such as pyrolysis, have been suggested as processes that generate a range of purified petrochemical products notably a liquid fraction closely resembling commercial gasoline (Achilias et al., 2007).

2.5.4 LANDFILL

Since the mass production of plastics began in the 1950s the worldwide accumulation of plastic waste is approximated to be 6.3 billion tons, with 79% deposited in both landfills and the natural environment. Throughout history, landfills have consistently been the primary approach for organized waste disposal and remain widely utilized in many regions around the world (P. Singh & Sharma, 2016b). Landfilling is an easy option for getting rid of waste, but it has become more expensive and is no longer acceptable in many countries due to rising consumption, a decline in available space for disposal, and possible environmental risks from the polymer's chlorine content (Mantia, 1996).

Presently, the usual practice in several developing countries is to dispose of plastic waste in landfills. Less than 1% of all plastic waste produced in Iran is recycled and the rest is disposed of in landfills (Behboudi et al., 2011; Nakamura et al., 2009; Park et al., 2007; Sadat-Shojai & Bakhshandeh, 2011). By 2020, it's projected that 2.8 million tons of PVC trash annually will need to be disposed of in landfills. Landfilling pollutes the environment and consumes a lot of land. Plastic waste landfilling should be avoided and by 2025, the European Commission wants to have zero plastic waste landfilling (Ma et al., 2016).

2.6 MUNICIPAL SOLID WASTE MANAGEMENT CHALLENGES IN URBAN AREAS OF DEVELOPING COUNTRIES

Municipal solid waste management (MSWM) is a significant challenge for urban areas, especially in developing countries, due to rapid urbanization, lack of technical and financial capacity, and low policy priority (Zhang et al., 2024a). This is particularly problematic in informal settlements, where only a few wastes are regularly collected (Uddin, 2018). Key challenges include a lack of public awareness and participatory approach, inadequate waste storage and collection, poor infrastructure and lack of funding, and lack of data and planning. Potential solutions involve improving public awareness and stakeholder involvement, enhancing waste collection and transportation, investing in infrastructure and funding, promoting rural development, and adopting sustainable waste management practices (Jerin et al., 2022a). Addressing these challenges requires a comprehensive approach involving stakeholder engagement, data-driven planning, and sustainable waste management practices to ensure a socially favorable, economically viable, and environmentally sound waste management system in urban areas of developing countries.

A table (**Table 2.2**) presents a detailed overview of the key challenges associated with municipal solid waste management in urban areas of developing countries.

Table 2.2 Overview of the key challenges associated with municipal solid waste management in urban areas of developing countries

Challenge	Description	Impact	Source
Inadequate service coverage	Many urban areas lack comprehensive waste collection services, with estimates indicating that 50-70% of waste is uncollected.	Leads to illegal dumping, environmental pollution, and health hazards.	(Bhuiyan, 2010)
Operational inefficiencies	Waste management systems often suffer from inefficiencies due to poor infrastructure, lack of trained personnel, and insufficient funding.	Results in increased costs and reduced effectiveness of waste management efforts.	(Bundhoo, 2018)
Limited recycling activities	Recycling rates are low due to a lack of awareness, infrastructure, and economic incentives.	Contributes to higher volumes of waste sent to landfills.	(Matter et al., 2015)
Hazardous waste management	Inadequate management of hazardous waste, including electronic and medical waste, poses serious health risks.	Increases the potential for environmental contamination and public health crises.	(Hannan & Aigbogun, 2021)
Open dumping and burning	Open dumping and burning of waste are leading to air and soil pollution.	Contributes to GHGs emissions and health risks for nearby communities.	(dos Muchangos & Tokai, 2020)

Challenge	Description	Impact	Source
Informal sector involvement	A significant portion of waste management is handled by the informal sector, which lacks regulation and support.	Workers face health risks, and the sector is often overlooked in formal waste management planning.	(Tong et al., 2021)
Lack of public awareness	Limited public knowledge about waste segregation and management practices hampers effective waste management.	Results in contamination of recyclables and increased waste generation.	(Jerin et al., 2022b)
Financial constraints	Insufficient funding for waste management services leads to inadequate infrastructure and service provision.	Limits the ability of municipalities to implement effective waste management strategies.	(Zhang et al., 2024b)
Rapid urbanization	Increasing urban populations exacerbate overwhelming current systems.	Leads to increased waste generation and strain on municipal services.	(Ashikuzzaman & Howlader, 2019)
Policy and regulatory gaps	Weak policies and a lack of enforcement hinder the development of effective waste management systems.	Results in inconsistent practices and inadequate response to waste management challenges.	(Salvia et al., 2021)

2.7 SUSTAINABLE WASTE MANAGEMENT FOR ENVIRONMENTAL DEVELOPMENT

Sustainable waste management is critical for enhancing environmental health and promoting urban development, particularly in rapidly urbanizing regions. Effective waste management practices mitigate the adverse impacts of waste accumulation, such as air and water pollution, which pose significant risks to public health and ecosystem integrity. Research indicates that unsustainable waste management practices, prevalent in many developing countries, exacerbate environmental degradation and health issues, disproportionately affecting marginalized communities (Ferronato & Torretta, 2019). The improper disposal of waste can lead to the contamination of drinking water sources and the emission of harmful greenhouse gases, further contributing to climate change (Bolan et al., 2024). Conversely, sustainable waste management approaches—such as waste reduction, recycling, and energy recovery—can conserve natural resources, reduce pollution, and create economic opportunities through job creation in the recycling and waste processing sectors (Mashudi et al., 2023). Moreover, integrating environmentally friendly technologies and community education into waste management policies can enhance public awareness and participation, leading to improved health outcomes and a more resilient urban infrastructure.

2.8 MATERIAL FLOW ANALYSIS (MFA)

2.8.1 DEFINITION

MFA is a systematic methodology used to quantify and analyze the flow of materials within a defined system over time, providing insights into resource utilization and sustainability (M. T. Islam & Huda, 2019). Defined by Brunner and Rechberger, MFA involves the accounting of material inputs, outputs, and stocks, adhering to the principle of mass conservation, which asserts that the total mass of materials entering a system must equal the total mass exiting it,

accounting for any losses or accumulations (P. Brunner & Rechberger, 2016). MFA is applicable across various contexts, including industrial processes, urban waste management, and national resource assessments, and can be utilized in both static and dynamic forms; static MFA provides a snapshot of material flows at a specific point in time, while dynamic MFA allows for projections of future material flows based on historical data (Allesch & Brunner, 2016). The versatility of MFA makes it a critical tool for identifying inefficiencies, informing policy decisions, and promoting sustainable practices within anthropogenic systems, thereby supporting the transition toward a circular economy that minimizes waste and maximizes resource recovery.

2.8.2 PURPOSE OF MATERIAL FLOW ANALYSIS IN WASTE MANAGEMENT

MFA has emerged as a vital tool in waste management, particularly for assessing and improving municipal solid waste (MSW) systems. MFA facilitates a comprehensive understanding of material flows within waste management frameworks, allowing for the identification of waste generation sources, recycling opportunities, and inefficiencies in current practices. Recent studies, such as one conducted in Bogor, Indonesia, utilized MFA to evaluate local waste management strategies, revealing significant potential for recycling and recovery of inorganic waste, while highlighting the need for improved waste processing methods like establishing waste banks and organic waste recycling through methods such as Maggot BSF cultivation (Ratnawati et al., 2023). Additionally, research in the Banja Luka region of Bosnia and Herzegovina demonstrated how MFA can model waste management scenarios, emphasizing the importance of separate collection and recycling over mere disposal (Topić et al., 2013). The integration of MFA with Life Cycle Assessment (LCA) has also been advocated to enhance decision-making in waste management, as seen in studies from Bangkok, Thailand, which aimed to quantify waste mass balances and evaluate

providing data-driven insights that inform policymakers, enabling the creation of effective regulations and initiatives aimed at waste reduction. Furthermore, MFA facilitates sustainable practices by illuminating material flows, promoting recycling efforts, and ultimately reducing environmental impacts.

Table 2.3 Importance and challenges of MFA in waste management.

Purpose of MFA	Description	Benefits	Challenges	Source
Assessing waste management strategies	Systematically examines the flow and stock of materials within a defined system.	Provides the insights into effectiveness of current waste management practices.	Requires accurate data collection, which can be resource intensive.	(Makarichi et al., 2018)
Identifying waste generation sources	MFA helps in pinpointing the sources of municipal solid waste (MSW) generation, facilitating targeted waste reduction efforts.	Enables municipalities to develop focused interventions for waste minimization and recycling.	Data availability and reliability can be problematic, especially in developing regions.	(Tang & Brunner, 2014)
Supporting policy development	MFA informs a comprehensive understanding of material flows, supporting the creation of effective waste	Enhances the ability to design policies that promote recycling and sustainable waste management practices.	Policy implementation can be hindered by political and economic constraints.	(Ratnasari et al., 2023)

Purpose of MFA	Description	Benefits	Challenges	Source
	management policies.			
Evaluating environmental impacts	MFA can be integrated with life cycle assessment (LCA) to evaluate the environmental impacts of different waste management options.	Allows for a more holistic understanding of the environmental benefits and burdens associated with waste management practices.	Complexity of integrating MFA with LCA can be challenging and require specialized knowledge.	(Barkhausen et al., 2023)
Facilitating circular economy	MFA supports the transition towards a circular economy by identifying opportunities for material recovery and reuse.	Promotes sustainable resource management and reduces reliance on virgin materials.	Transitioning to a circular economy requires systemic changes and stakeholder collaboration.	(Hartley et al., 2020)
Quantifying material stocks and flows	MFA quantifies the stocks and flows of materials in waste management systems, providing a basis for	Helps in understanding material efficiency and identifying potential losses in the system.	Accurate quantification can be difficult due to variability in waste composition and generation rates.	(Wiedenhofer et al., 2019)

Purpose of MFA	Description	Benefits	Challenges	Source
	performance evaluation.			
Enhancing public awareness	By visualizing material flows, MFA can communicate waste management issues to the public and stakeholders effectively.	Increases public engagement and support for waste management initiatives.	Public understanding of complex material flows may still be limited.	(Zhang et al., 2024b)

2.8.3 MFA IN UNDERSTANDING WASTE FLOWS AND IDENTIFYING RECYCLING OPPORTUNITIES

MFA is a crucial tool for understanding waste flows and identifying recycling opportunities (Allesch & Brunner, 2015). MFA systematically examines the flow and stock of materials within a given system, providing insights into resource efficiency and sustainability. By quantifying the flow of resources, such as raw materials, energy, and waste, MFA can help identify hotspots of resource depletion, pollution, or waste generation (Kasavan et al., 2021). This information is particularly valuable for waste management planning, as MFA can be used to evaluate an entire waste management hierarchy or a single waste stream. Several studies have employed MFA to model waste management scenarios and identify opportunities for improvement. For instance, MFA can help analyze the flow of plastics within a city, tracking the distribution, consumption, and disposal pathways to identify inefficiencies and provide insights into promoting recycling initiatives, reducing plastic usage, or enhancing waste management systems (Allesch & Brunner, 2016; Kasavan et al., 2021; Ratnawati et al., 2023). By adhering to principles such as clearly defining system boundaries, mass balance,

and quantitative data collection, MFA provides a structured framework for understanding material movements and aiding in decision-making for resource management and sustainability.

2.9 SDGs AND WASTE MANAGEMENT

2.9.1 SOLID WASTE MANAGEMENT AND THE SDGs

Solid waste management (SWM) plays a crucial role in achieving the United Nations Sustainable Development Goals (SDGs), despite not being explicitly mentioned in any of the 17 goals (Rinasti et al., 2022). Effective SWM strategies contribute significantly to several SDGs, particularly Goal 11 (Sustainable Cities and Communities) and Goal 12 (Responsible Consumption and Production) (Bowen, 2023). These strategies encompass practices such as reducing waste generation, promoting recycling, and ensuring environmentally sound disposal methods. By improving waste management systems, societies can mitigate environmental impacts, enhance public health, and foster economic development. For instance, sustainable waste management can reduce greenhouse gas emissions, improve urban air quality, and create job opportunities, thereby addressing multiple SDG targets simultaneously.

Moreover, the integration of circular economy principles into SWM not only minimizes waste but also maximizes resource efficiency, aligning with the broader objectives of sustainable development. Overall, the interconnection between SWM and the SDGs underscores the importance of adopting comprehensive waste management practices to foster a sustainable future for all.

2.9.2 MFA IN ACHIEVING SDGs.

Solid waste management (SWM) is intrinsically linked to several Sustainable Development Goals (SDGs) (**Fig. 2.7**), notably SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production). SDG 11.6 emphasizes the need to reduce the adverse environmental

impact of cities, particularly through effective municipal solid waste management, which involves ensuring that waste is collected and treated in controlled facilities.



Fig. 2.7 Solid waste management and SDGs (Rinasti et al., 2022).

Similarly, SDG 12.3 targets the reduction of food waste and promotes sustainable management of resources, aligning with practices that minimize waste generation and enhance recycling efforts (Rinasti et al., 2022). The role of MFA in achieving these goals is significant (**Table 2.4**), as it provides a systematic approach to understanding the flow of materials through economies and ecosystems. MFA helps identify inefficiencies and opportunities for resource recovery within waste streams, facilitating informed decision-making for policy and practice aimed at sustainable waste management. By integrating MFA into waste management strategies, stakeholders can better assess the impacts of waste on the environment and public health, ultimately contributing to the realization of the SDGs and fostering a circular economy.

Table 2.4 MFA in achieving the Sustainable Development Goals (SDGs).

Aspect	Contribution to SDGs	Challenges	Source
Framework for decision-making	Supports SDG 12 (Responsible Consumption and Production) by promoting efficient resource use and waste reduction.	Requires comprehensive data collection.	(Debnath et al., 2023)
Identifying resource efficiency	Contributes to SDG 9 (Industry, Innovation, and Infrastructure) by fostering sustainable industrial practices.	Complexity in analysing diverse material flows can complicate assessments.	(Papamichail et al., 2023)
Supporting circular economy initiatives	Aids in achieving SDG 11 by promoting sustainable urban waste management practices.	Transitioning to a circular economy requires systemic changes.	(Azizi et al., 2023b)
Environmental impact assessment	Supports SDG 13 by identifying opportunities to reduce greenhouse gas emissions through better waste management.	Integrating MFA and LCA can be technically challenging and resource intensive.	(Bisinella et al., 2024)
Policy development and evaluation	Contributes to SDG 16 (Peace, Justice, and Strong Institutions) by promoting transparent governance in waste management.	Political will and enforcement of policies can be inconsistent, hindering effective implementation.	(Makarichi et al., 2018)
Enhancing public awareness	Supports SDG 4 (Quality Education) by fostering awareness	Public comprehension of complex material	(Zulkipli et al., 2022)

Aspect	Contribution to SDGs	Challenges	Source
	and education on sustainable waste practices.	flows may still be limited, requiring effective communication strategies.	
Integrating economic consideration	Aids in achieving SDG 8 (Decent Work and Economic Growth) by identifying economic opportunities in waste reduction and recycling.	Economic constraints may limit the adoption of MFA in smaller enterprises.	(Garbelini Anuardo et al., 2023)
Environmental protection	Supports SDGs 3, 6, 14, and 15 by identifying pollution sources and material leakages	Requires comprehensive data collection.	(Debnath et al., 2023)

2.10 CASE STUDIES AND COMPARATIVE ANALYSIS

2.10.1 SIMILAR STUDIES CONDUCTED IN OTHER URBAN TERRITORIES

MFA highlights various urban initiatives aimed at addressing the growing crisis of plastic pollution. Studies from diverse urban territories indicate a common theme: cities are grappling with substantial plastic waste due to rapid urbanization and inadequate waste management systems (**Table 2.5**). Research conducted in South Korea emphasizes the integration of informal waste collectors into formal recycling systems, significantly improving recovery rates (Matter et al., 2013). Similarly, initiatives in Italy and Spain demonstrate the effectiveness of robust recycling frameworks and community engagement in enhancing plastic waste management (Aprile & Fiorillo, 2019). The study underscores the need for a comprehensive operational framework to manage plastic waste effectively, drawing lessons from global practices that highlight the

importance of stakeholder collaboration and innovative local solutions to mitigate plastic pollution impacts in urban environments.

Table 2.5 Comparison of different countries with various attributes.

Attribute	South Korea	Italy	Spain	Other Urban Areas
Key focus	Integration of informal waste collectors	Robust recycling frameworks	Community engagement	Comprehensive operational framework
Main strategy	Incorporating informal sector into formal recycling systems	Implementing advanced recycling technologies	Promoting public participation in waste management	Developing holistic waste management approaches
Impact on recovery rates	Significant improvement	Moderate to high improvement	Moderate improvement	Varied, depending on implemented strategies
Stakeholder involvement	High (formal and informal sectors)	Medium (primarily formal sector)	High (community-driven)	Varied, emphasis on collaboration
Innovation level	Medium (system integration)	High (technological solutions)	Medium (social initiatives)	High (diverse local solutions)
Urban context	Dense urban areas	Mixed urban and suburban	Primarily urban	Diverse urban environments

Attribute	South Korea	Italy	Spain	Other Urban Areas
Challenges addressed	Informal sector integration, waste collection efficiency	Technological barriers, recycling capacity	Public awareness, behavior change	Varied, including rapid urbanization and inadequate systems

2.10.2 COMPARATIVE ANALYSIS OF WASTE MANAGEMENT PRACTICES BETWEEN BANGLADESH AND OTHER COUNTRIES.

The comparative analysis of waste management practices between Bangladesh and other countries reveals significant efficiency, infrastructure, and regulatory framework disparities. In Bangladesh, studies indicate that municipal solid waste management (MSWM) is still developing, characterized by informal collection systems and limited recycling capabilities. Researchers from Khulna highlight that the average waste generation is approximately 0.472 kg per person per day, with a notable portion being organic waste, yet only a fraction is effectively recycled due to inadequate infrastructure and policy support (Noman et al., 2023). In contrast, countries like South Korea and Italy have established comprehensive waste management systems that integrate formal and informal sectors, resulting in higher recycling rates and better resource recovery (Aprile & Fiorillo, 2019). South Korea's approach emphasizes community engagement and legislative support, which has led to significant improvements in waste diversion from landfills (Matter et al., 2013). Furthermore, while Bangladesh's per capita plastic consumption remains low compared to developed nations, the rapid urbanization and anticipated increases in plastic use necessitate urgent reforms to align with global best practices in waste management (Abdullah & Abedin, 2024). This comparative perspective underscores the need for Bangladesh to

develop a robust legal framework and institutional capacity to enhance its waste management systems, drawing lessons from more advanced practices observed in other urban territories.

2.10.3 WASTE MANAGEMENT STRATEGIES

Effective waste management is increasingly recognized as essential for environmental sustainability, public health, and economic efficiency (Hajam et al., 2023). The hierarchy of waste management strategies prioritizes prevention and minimization, followed by recycling and reuse, biological treatment, incineration, and, as a last resort, landfill disposal (Ferrari et al., 2016). Research highlights the importance of integrating public-private partnerships and community involvement in waste management programs, as seen in successful cases from Brazil where governance structures facilitated the inclusion of informal waste collectors (Zhang et al., 2024a). Additionally, innovative recycling programs and waste-to-energy initiatives have shown promise in reducing landfill use and conserving resources, underscoring the need for adaptive strategies that consider local contexts and stakeholder engagement (Osama & Lamma, 2021). Moreover, data accuracy and project planning are critical for the success of waste management initiatives. Lessons from local authorities indicate that thorough preparation and the involvement of experienced project managers can significantly enhance project outcomes.

Overall, Effective waste management requires a multifaceted approach that combines technological advancements, community participation, and sound governance. This approach should prioritize prevention, minimization, recycling, and reuse, followed by biological treatment, incineration, and landfill disposal as a last resort. Public-private partnerships and community involvement, such as integrating informal waste collectors, are crucial for success. Innovative recycling programs and waste-to-energy initiatives can reduce landfill use and conserve resources. Additionally, accurate data and

thorough project planning are essential for achieving sustainable waste management goals that adapt to local contexts and engage stakeholders effectively.

2.11 POLICY FRAMEWORK

2.11.1 OVERVIEW OF EXISTING POLICIES RELATED TO WASTE MANAGEMENT IN BANGLADESH.

Bangladesh reveals a complex landscape shaped by rapid urbanization, population growth, and environmental concerns. The primary legislative framework is anchored in the Bangladesh Environment Conservation Act of 1995, which has been amended to include provisions for solid waste management, notably the Solid Waste Management Rules established in 2021. These rules emphasize extended producer responsibility (EPR) and outline procedures for the collection, transportation, and disposal of waste, including hazardous materials. Despite these frameworks, the implementation remains a significant challenge. Studies indicate that the awareness and adherence to these regulations among producers are lacking, leading to inadequate waste processing and increased environmental pollution. The national 3R (Reduce, Reuse, Recycle) strategy, initiated in 2010, aims to promote sustainable waste practices, yet its effectiveness is hampered by insufficient infrastructure and public education. Furthermore, specific policies targeting plastic waste, such as the Jute Packaging Act of 2010, reflect the government's commitment to sustainable practices but face obstacles like public ignorance and inadequate recycling facilities. Overall, while Bangladesh has established a foundational legal framework for waste management, the effectiveness of these policies is contingent upon improved enforcement, public awareness, and infrastructure development to meet the growing waste management needs of its urban population.

2.11.2 LAWS AND POLICIES RELATED TO PLASTIC WASTE MANAGEMENT IN CHATTOGRAM

The Government of Bangladesh (GoB) has established a robust regulatory framework for solid waste management (SWM), comprising Acts, Rules, Policies, and Strategies. These documents, such as the Environment Conservation Act of 1995 and the Solid Waste Management Rules 2021, primarily assign responsibilities to local government institutions like municipalities (“Assessment of the Legal Framework Regulating Waste Management in Bangladesh,” 2022). In Chittagong, the Chittagong City Corporation (CCC) has not yet formulated specific plans or policies for effective SWM. Still, it diligently maintains comprehensive waste management data, essential for future planning. CCC aims to develop a plan for the overall waste collection and transportation system, potentially collaborating with the JICA Project Team (JPT), to progress towards an integrated SWM plan that includes aspects beyond collection and transportation, such as landfill site management and waste reduction. However, specific commitments or timelines from CCC have not been publicly announced in media forums or meetings. Typically, such announcements would be made through official city corporation meetings, media briefings, or public forums, but as of now, there is no detailed information available on specific plans or timelines.

2.12 SUMMARY

The literature review highlights the increasing challenges posed by economic growth and population expansion, which have intensified the generation of solid waste, including plastics. The review discusses various methodologies employed in previous studies, including MFA, which is utilized to assess waste management systems effectively. It emphasizes the importance of understanding waste composition, generation rates, and disposal practices to formulate effective management strategies. The review also identifies gaps in

existing research, particularly regarding the integration of informal waste management sectors and the need for improved recycling rates. Furthermore, it underscores the environmental impacts of mismanaged waste, such as greenhouse gas emissions from landfills, and advocates for sustainable practices that align with global Sustainable Development Goals (SDGs). Overall, the literature review establishes a foundation for the thesis by contextualizing the significance of effective plastic waste management in urban settings and the necessity for comprehensive strategies to address these challenges.

Chapter 3. METHODOLOGY

3.1 GENERAL

The methodology section details the application of the Waste Wise Cities Tool (WaCT) and the STAN software to assess and improve municipal solid waste (MSW) management practices, particularly focusing on plastic waste. The WaCT, developed by UN-Habitat, will guide the data collection process on waste generation, collection, and management, engaging various stakeholders to establish a baseline for the city's waste management system. The Waste Flow Diagram (WFD) and stakeholder engagement workshops will provide visual representations of waste flows and identify plastic leakage points. The STAN software will then be utilized to perform a detailed materials flow analysis (MFA), integrating data from the WaCT to model material flows within the waste management system and estimate plastic waste emissions. By employing both the WaCT and STAN, this thesis aims to contribute to a deeper understanding of plastic waste dynamics in Chattogram, ultimately guiding policy recommendations and practical interventions for improved waste management practices.

3.2 STUDY AREA

Chattogram City Corporation (CCC), situated between 22°13' to 22°27' north latitude and 91°40' to 91°53' east longitude, is notable for its diverse natural features such as mountains, rivers (Karnaphuli, Halda, and Sangu), seas, forests, and valleys (**Fig. 3.1**). The region experiences an annual mean temperature that varies from 22 to 32 °C in summer and 20–26 °C in the winter, with an average annual rainfall of 2,889.7 mm (Naim & Kafy, 2021). The CCC serves a population of 3,230,262 over an area of 155.4 square kilometers (BBS, 2023). In the urban areas of Chittagong City, the soil types include sandy loam, loamy sand, and silt loam, with sand content varying from 53% to 83% (Alamgir et al., 2016). Twenty-one

(21) plastic recycling factories in Chattogram export plastic flakes to various countries such as China, Belgium, Vietnam, and India (The Daily Star, 2022). The city also has a deep harbor, which significantly boosts its commerce, business, and industrial activities.

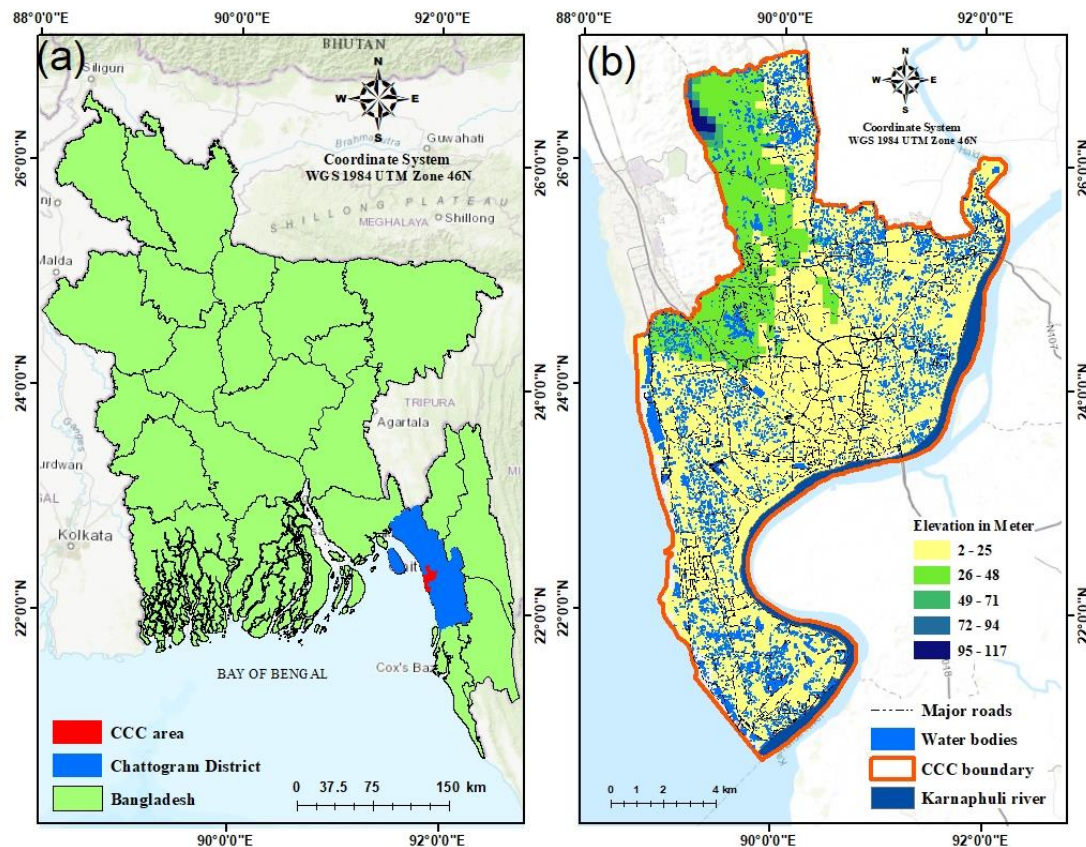


Fig. 3.1 Location map of the study area: a) Bangladesh and b) CCC area (Naim & Kafy, 2021).

3.3 CURRENT WASTE MANAGEMENT SYSTEM OF CHATTOGRAM CITY CORPORATION

Chattogram City, the largest port city and the second most populous in Bangladesh is particularly vulnerable to environmental challenges due to the accumulation of uncollected waste on the streets and in other public areas. Although the CCC has yet to formulate a comprehensive plan, policy, or strategy for effective Solid Waste Management (SWM), it is currently maintaining the necessary data to develop a robust waste management strategy encompassing

collection, transportation, and landfill management, with support from an international cooperation agency. The primary waste collectors, locally known as "Sebok," begin their operations around 2:00 pm, collecting household (HH) waste as well as commercial waste from markets, restaurants, and offices. They use rickshaw vans or tri-cycle tom-toms for transportation and perform minimal segregation of recyclable materials such as PET bottles, plastics, metals, leather bags, and pots during door-to-door collection. After gathering the waste, the primary collectors unload it either at nearby container locations or directly into waiting compactor machines (CM), open trucks (OT), or dump trucks (DT) stationed at selected points. Sometimes, they deposit the waste at secondary transfer stations (STS) or open spots near roadsides and drains. A schematic diagram of the current waste generation, collection, and transportation plan in CCC is shown in **Fig. 3.2**.

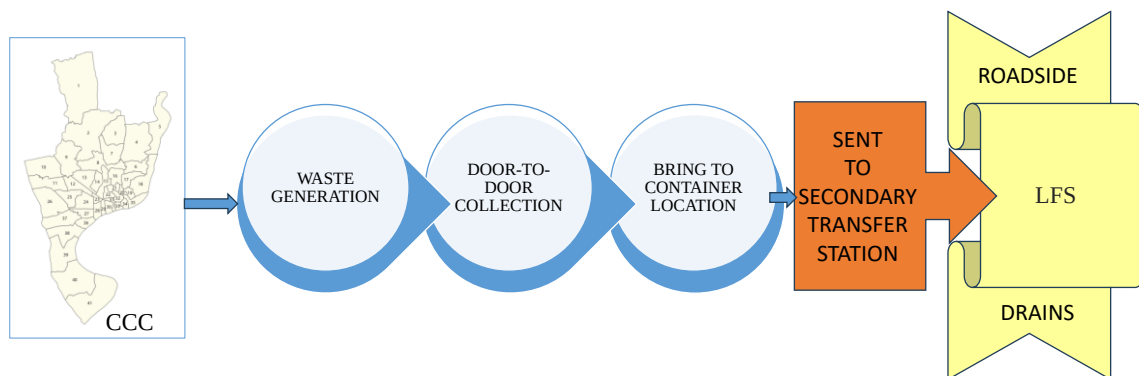


Fig. 3. 2 Current waste generation, collection, and transportation plan in CCC.

A feasibility study reports that the CCC has 888 secondary waste collection points, of which 58% are open spots and 29% are concrete bins (CCC, 2020). The open dumping areas cover 2,838 m² and are highly susceptible to waste leakage from rainfall runoff and wind erosion. Currently, only six secondary transfer stations (STS) are operational, but they are poorly utilized due to inadequate road conditions. **Fig. 3.3** shows the tentative routes of STS to final dumping sites, which are not fixed all the time (Debnath et al., n.d.). Additionally, 35 plastic bin

spots and 70 container spots are in operation, yet the total capacity of 655 tons at the secondary waste collection points is insufficient for the city's population.

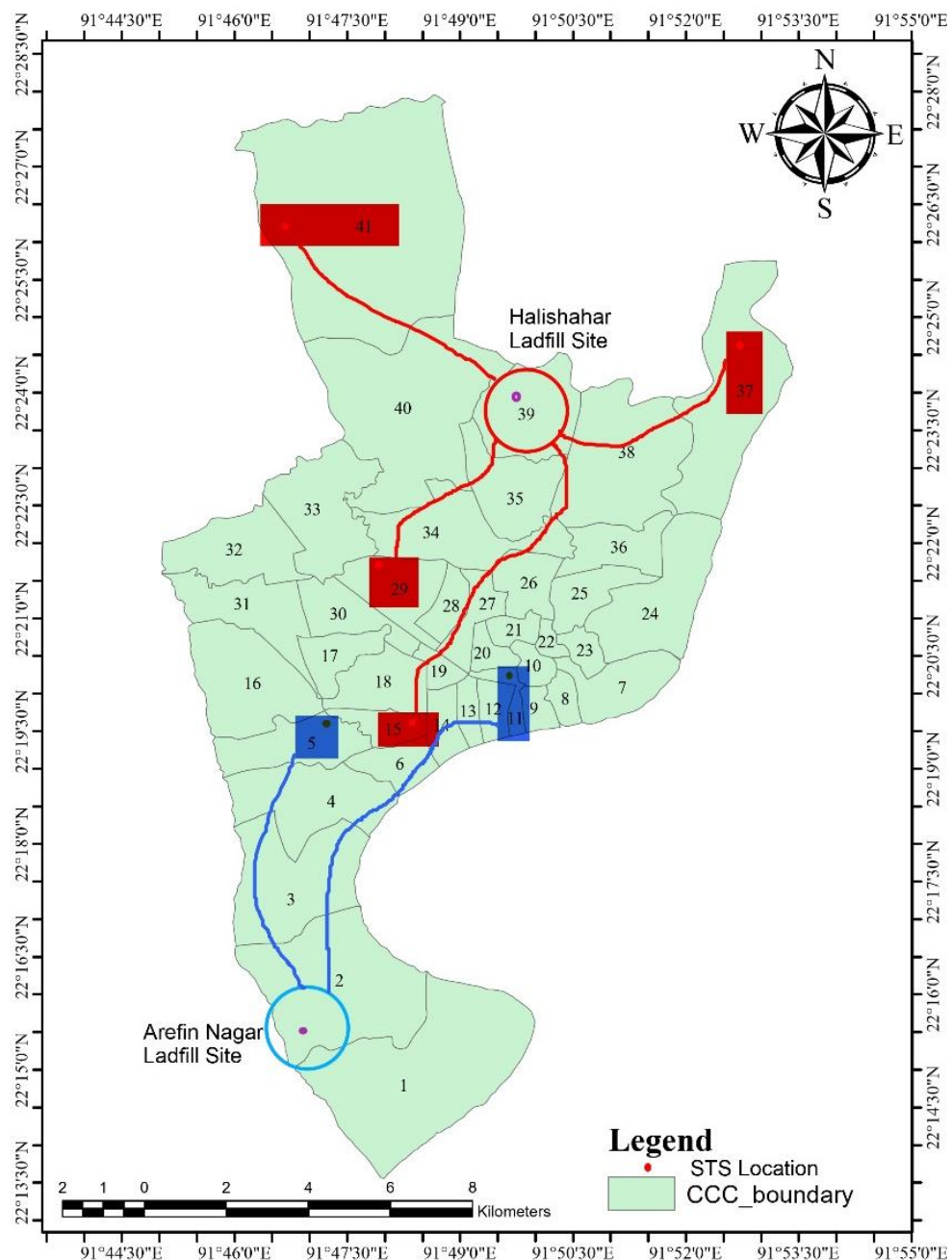


Fig. 3.3 The tentative routes of STS to final dumping sites.

The CCC is divided into north and south zones, with waste from 22 wards directed to the Arefin Nagar Landfill Site (North Zone) and waste from 19 wards sent to the Haulshahar Landfill Site (South Zone) (A. Islam, 2024). The present waste management scenario of Chattogram City Corporation is shown in **Fig. 3.4**.



(a) Blockage of the drain due to waste dumping.



(b) Putting waste through water passing bore by human awareness.



(c) Sample collection at the dumping site.



(d) Recyclers activities in municipal dumping sites.



(e) Present situation of final landfill site (LFS)



(f) Recycling of PET from LFS.

Fig. 3. 4 Present waste management scenario of Chattogram City Corporation.

3.4 DATA COLLECTION

3.4.1 SAMPLE SIZE

Established in 1863, Chattogram Municipality was transformed into a city corporation in July 1990 and is currently divided into 41 wards. The study area (CCC) was selected due to its urban significance, diverse waste generation patterns, and environmental challenges. Five wards—Ward No. 02, 07, 31, 39, and 41—were chosen to represent varying population, commercial importance, and proximity to environmental features. Specifically, South Haliashahar (Ward No. 39), Jalalabad (Ward No. 02), and West Sholoshahar (Ward No. 07) were selected for their high population and corresponding levels of waste generation. Alkaran (Ward No. 31) was included due to its commercial significance and the waste management challenges prevalent in its industrial areas. South Patenga (Ward No. 41), located near a river and popular with tourists, was chosen to highlight the environmental impact of inadequate waste management facilities (**Fig. 3.5**). Collectively, these wards provide a comprehensive overview of the city's plastic waste management issues and infrastructure gaps.

The sample size (n) for the household survey was estimated using the following formula (Ahmed et al., 2017).

$$n = \frac{N \times Z^2 \times p \times (1 - p)}{N \times d^2 + Z^2 \times p \times (1 - p)} \quad (1)$$

Where N is the total number of households (822,882), Z is the level of confidence according to the standard normal distribution ($z = 1.96$ for a 95% confidence level), d is the tolerated margin of error (10%), and p is the estimated proportion of the population exhibiting the characteristic ($p = 0.5$).

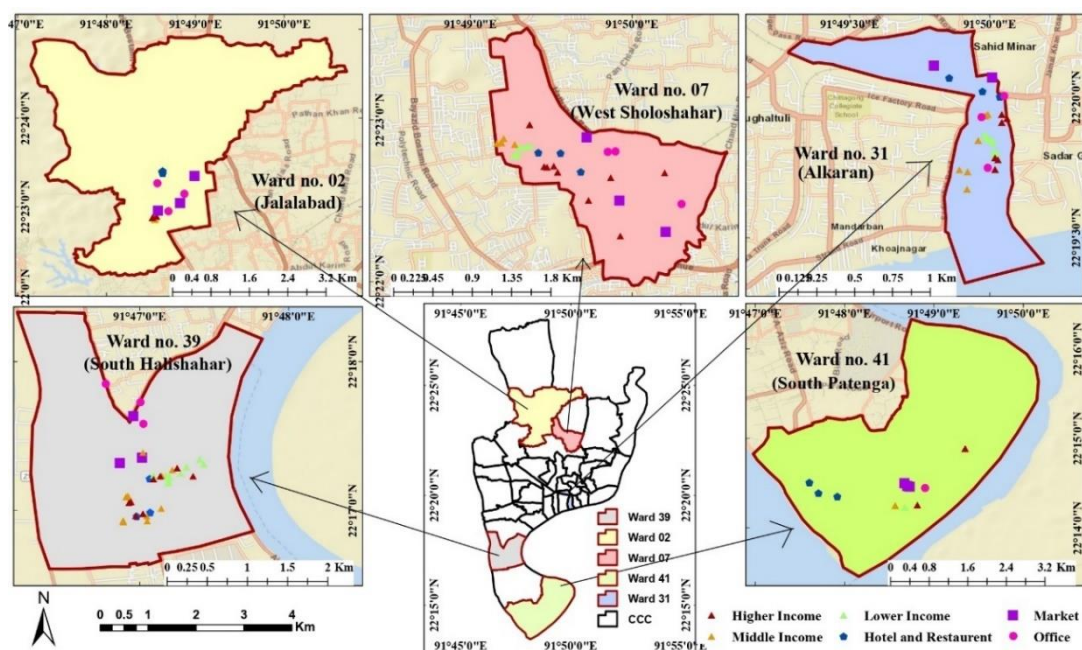


Fig. 3.5 Sample collection points of five different wards.

3.4.2 SAMPLE COLLECTION PROCESS AND GENERATION ASSESSMENT

The datasets used in this study were collected, extracted, and analyzed from both primary and secondary sources. Primary data were collected through on-site investigations, observations, surveys, and interviews with key participants involved in the waste plastic management chains over six months, from September 2023 to March 2024. The UN-Habitat WaCT Tools, previously field-tested in Nairobi (Mombasa) and Mahé Island (UN-Habitat, 2021), were used for primary data collection. As determined using Eq. (1), the required household sample size (n) for waste generation assessment is 96; however, to enhance accuracy, this study included 150 households from three income groups: high, middle, and low (see definition in **Table 3.1**). Specifically, fifty households (10 from each of the five wards) were selected from each income group. Solid waste samples were collected from the households over a 0–7-day period (**Fig. 3.7**), excluding day 0 to avoid carryover effects of waste from the previous day. In total, 1,050 solid waste samples were collected from the households (150 households $\times$ 7 days) (**Appendix A**). Some initial assumptions regarding waste composition and per capita generation rates were informed by reports from other

urban centers, such as the Dhaka North City Corporation (DNCC) Master Plan-2019, due to limited baseline data availability specific to CCC. According to the recommendations outlined in the DNCC master plan for the generation of solid waste, this study considered that household solid waste generation accounts for 61 % of total solid waste. The remaining 39 % of solid waste generation is attributed to various non household sources: markets (10 %), hotels and restaurants (9 %), offices (3 %), and streets (17 %) (DNCC, 2019). Non-household waste samples were collected from three representative locations within each category: markets, hotels & restaurants, offices, and streets. Waste samples were collected from three major public markets known for high footfall and extensive use of plastic packaging; three mid-sized hotels and restaurants with moderate daily customer traffic; three government or private offices with standard operational hours; and three busy commercial street segments characterized by visible litter accumulation (**Appendix D**). These locations were selected based on accessibility, visibility, and typicality, rather than formal stratification by business size or type. Waste samples were also collected from two landfills, 41 municipal dumping sites (one site per ward) (**Appendix C**), and various recycler associations and industries to assess the generation and monitor recycling activities at different stages. The total non-household waste sample size was 463 ((60 facilities × 7 days) + 41 dumping sites + 2 Landfill site).

Secondary data were obtained from reliable institutional sources such as the Japan International Cooperation Agency (JICA), CCC, the Bangladesh Plastic Goods Manufacturers & Exporters Association (BPGMEA), various NGOs, and local recycling industries. These data included historical records on waste generation, landfill operations, and recycling activities, which were used to complement and validate the findings from the primary data collection.

Table 3.1 Definition of income groups (UNDP, 2016; UN-Habitat, 2021).

Income Group	Income Level	Housing Type Examples
High-income group (10% of the total population)	An individual or household's income is categorized as high if it surpasses Tk. 80,000	High-end apartment buildings, detached homes with gardens, and advanced security systems
Middle-income group (50% of the total population)	Over Tk. 10,000 but less than Tk. 80,000	Apartments, a single detached house without a garden
Low-income group /Informal settlements (40% of the total population)	Tk. 10,000 or less	Slums, apartments with single rooms

After collecting MSW samples, they were categorized into plastic waste and organic & other waste. The plastic waste was further classified according to the guidelines set by the Central Pollution Control Board (CPCB), as detailed in **Table 3.2**. Additionally, per capita waste generation was calculated using the simple arithmetic mean, represented by the following Eq. 2 and **Fig 3.6** (Wilson et al., 2010):

$$\text{Per capita waste generation} = \frac{\sum_{i=1}^7 W_i P_i}{p} \quad (2)$$

Where W_i is the waste (in gms) from the specified household, P_i is the number of people present that day, and P is the total population over 7 days.

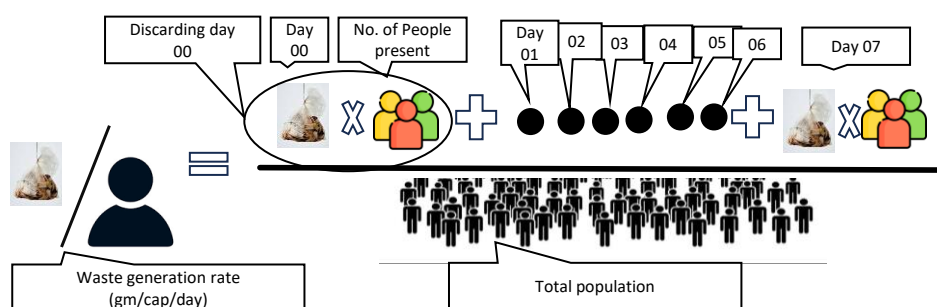


Fig. 3.6 Calculation process of per capita waste generation.

Table 3.2 Classification basis of plastic waste according to CPCB (CPCB, 2015).

Scientific Name	Examples of Application
Polyethylene terephthalate (PET)	Water bottles, soft drink bottles, food jars, cooking oil containers
High-density polyethylene (HDPE)	Bottles, water and sewer pipes, buckets (pails), chairs, detergent bottles
Polyvinyl chloride (PVC)	Food trays, plumbing products, electrical cable insulation, outdoor furniture
Low-density polyethylene (LDPE)	Carrier bags, single-use plastics (SUP), bread bags, food tubs
Polypropylene (PP)	Disposable cups, bottle caps, straws, auto parts, and industrial fiber
Polystyrene (PS)	Boxes and various foam, disposable glasses, plates, spoons, trays
Others (O)	Thermoset plastics, multilayer and laminates, Nylon, fiber-reinforced plastic, CD, melamine plates, helmets, and shoe soles

Additionally, to assess the collection efficiency at landfill sites, this study utilized a weighbridge machine setup facilitated by CCC. This setup involves

weighing garbage trucks before and after dumping waste at the landfill site. The weight difference between the truck's arrival with waste and its departure without waste provides the amount of solid waste received at the landfill site. This method ensures accurate quantification of the waste dumped, enabling the evaluation of collection efficiency at the landfill site. The collection efficiency of CCC at landfill sites is calculated using **Eq. (3)** (Tusiime et al., 2022).

$$\text{Collection Efficiency (\%)} = \frac{C_w}{G_w} \times 100 \quad (3)$$

Where C_w is the collected waste in a landfill from the CCC area in a day, and G_w is the generated waste in CCC on that day.

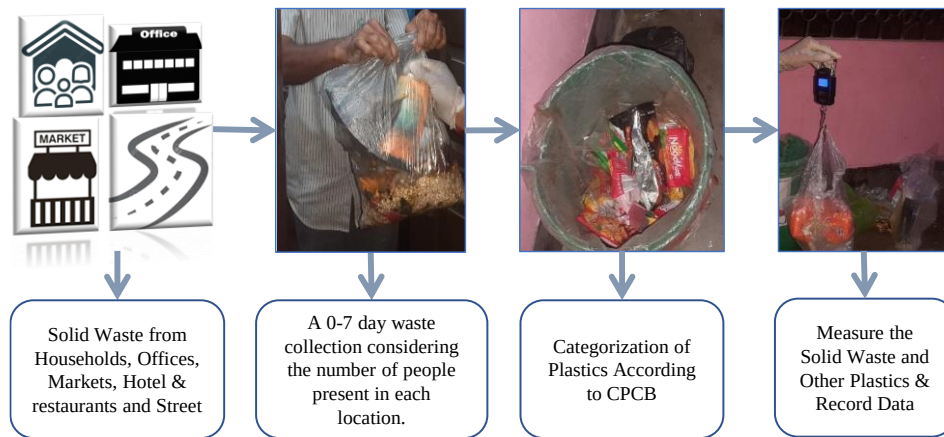


Fig. 3.7 The whole data collection process of waste samples.

3.5 MATERIALS FLOW ANALYSIS

MFA systematically evaluates the flows and stocks of materials within a system defined by specific spatial and temporal boundaries. In MFA, the flows encompass analyzing and quantifying material movement within a defined process. These flows track how materials enter, exit, and move within the system, measured in tons per day (t/day). This study includes various flows related to waste collection, transport, treatment, and final disposal (landfilling or open dumping) within a spatial boundary set to the CCC and a temporal boundary set from September 2023 to March 2024. The collection and transportation flow

covers municipal waste collection systems in both formal and informal sectors. The treatment flow involves intermediaries and nonprofit organizations that handle recyclable materials, and the final disposal flow includes landfills and open dumps that impact the environment. The MFA process is outlined, with specific details provided in **Table 3.3**.

The software STAN is utilized to model the waste management system based on the mass balance principle. Detailed explanations of the software can be found in the work of P. Brunner and Rechberger (2016). According to Stanisavljevic & Brunner (2014), while uncertainties of flows and stocks are acknowledged, they are often inadequately addressed in waste management and MFA studies. This study prioritizes speed and minimal data over detailed accuracy; therefore, uncertainties are not addressed.

Table 3.3 Data evaluation process for MFA.

Process Name	Process Description
System boundary definition	Chattogram City Corporation (CCC)
Plastic inflow data collection	Suppliers, manufacturers, and BPGMEA
Flow and stock data collection	Waste from households, markets, hotels and restaurants, offices, streets, dumping sites or secondary stations, and final dumping sites
Generation analysis of solid waste	Sorting and analyzing the generation of various waste content using mass-volume measurements (Appendix A)

Process Name	Process Description
Generation analysis of plastic waste	Detailed generation analysis of plastic waste, differentiating between LDPE, HDPE, PP, PVC, PS, PET, and other types of plastics (Appendix C).
Recycling data collection	Plastic waste recyclers associations in Chattogram, Local NGOs, YPSA, Field interview of different scrap collectors.
Collection efficiency and flow and stock calculation	Using Eq. (3) for collection efficiency and flow and stock calculation follows the mass balance principle: $\sum Import = \sum Export + \Delta Stock$
Industrial waste generation calculation	Using STAN2.7.101 and the mass balance principle for unknown data calculation (Appendix D)
Creation of Sankey diagram for plastic waste management	Using STAN2.7.101

3.6 INDICATORS DEFINITION

The Global Recovery Indicator (**GRI**) provides a comprehensive view of recycling practices worldwide, aiding policymakers and environmental organizations in tracking progress and identifying areas for improvement. The Formal Recovery Indicator (**FRI**) focuses on assessing recycling activities managed by official entities like governments and organizations. At the same time, the Informal Recovery Indicator (**IRI**) evaluates recycling efforts conducted through informal channels, such as small-scale recyclers and waste pickers, emphasizing their impact on local communities (Villalba, 2020). To develop indicators to enhance understanding of the system's functionality concerning the study's objectives, the MFA system is illustrated in **Fig. 3.8**. To achieve this, first

created a mass balance table, drawing inspiration from the Standard Model of Water Loss by the International Water Association (IWA) (Villalba, 2020). This table served as a foundation for designing the indicators detailed below. According to **Fig. 3.8**,

$$GRI = \frac{F8}{F1 + F2} * 100 \quad (3)$$

$$FRI = \frac{F4}{F1 + F2} * 100 \quad (4)$$

$$IRI = \frac{F5}{F1 + F2} * 100 \quad (5)$$

Where: F1 - Household Municipal Solid Waste; F2 - Non-Household Municipal Solid Waste; F3 – Municipal Solid Waste Collection by CCC; F4 - Service by the selected Cleaning Service Organization (**CSO**) of Non-Profit Organization YPSA; RW – Recycled waste; E - Export amount; P – Stock; F5 - Collection of waste by-waste pickers/Tokai (In Bangladesh, "Tokai" are street children often working as waste pickers, scavenging for recyclables to survive.); F6 - Collection of waste from open dumps by-waste pickers/Tokai; F7 - Collection of waste from final dumping sites by-waste pickers/Tokai; F8 - Flakes and Resin export to out of Chattogram City Corporation (Vietnam, China). GRI, FRI, and IRI are in %, and all flows are in t/a.

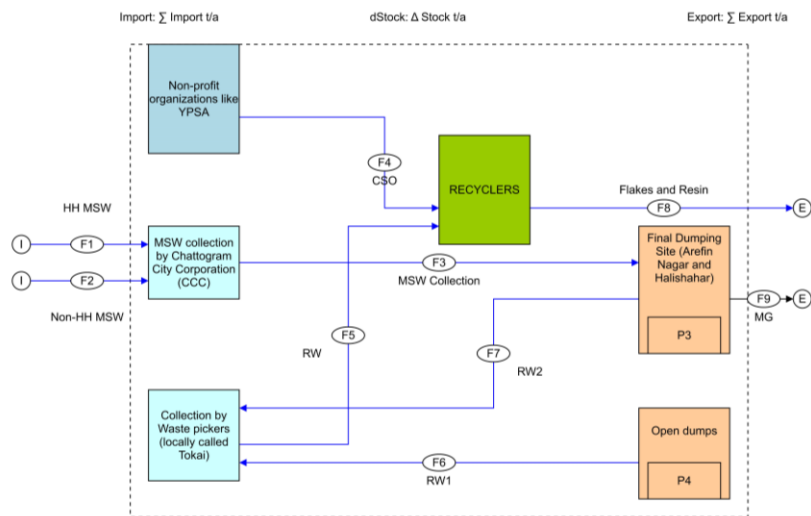


Fig. 3.8 The flow diagram covers the definition of the indicators.

Chapter 4. RESULTS AND DISCUSSION

4.1 MUNICIPAL PLASTIC WASTE GENERATION IN CCC

The estimated waste proportion from different waste sources is outlined in **Table 4.1**. The findings indicate that plastic waste percentages varied by source, with 11.22 % in markets, 7.69 % in hotels and restaurants, 9.37 % in offices, and 7.43 % on streets. Overall, CCC generates approximately 1,630.91 tons of waste per day, with the largest share (994.85 tons) coming from household sources, which vary by income group. The per capita household solid waste generation rates were 373.59 grams for high-income groups, 352.97 grams for middle-income groups, and 235.34 grams for low-income groups. Notably, these waste generation rates were higher for lower and middle-income groups than a previous study, which reported 350 grams for middle-income individuals, and 189 grams for low-income individuals (Alamgir and Ahsan, 2007).

Table 4. 1 Estimated waste proportion from different waste sources.

Waste Type	Household (HH) (Income Level)			Market	Hotel and restaurant	Office	Street
	High	Middle	Low				
Total wastes (gm/cap/d)	373.59	352.97	235.34	N/M	N/M	N/M	N/M
Organic and other wastes (%)	89.09	89.91	92.27	88.78	92.31	90.6	92.5
Plastics (gm/cap/d)	40.60	36.02	18.10	N/M	N/M	N/M	N/M
Plastics (%)	10.91	10.09	7.73	11.22	7.69	9.37	7.43

N/M (Not Measured)

Among the solid waste generated in this study, high-income individuals produced 40.60 grams of plastic waste per capita per day, 1.13 and 2.24 times more than middle- and low-income individuals, respectively. The average plastic

waste percentage in CCC was 9.23 %, comparable to previous findings of 8.7 % in Chattogram City (Shams et al., 2017). The increased generation of both solid and plastic waste among high- and middle-income groups can be attributed to their higher consumption levels. Additionally, these groups often do not use reusable shopping bags when purchasing goods, thereby contributing significantly to more plastic waste generation.

Table 4.2 outlines the percentage of plastic waste types from various sources. LDPE was found to be the most prevalent type in households (46.30%), markets (47.42%), and streets (59.41%), whereas PET was most common in offices (75.84%), and hotels and restaurants (81.17%). In household waste, single-use plastic shopping bags are the primary source of LDPE. For market waste, LDPE mainly originates from packaging materials. On the streets, people often dispose of food packaging, such as chip bags and other food wrappers, contributing to the high amount of LDPE. Hotels and restaurants mainly generate PET waste from bottles used for water and cold drinks.

Table 4. 2 Plastic waste percentage by types in different waste sources.

Facilities Type	PET (%)	HDPE (%)	PVC (%)	LDPE (%)	PP (%)	PS (%)	Others (%)
Household	15.75	10.74	5.84	46.30	13.10	5.46	2.81
Market	39.08	2.10	3.20	47.42	4.26	2.60	1.36
Hotel and restaurant	81.17	0.33	0.20	3.89	7.72	6.31	0.38
Office	75.84	1.94	0.67	4.39	11.14	5.16	0.87
Street	21.52	0.85	1.26	59.41	8.25	7.99	0.73
Overall	26.75	6.99	4.13	43.57	10.85	5.67	2.03

Overall, LDPE (43.57%) was the most prevalent type of plastic found in CCC due to its durability and widespread use for various packaging materials. The generated plastic waste percentages from different sources reflect the consumption patterns of the people in CCC.

4.2 SPATIAL DISTRIBUTION OF TOTAL PLASTIC WASTE GENERATION

The spatial distribution of total plastic waste generation, along with population counts across the 41 administrative wards of CCC, is presented in **Fig. 4.1**. The figure highlights Wards 2, 4, 7, 8, 24, and 39 as plastic waste generation hotspots, with daily outputs ranging from 5.52 to 11.85 tons. These high volumes are directly correlated with large populations in these wards, which range from 119,407 to 256,206 residents.

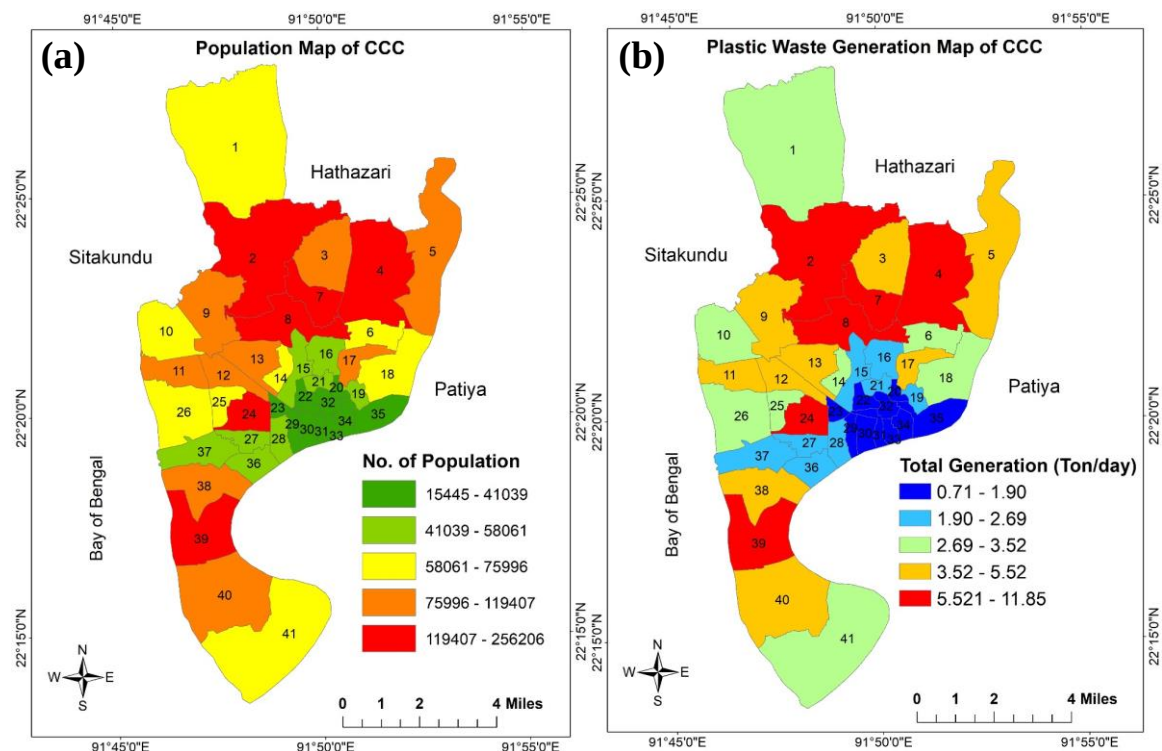


Fig. 4. 1 Spatial distribution of (a) population and (b) total plastic waste generation of CCC. (These maps are generated by ArcGIS 10.8).

In addition to dense residential populations, these wards host numerous commercial, business, and administrative centers, further contributing to elevated plastic waste levels. In contrast, wards 20, 22, 23, and 31 to 35 show significantly lower levels of plastic waste generation, ranging from 0.71 to 1.90 tons per day. These wards are situated on the outskirts of the city and are characterized by lower population numbers (15,445-41,039), newer residential developments, and relatively fewer commercial and administrative activities. A

previous study also noted that MSW generation rate in specific wards is associated with population density and the socio-economic characteristics of residents (Mushtaq et al., 2020).

4.3 CURRENT RECYCLING PRACTICES IN CCC

The recycling process in CCC comprises two distinct stages: initially from households by scrap collectors, followed by collection from dumping sites and the Landfill Site (LFS) by Tokai.

Historically, LDPE was not collected by recyclers due to its low recycling value. However, a financial incentives program implemented by NGOs has enabled Civil Society Organization (CSO) recyclers to now collect LDPE (**Fig. 4.2 (a) and 4.2 (b)**) (YPSA, 2022). **Table 4.3** provides a comprehensive view of how different types of plastic waste are managed through recycling across various sectors within CCC.



(a)



(b)

Fig. 4.2 (a) Collection of LDPE by the recyclers from LFS, (b) Dumped LDPE at LFS.

Table 4.3 Plastic waste recycling in different sources.

Recycling Waste Type	Household (HH) (ton/day (% of total solid)	Market (ton/day) (% of total solid)	Hotel and Restaurant (ton/day) (% of total solid)	Office (ton/day) (% of total solid)	Street (ton/day) (% of total solid)	Total (ton/day) (% of total solid)
PET	10.8 (27.56)	5.18 (13.22)	6.64 (16.95)	2.52 (6.43)	3.21 (8.19)	28.35 (72.44)
HDPE	1.13 (10.70)	0.04 (0.38)	0.004 (0.04)	0.01 (0.09)	0.02 (0.18)	1.20 (11.05)
PVC	4.61 (71.79)	0.49 (7.62)	0.019 (0.30)	0.025 (0.39)	0.22 (3.43)	5.36 (83.49)
LDPE	13.3 tons/day (as per the report of YPSA)					
PP	1.51 (9.29)	0.09 (0.55)	0.11 (0.68)	0.06 (0.37)	0.21 (1.29)	1.98 (12.18)
PS	Dumped to landfill sites (notoriously difficult to recycle due to being made into foam products with 98% air)					
Others	Disposed into landfill sites with very little recycling (traditionally not recycled for a wide variety of plastic resins that don't fit into the previous categories)					

In total, 50.2 tons/day (24.49%) of various plastic types undergo recycling at different stages, from the point of generation to the landfill. PET (28.35 tons/day) and LDPE (13.3 tons/day), commonly used in beverage bottles and plastic bags, respectively, are extensively recycled from households and commercial establishments (markets and hotels). Conversely, plastics such as HDPE (1.20

tons/day), PVC (5.36 tons/day), and PP (1.98 tons/day), used in products like containers, pipes, and stationery materials, have lower recycling rates and mainly originate from households. PS, known for its use in disposable cutlery and foam packaging, is absent in the recycling streams due to its properties, including low density and bulkiness, which make it less economical to collect and process. The lack of infrastructure, market demand, and effective collection systems are also the causes of no established recycling practices for PS in CCC. Similarly, other plastics that do not fit into specific categories also face limited recycling opportunities and are typically disposed of in the LFS. **Fig. 4.3** illustrates the current recycling practices—specifically how various types of plastics are recycled—within CCC. The main recycling steps include collection, sorting, cleaning/washing, drying, melting, cooling, pelletization, and packaging. Currently, there are over 300 recyclers in Chattogram (YPSA, 2022). However, the field shows a lack of safety precautions in the plastic recycling process, particularly during the collection, sorting, and washing phases. Workers are exposed to various contaminants, dust, and residual chemicals, leading to respiratory issues, skin irritations, infections, nausea, and vomiting. The absence of personal protective equipment (PPE), inadequate training, and poor ventilation exacerbate these risks, resulting in chronic health problems. Additionally, manual handling and repetitive tasks contribute to musculoskeletal disorders (Emma-Anyasodo et al., 2024; ILO, 2023; LOHP, 2013).

HDPE	COLLECTION AND SORTING	CUTTING	SMALL FLAKES	POWDERED FLAKES	MELTING AND EXTRUSION	COOLING AND SOLIDIFICATION	PELLETIZATION	PACKAGING
Amount of Recycling per month in CCC: 36.12 ton								
LDPE	COLLECTION	SORTING	CLEANING AND DRYING	SHREDDING	MELTING AND EXTRUSION	COOLING AND SOLIDIFICATION	PELLETIZATION	PACKAGING
Amount of Recycling per month in CCC: 400 ton								
PET	COLLECTION AND SORTING	CUTTING	SMALL FLAKES	MANUAL WASHING	MECHANICAL WASHING	MANUAL DRYING	MECHANICAL DRYING	PACKAGING
Amount of Recycling per month in CCC: 850.5 ton								
PVC	COLLECTION	CUTTING	SMALL FLAKES	MELTING	COOLING AND SOLIDIFICATION	SHAPING MACHINE	CUTTING FOR ADJUSTMENT	NEW PVC
Amount of Recycling per month in CCC: 160.92 ton								
PP	COLLECTION AND SORTING	FLAKES	POWDERED FLAKES	MELTING	EXTRUSION	COOLING AND SOLIDIFICATION	PELLETIZATION	PACKAGING
Amount of Recycling per month in CCC: 59.4 ton								
OTHERS	COLLECTION	CUTTING	SMALL CHIPS	MELTING	SHAPE GIVING	FINAL PRODUCT	PS	CURRENTLY, NO RECYCLING EVIDENCE IN CCC
Amount of Recycling per month in CCC: Very little and is not properly observed in this study.								

Fig. 4.3 Current recycling practices of different plastic waste in CCC.

4.4 SOURCE WISE WASTE GENERATION AND RECYCLING TRENDS

This study also evaluates the waste generation trends in different waste sources and recycling activities in the Chattogram City Corporation (CCC).

4.4.1 HOUSEHOLD

In household waste (**Fig. 4.4**), LDPE was found to be the most prevalent type (46.30 %), primarily due to its widespread use in single-use shopping bags. Despite its high generation rate, LDPE has a relatively low recycling rate, consistent with findings by Abdullah and Abedin (2024), who attributed this to contamination and the lack of efficient collection systems for flexible films.

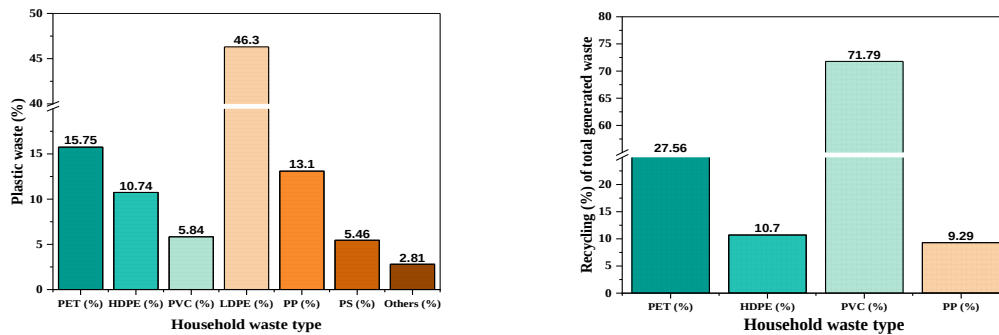


Fig. 4.4 Household plastic waste generation and recycling rate.

PVC is currently generated at a rate of 4.61 tons per day, with an impressive 71.79 % being recycled, indicating a well-established recycling infrastructure due to its durability and common use in construction and industrial applications (Minde et al., 2024).



Fig. 4.5 People carry SUPs from the market.

In household waste, single-use plastic shopping bags are the primary source of LDPE (Fig. 4.5). In contrast, PET is recycled at a volume of 10.8 tons per day, with 27.56 % of this material being recovered, primarily from household sources. People often reuse PET containers for various household purposes including food storage, planters, and holders (Miao et al., 2023). HDPE and PP have even lower recycling rates (10.70 % and 9.29 %, respectively), likely due to their frequent use in mixed-material products (e.g., containers with labels or other components), which complicates separation process (Zhang et al., 2024b). Polystyrene (PS) is nearly absent from recycling streams, corroborating findings by Samper et al. (2010), who highlighted its low economic viability due to its low density, bulkiness, and limited market demand for recycled PS.

4.4.2 MARKET

Fig. 4.6 illustrate plastic waste generation and recycling rates from markets, where LDPE dominates at 47.42 %, primarily from single-use shopping bags—a pattern also observed in Dhaka’s commercial sectors (Hasan et al., 2023). However, despite its prevalence, LDPE recycling remains minimal, reflecting challenges observed in other South Asian urban markets where thin-film plastics are often contaminated and lack efficient collection systems (Hasan et al., 2023). PVC achieves only a 7.62 % recycling rate in markets, a disparity that reflects contamination from food waste and lack of source segregation, similar to findings from Khulna’s wholesale markets (Abdullah and Abedin, 2024). PET shows a relatively better market recycling rate (13.22 %), due to its economic value for informal waste pickers (Begum et al., 2022). HDPE (0.38 %) and PP (0.55 %) face near-total non-recycling because of mixed waste streams and low economic return (Gandhi et al., 2021). The stark variation in recycling rates between market and household waste stems from key differences: markets produce more contaminated, mixed plastics; rely heavily on informal collectors

who selectively recover high-value items; and lack targeted waste management policies (Abbott et al., 2011).

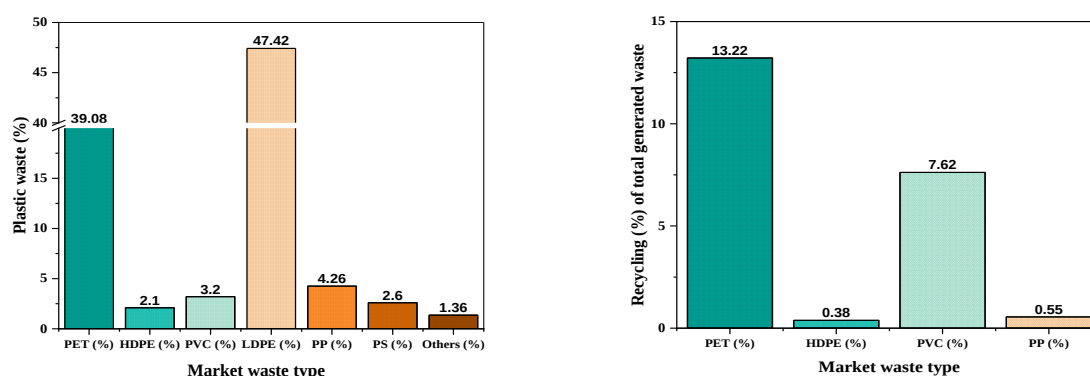


Fig. 4.6 Market plastic waste generation and recycling rate.

4.4.3 HOTEL AND RESTAURANTS

Plastic waste from hotels and restaurants (**Fig. 4.7**) in CCC is dominated by PET (81.17 %), primarily from beverage containers. However, only 16.95 % of this enters recycling streams—higher than other plastics but lower than household PET recovery (27.56 %). PET from foodservice establishments often faces more processing challenges due to contamination compared to cleaner household PET containers (Abdullah and Abedin, 2024).

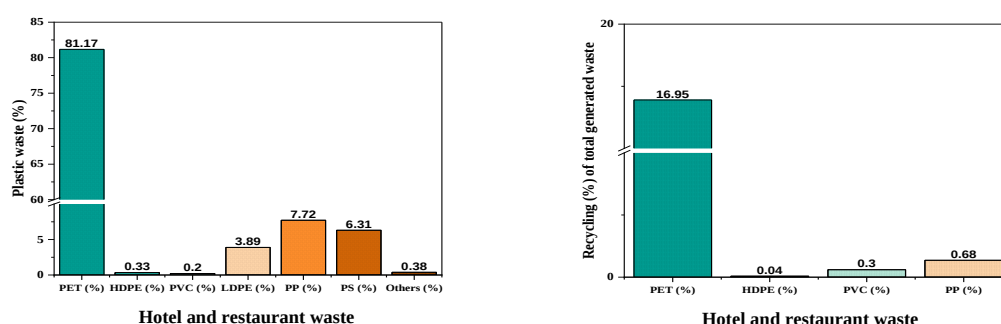


Fig. 4.7 Hotel and Restaurant plastic waste generation and recycling rate.

Extremely low recycling rates are observed for PVC (0.30 %), HDPE (0.04 %), and PP (0.68 %), largely due to food contamination and the lack of effective segregation. Across Southeast Asia, PET-focused collection systems and contamination reduce recyclability (Jerin et al., 2022; Minde et al., 2024).

4.4.4 OFFICE

Fig. 4.8 depict plastic waste from offices, showing PET as the dominant type (75.84 %), mainly from water and beverage bottles consumed on-site. Currently, PET from offices contributes 6.43 % to the overall recycled PET volume. Recycling rates for PVC and HDPE are notably low—0.39 % and 0.09 %, respectively—while PP recycling is similarly limited (0.37 %). These low values stem from minimal segregation and the generally small quantity of plastic waste generated in office settings (Otitoju et al., 2023).

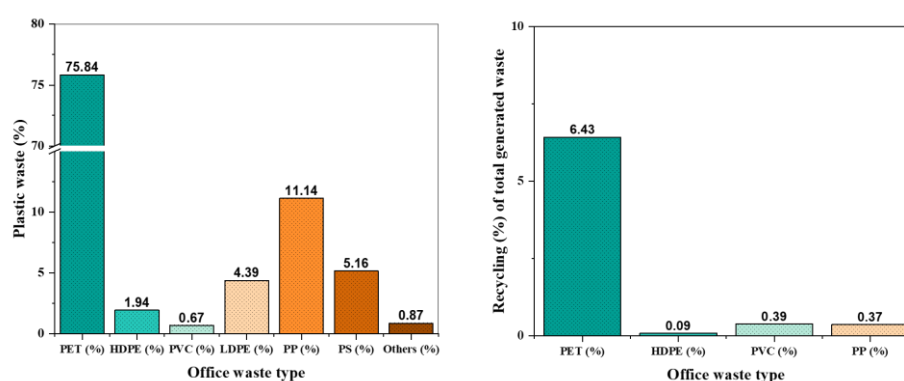


Fig. 4.8 Office plastic waste generation and recycling rate.

4.4.5 STREET

Fig. 4.9 show the distribution of plastic waste from street sources, where LDPE dominates at 59.41 %, primarily originating from single-use bags and snack wrappers. These items are frequently discarded due to low public awareness and limited waste disposal infrastructure. Compared to similar urban areas such as Dhaka and Khulna, Chattogram shows a higher prevalence of LDPE, likely due to weaker enforcement of plastic bag bans and more widespread use of non-recyclable packaging by informal vendors (Begum et al., 2022). PET constitutes 21.52 % of the plastic waste stream, but only 8.19 % is recycled—lower than the 12–15 % recovery rate reported in Dhaka’s formal waste sector (Abdullah and Abedin, 2024). This shortfall is linked to the reliance on informal pickers who prioritize high-value plastics (like PET bottles) and the absence of systematic

collection for low-value items like HDPE. HDPE recycling remains negligible (under 1 %) due to contamination, low market demand, and the absence of specialized processing facilities. Unlike more regulated cities, Chattogram’s recycling system suffers from fragmented policies, limited public engagement, and weak economic incentives, which collectively exacerbate disparities in plastic waste recovery rates.

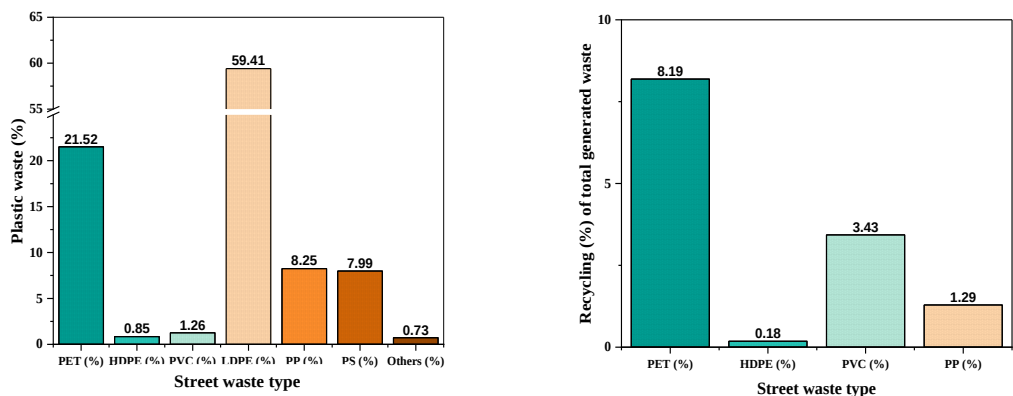


Fig. 4.9 Street plastic waste generation and recycling rate.

4.5 INDICATOR RESULTS

The results from **Fig. 4.10** of the Global Recovery Indicator (GRI), Formal Recovery Indicator (FRI), and Informal Recovery Indicator (IRI) reveal significant insights into recovery practices. The low GRI score of 2.82% indicates substantial challenges to recovery effectiveness, including infrastructure deficiencies and limited public engagement. Meanwhile, the FRI score of 1.34% highlights potential inefficiencies within formal recycling operations, suggesting opportunities for cost reduction and operational improvement. The IRI score of 1.48% underscores the important role of informal recycling sectors in waste recovery, despite their informal nature and economic challenges.

Based on the general picture obtained through the MFA, it is evident that the Global Recovery Indicator (GRI) is very low. In the context of CCC, waste pickers play a crucial role in waste recovery, according to the defined system boundaries. Several factors may contribute to this difference in recycling

performance. One reason is the extensive experience waste pickers have accumulated over decades in recovering materials for subsistence. In terms of overall recovery performance, polyethylene terephthalate (PET) stands out as the most successfully recovered material. In contrast, high-density polyethylene (HDPE) has a significantly lower recovery rate compared to PET, despite both being commonly labeled and promoted for recycling under the general category of "plastics." This discrepancy may be due to the higher "popularity" of PET bottles as recyclable waste and a potential lack of public awareness regarding the recoverability of HDPE containers. Further qualitative research is needed to gain a deeper understanding of this issue. This situation raises concerns about the municipal waste management strategy, which primarily focuses on recovering waste materials from households, even though a significant portion of these materials is generated elsewhere. addressing these concerns and findings requires a more comprehensive and informed approach to waste recovery and recycling practices, which could enhance recycling infrastructure, policy frameworks, and community involvement to achieve more sustainable waste management practices.

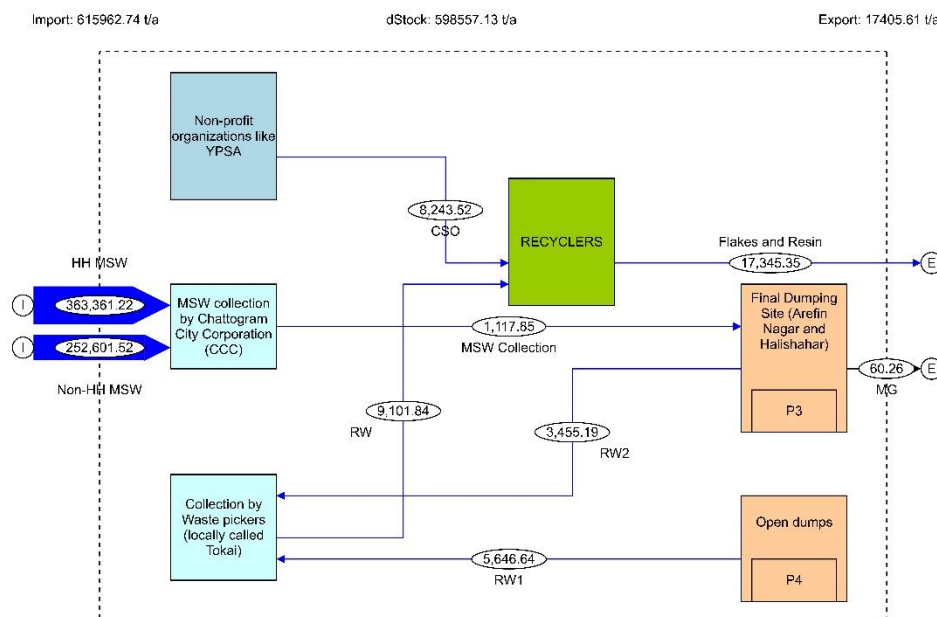


Fig. 4.10 The calculated value for the definition of the indicators.

4.6 PLASTIC WASTE FLOW

The detailed depiction of plastic waste flows and management within CCC is presented in **Fig. 4.11**. The figure reveals that CCC receives approximately 204.99 tons per day of final plastic products (Flow 1), highlighting the extensive use of plastic across various sectors. Households generate the most plastic waste (94.67 tons/day) due to the widespread use of plastic products in daily life (Flow 9). Among different plastic types, LDPE (113.42 tons/day) in Flow 5 stands out as a major contributor to plastic waste, primarily due to its prevalent use in single-use applications such as packaging for fruits, groceries, and snack wrappers (Ncube et al., 2021). The production of PET as finished plastic goods, particularly for beverage and oil bottles, also contributes significantly (39.14 tons/day) after LDPE (Flow 2). Notably, PET has a higher recycling rate (28.35 tons/day) compared to other plastic types. Additionally, approximately 13.33 tons of LDPE are recycled each day from the streets and LFS due to cash incentives provided by YPSA (YPSA, 2022).

An important aspect highlighted in the figure is the plastic recycling process (Flows 29, 30, and 31), which accounts for approximately 50.2 tons per day. The recycling efficiency in Stage 1 (Flow 29), which involves the initial collection from households by scrap collectors, is 12.37 %. In Stage 2 (Flows 30 and 31), which includes waste collected from dumping sites and the LFS managed by Tokai, the recycling efficiency is 12.12 %. This recycling efficiency represents only a small portion of the waste diverted from the LFS. Despite efforts in plastic waste collection and recycling, an estimated 154.79 tons per day of plastic waste remains inadequately managed. This unmanaged waste ultimately ends up in landfill sites, contributing to environmental pollution, including the contamination of water bodies (Hossain et al., 2021).

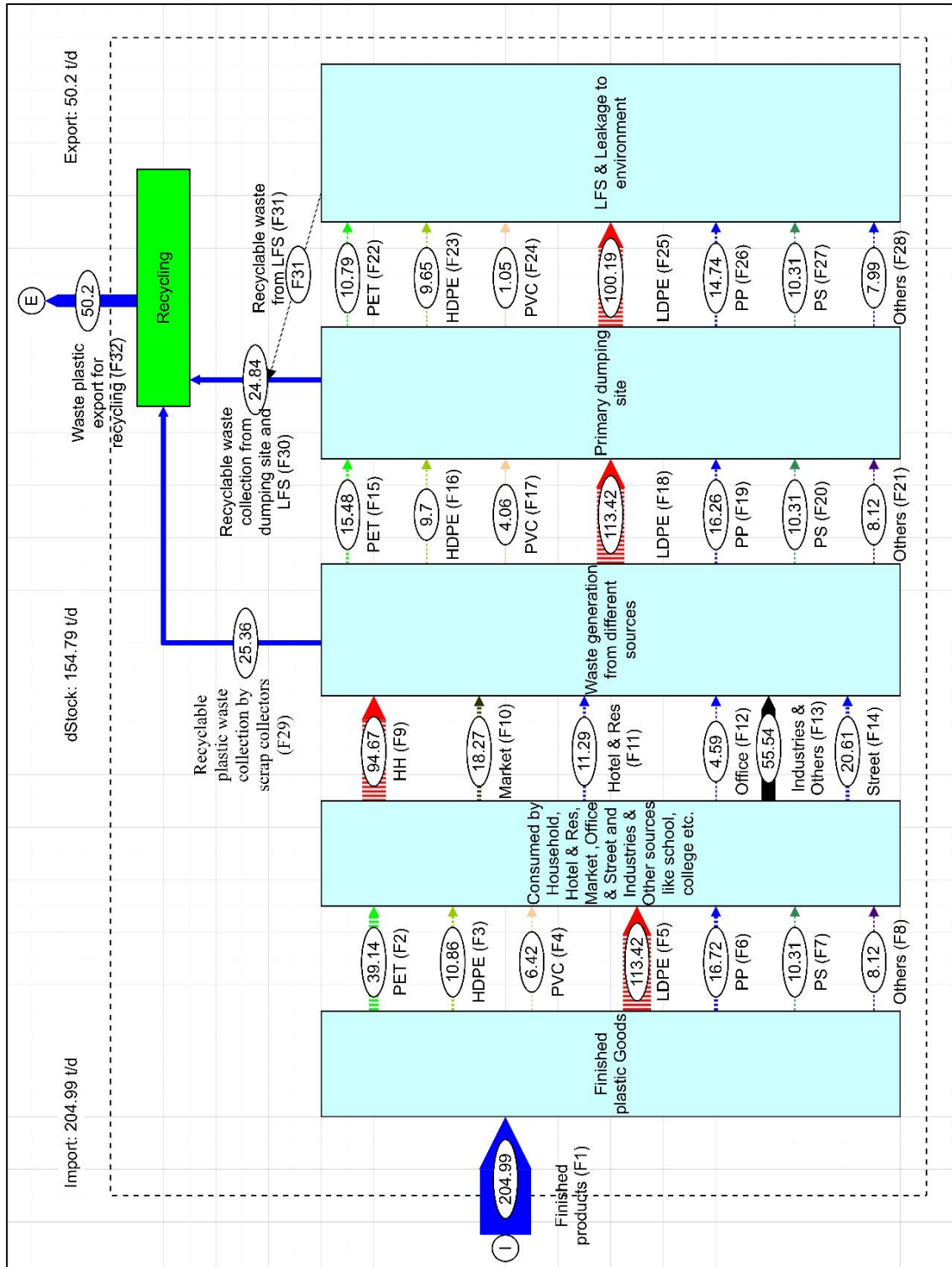


Fig. 4.111 The flow of different plastic wastes of CCC.

The MFA results provide critical insights into the flow and mismanagement of MPW in CCC, highlighting several opportunities to improve sustainability within urban waste systems. For instance, only 24.49 % of

generated plastic waste is currently recycled, underscoring the need for enhanced collection infrastructure and the formalization of the informal recycling sector. The dominance of LDPE in the waste stream, coupled with its relatively low recycling rate, suggests that targeted interventions—such as community-level buy-back centers or subsidies for LDPE recycling—could significantly improve resource recovery and reduce environmental leakage. By quantifying plastic waste flows and identifying gaps in collection and recycling, our results offer essential data for tracking progress toward the SDGs and the National 3R Strategy at the city level. Furthermore, by identifying key inefficiencies in the current system, this MFA-based analysis provides a data-driven foundation for policymakers to design and implement more sustainable, integrated waste management practices tailored to Chattogram’s urban context.

Chapter 5. CONCLUSION AND RECOMMENDATIONS

5.1 GENERAL

Plastic waste management has become a concerning issue in developing countries owing to increasing economic development, population growth, and consumption patterns. This study employs Material Flow Analysis (MFA) to assess plastic waste generation, composition, and management in the Chattogram City Corporation (CCC), Bangladesh.

5.2 CONCLUSION

This study utilized MFA to assess plastic waste generation by source and identify gaps in management within CCC area. The following findings are found from the investigation and secondary data analysis.

- Approximately 12.57% plastic waste was present in the 1,630.91 tons of daily solid waste.
- LDPE was found to be the dominant plastic type in domestic and public spaces, accounting for 46.30% of household waste, 47.42% in markets, and 59.41% in street waste, while PET was predominant in commercial establishments (75.84% in offices and 81.17% in hotels and restaurants).
- The MFA revealed that industrial and other sources in CCC generate approximately 55.54 tons of plastic waste daily, a previously unquantified portion of the waste stream. STAN-generated Sankey diagrams illustrate the predominantly linear flow of this waste, with only 24.49% entering formal and informal recycling channels. Alarming, 154.79 tons remain mismanaged daily, exacerbating urban waterlogging.

The study emphasizes the urgent need for localized plastic waste management strategies in Bangladeshi cities and recommends national policy interventions that integrate formal and informal recycling sectors, improve waste

collection and treatment infrastructure, and promote community engagement. To address these issues, Chattogram must transition from a linear to a circular plastic economy through the implementation of Extended Producer Responsibility (EPR) frameworks and the exploration of Waste-to-Energy (WtE) solutions aligned with circular economy principles and energy demand needs. Future research should include larger-scale stratified sampling, seasonal data collection, uncertainty analysis, local data validation, and an assessment of informal recycling hubs.

5.3 RECOMMENDATIONS

Based on the findings for plastic waste in CCC, a systematic and scientific approach is necessary to effectively implement the National 3R (Reduce, Reuse, and Recycle) strategies.

- The initial focus should be on reducing plastic use by promoting alternative materials such as paper, cardboard, glass, and metal for sustainable packaging. Bioplastics like Polylactic Acid (PLA) and Polyhydroxyalkanoate (PHA), derived from plant starch and bacterial fermentation, are also viable options for packaging and disposable items.
- Additionally, natural fibers—including cotton, jute, wool, durable silicone, and fast-growing bamboo—offer environmentally friendly alternatives due to their biodegradability and reduced carbon footprint.
- Subsequently, it is essential to encourage reuse and facilitate recycling by implementing Extended Producer Responsibility (EPR) to enhance resource efficiency. Recycling costs would be integrated into product pricing, enabling consumers to sell used plastics to intermediary agents, who would sort and return them to the producers. This approach reduces financial burdens on producers while incentivizing consumer participation. Such a system aligns with global practices in countries like

Japan and the UK and offers multiple benefits, including increased recycling rates, reduced plastic leakage and landfill dependence, formalization of informal recyclers, and the promotion of plastic circular economy.

Finally, developing recycling options to convert plastic waste into eco-friendly value-added products is essential for sustainable waste management.

5.4 FUTURE SCOPE OF STUDY

Future research should aim to expand the geographic scope to include multiple urban areas and conduct long-term studies to monitor changes over time.

- Employing more rigorous data collection methods, including the integration of artificial intelligence (AI) and machine learning algorithms (MLA), could enhance data reliability and accuracy.
- Furthermore, future studies should consider incorporating other types of municipal solid waste to gain a more comprehensive understanding of waste management practices.
- Analyzing the impact of existing policies on waste management and investigating community attitudes toward plastic waste could further improve stakeholder engagement and recycling initiatives.

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Appendices

Appendix A

Table A.1 Detailed Survey data of households, Street, office and Restaurants at Ward no. 02.

Ward No. : 02									
Facilities Type: Household (HH)									
Group:High Income Group									

House no = 1		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	5	5	5
Organic waste	gm	1415	670	980	1385	2915	1745	1690	2670
PETE/PETEE	gm	65				75			125
HDPE	gm							80	85
PVC	gm				80				
LDPE	gm	90	120	80	130	140	85	105	125
PP	gm		105				135		
PS	gm				85				
OTHERS	gm								
House no = 2		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	1270	2030	1160	840	1845	1230	1670	1880
PETE/PETEE	gm				75		85		
HDPE	gm	45	55						65
PVC	gm			60					
LDPE	gm	120	130	80	75	45	90	85	75
PP	gm					105		50	
PS	gm								65
OTHERS	gm								
House no = 3		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		8	8	8	8	8	8	8	8
Organic waste	gm	3030	2855	2080	4205	1860	2930	2050	775
PETE/PETEE	gm		45	25			95		90
HDPE	gm		35		90		45		

PVC	gm					105			
LDPE	gm	150	170	200	145	100	250	187	87
PP	gm			120					90
PS	gm							110	
OTHERS	gm								

House no = 4		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	5	5	5
Organic waste	gm	800	1350	1785	1020	560	1470	1365	1935
PETE/PETEE	gm			20		80	30		90
HDPE	gm	90			60			45	35
PVC	gm				50				
LDPE	gm	80	120	95	90	35	85	125	115
PP	gm			85				70	
PS	gm					65			
OTHERS	gm		1410						
House no = 5		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	5	5	5
Organic waste	gm	1660	980	1950	6615	1570	1230	6280	810
PETE/PETEE	gm	40			95		60	85	
HDPE	gm			60			60		
PVC	gm					85			
LDPE	gm	160	90	100	185	80	120	450	45
PP	gm		75				60		85
PS	gm				90				
OTHERS	gm								
House no = 6		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	1435	960	1012	2335	1825	1440	850	1260
PETE/PETEE	gm	60		85	60				45
HDPE	gm				60				35
PVC	gm						65		
LDPE	gm	80	100	85	95	100	90	75	110
PP	gm			80			70		35
PS	gm				55				
OTHERS	gm								

House no = 7		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	5	5	5
Organic waste	gm	1715	1050	1235	1560	1360	1420	2845	800
PETE/PETEE	gm	120				35			140
HDPE	gm				60				
PVC	gm						65		
LDPE	gm	170	80	100	75	45	120	120	85
PP	gm			80		105			
PS	gm				60				
OTHERS	gm								
House no = 8		Latitude = 22.38128				Longitude = 91.80862			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	5	5	5
Organic waste	gm	1375	1965	1560	1360	1820	1680	1980	1650
PETE/PETEE	gm	80					125		95
HDPE	gm			15				120	
PVC	gm					70			
LDPE	gm	80	120	90	115	95	80	85	60
PP	gm		90						85
PS	gm						60		
OTHERS	gm								
House no = 9		Latitude = 22.38156				Longitude = 91.80932			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	1480	1260	980	1870	1315	1920	850	670
PETE/PETEE	gm	35		65		90			
HDPE	gm	25		15			35	80	
PVC	gm					55			
LDPE	gm	120	85	90	65	80	75	85	80
PP	gm				70			95	
PS	gm						55		
OTHERS	gm								
House no = 10		Latitude = 22.38156				Longitude = 91.80932			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	1560	670	1980	1670	1917	670	528	1255
PETE/PETEE	gm		35		45		25	35	35
HDPE	gm		25	15			70		
PVC	gm					55			
LDPE	gm	85	120	95	85	95	35	85	80

PP	gm			65			80		
PS	gm					60			
OTHERS	gm								

Group : Middle Income Group

House no = 1		Latitude = 22.380974				Longitude = 91.809021			
Day		0	1	2	3	4	5	6	7
Nos of population		7	5	5	5	5	5	5	5
Organic waste	gm	1205	1590	1255	1225	1725	1720	1675	1985
PETE/PETEE	gm	15	35		30		45	50	
HDPE	gm					45		60	
PVC	gm				50				
LDPE	gm	40	60	65	75	85	55	95	40
PP	gm			60			50		
PS	gm							55	
OTHERS	gm								
House no = 2		Latitude = 22.381431				Longitude = 91.809304			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	5	5	5
Organic waste	gm	2105	1300	1405	1220	1575	1475	1980	1650
PETE/PETEE	gm		40		55		60		
HDPE	gm				40	45		35	
PVC	gm			50					
LDPE	gm	120	110	95	35	85	25	50	75
PP	gm		80						85
PS	gm					50			
OTHERS	gm								
House no = 3		Latitude = 22.380962				Longitude = 91.808992			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	3	4	4	3	4	4
Organic waste	gm	2330	1500	840	1280	680	680	1125	960
PETE/PETEE	gm	20			25		75		40
HDPE	gm					15		50	15
PVC	gm			40					
LDPE	gm	140	35	25	35	65	75	65	50
PP	gm		120				45		
PS	gm							35	
OTHERS	gm								

House no = 4		Latitude = 22.381551				Longitude = 91.809321			
Day		0	1	2	3	4	5	6	7
Nos of population		3	4	4	3	3	3	3	3
Organic waste	gm	1000	1555	905	1350	525	625	1225	1215
PETE/PETEE	gm		45	35		45	55	85	65
HDPE	gm			25	75	40	40	70	35
PVC	gm								
LDPE	gm	70	35	40	30	25	45	60	25
PP	gm								
PS	gm								
OTHERS	gm								
House no = 5		Latitude = 22.381050				Longitude = 91.809040			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	3	3	3	3	3
Organic waste	gm	1300	1250	750	1410	790	755	1260	860
PETE/PETEE	gm	45		35		40		35	
HDPE	gm				35			35	
PVC	gm						30		
LDPE	gm	80	35	45	25	40	35	45	70
PP	gm		60						35
PS	gm				30				
OTHERS	gm								
House no = 6		Latitude = 22.381532				Longitude = 91.809190			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	3	3	3	3	4	4
Organic waste	gm	335	1350	535	1245	780	665	1025	1480
PETE/PETEE	gm		35	45					
HDPE	gm		25			30			
PVC	gm						35		
LDPE	gm	85	90	50	30	50	35	25	30
PP	gm			40				50	
PS	gm					30			
OTHERS	gm								

House no = 7		Latitude = 22.380976				Longitude = 91.809093			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	800	1420	855	665	680	765	1230	1125
PETE/PETEE	gm			45		35	25		
HDPE	gm			45		30	30	65	
PVC	gm				45				

LDPE	gm	55	65	45	65	50	75	85	55
PP	gm					55			90
PS	gm							45	
OTHERS	gm								
House no = 8		Latitude = 22.380979				Longitude = 91.809085			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	520	1100	4000	1220	945	945	1020	1460
PETE/PETEE	gm				95				80
HDPE	gm							85	30
PVC	gm		50						
LDPE	gm	65	75	95	65	55	85	90	45
PP	gm					90			60
PS	gm						55		
OTHERS	gm			90					
House no = 9		Latitude = 22.381045				Longitude = 91.809099			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	3	3	4	4	4	4
Organic waste	gm	400	1450	950	1450	820	785	1225	910
PETE/PETEE	gm	85		75		80			
HDPE	gm						60		35
PVC	gm				50				
LDPE	gm	55	75	60	75	95	80	70	40
PP	gm		55			70			30
PS	gm						55		
OTHERS	gm								

House no = 10		Latitude = 22.380972				Longitude = 91.809001			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	3	3	3	4	4	4
Organic waste	gm	600	800	1200	990	815	790	985	1350
PETE/PETEE	gm		50				75		
HDPE	gm								45
PVC	gm				30				
LDPE	gm	70	50	35	40	20	25	45	50
PP	gm					60		25	
PS	gm			25					
OTHERS	gm		120				45		

Group: Low-Income Group									
House no = 1		Latitude = 22.38132				Longitude = 91.80917			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	2	2	2	2	2
Organic waste	gm	310	350	350	380	875	250	450	435
PETE/PETEE	gm			35			15		
HDPE	gm					35			
PVC	gm				20				
LDPE	gm	55	15	15	25	20	15	35	25
PP	gm			25				30	
PS	gm					15			
OTHERS	gm								
House no = 2		Latitude = 22.38132				Longitude = 91.80918			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	380	540	890	1040	880	635	490	605
PETE/PETEE	gm					20		35	
HDPE	gm		20		25				
PVC	gm			20					
LDPE	gm	30	20	40	25	25	10	35	25
PP	gm						25		20
PS	gm			20					
OTHERS	gm								
House no = 3		Latitude = 22.38138				Longitude = 91.80937			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	3	3	3	3	3	3
Organic waste	gm	560	480	780	980	500	675	825	350
PETE/PETEE	gm				45		15		
HDPE	gm	30		15			20	20	
PVC	gm					20			
LDPE	gm	55	25	25	35	30	30	45	15
PP	gm		25					35	
PS	gm				20				
OTHERS	gm								

House no = 4		Latitude = 22.38143				Longitude = 91.80941			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	570	560	905	1245	955	655	845	570
PETE/PETEE	gm				40			25	
HDPE	gm		15				30		

PVC	gm					25			
LDPE	gm	45	10	35	25	30	25	55	25
PP	gm			20				40	
PS	gm					20			
OTHERS	gm								
House no = 5		Latitude = 22.38132				Longitude = 91.80922			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	855	680	890	780	990	670	580	870
PETE/PETEE	gm			50			35		
HDPE	gm				10			55	
PVC	gm			35					
LDPE	gm	35	45	20	50	20	25	45	25
PP	gm				35		45		
PS	gm					35			
OTHERS	gm								
House no = 6		Latitude = 22.38144				Longitude = 91.80938			
Day		0	1	2	3	4	5	6	7
Nos of population		4	2	2	2	2	2	2	2
Organic waste	gm	540	300	335	450	385	845	425	620
PETE/PETEE	gm			20			20		
HDPE	gm		25						
PVC	gm				15				
LDPE	gm	60	15	20	20	10	25	25	20
PP	gm						25		15
PS	gm				15				
OTHERS	gm								

House no = 7		Latitude = 22.38133				Longitude = 91.80928			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	450	530	1450	615	765	810	685	1060
PETE/PETEE	gm				25			45	
HDPE	gm	20		35			20		
PVC	gm					30			
LDPE	gm	15	35	20	40	45	40	25	55
PP	gm		30						20
PS	gm			25					
OTHERS	gm								
House no = 8		Latitude = 22.38135				Longitude = 91.80932			
Day		0	1	2	3	4	5	6	7

Nos of population		2	4	4	4	4	4	4	4
Organic waste	gm	760	1210	725	875	985	430	895	510
PETE/PETEE	gm			35			25		
HDPE	gm	50	15		15	10			
PVC	gm							20	
LDPE	gm	40	20	10	15	35	20	35	90
PP	gm					20			35
PS	gm			25					
OTHERS	gm								
House no = 9		Latitude = 22.38132				Longitude = 91.80937			
Day		0	1	2	3	4	5	6	7
Nos of population		4	2	2	4	4	4	4	4
Organic waste	gm	400	860	400	775	950	615	675	430
PETE/PETEE	gm			20			20		
HDPE	gm				25				
PVC	gm		15						
LDPE	gm	55	15	15	35	20	25	10	15
PP	gm				20		10		10
PS	gm							20	
OTHERS	gm								
House no = 10		Latitude = 22.38135				Longitude = 91.80927			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	3	3	3	3	3	3
Organic waste	gm	480	460	535	995	975	890	850	575
PETE/PETEE	gm	15	50			30			
HDPE	gm	10		25				30	
PVC	gm				25				
LDPE	gm	25	45	15	10	15	50	85	40
PP	gm		30				20		
PS	gm				20				
OTHERS	gm								

Ward no. : 02									
Facilities Type : Hotel & Restaurant (HR)									

Restaurant no = 1 (Latitude = 22.38128 Longitude = 91.80862)									
Day		0	1	2	3	4	5	6	7
Nos of seats		50	50	50	50	50	50	50	50
Organic waste	gm	30250	35370	31215	40000	34750	26900	32450	33175
PETE/PETEE	gm	1690	2150	1570	3570	2190	1750	1860	1240
HDPE	gm	0	0	0	0	0	0	0	0
PVC	gm	0	0	0	0	0	0	0	0
LDPE	gm	105	125	100	120	95	60	75	90
PP	gm	155	235	160	245	150	165	115	180
PS	gm	160	95	70	195	155	125	250	215
OTHERS	gm	0	0	0	0	0	0	0	0
Restaurant no = 2 (Latitude = 22.38132 Longitude = 91.80937)									
Day		0	1	2	3	4	5	6	7
Nos of seats		42	42	42	42	42	42	42	42
Organic waste	gm	33570	35345	34695	26930	24420	34250	31555	30785
PETE/PETEE	gm	2350	2500	3540	1600	1730	2540	1985	1835
HDPE	gm	0	0	0	65	0	50	0	0
PVC	gm	0	0	0	0	0	0	0	0
LDPE	gm	75	100	75	55	110	85	60	115
PP	gm	140	145	195	100	175	245	165	230
PS	gm	115	90	175	115	195	155	160	120
OTHERS	gm	0	0	70	0	0	0	0	0
Restaurant no = 3 (Latitude = 22.38138 Longitude = 91.80937)									
Day		0	1	2	3	4	5	6	7
Nos of seats		34	34	34	34	34	34	34	34
Organic waste	gm	32425	26390	19455	23465	28950	21420	17565	23320
PETE/PETEE	gm	1500	1775	1555	1565	1660	1350	1400	1820
HDPE	gm	0	0	0	0	0	0	0	115
PVC	gm	0	0	0	95	0	0	0	0
LDPE	gm	35	75	55	95	120	90	65	75
PP	gm	195	185	135	175	145	180	135	210
PS	gm	180	135	110	105	80	75	115	160
OTHERS	gm	0	0	0	135	0	0	0	0

Ward no. : 02									
Facilities Type : Street									
Street 1 (Latitude = 22.38133 Longitude = 91.80928)									
Day		0	1	2	3	4	5	6	7
Organic waste	gm	12945	10955	13330	8750	11990	14775	13545	10490
PETE/PETEE	gm	245	190	150	175	310	450	295	255
HDPE	gm	0	0	55	0	0	0	0	0

PVC	gm	0	0	0	0	0	55	0	0
LDPE	gm	500	485	795	405	565	795	720	645
PP	gm	80	50	90	55	105	75	150	65
PS	gm	60	75	65	30	60	60	120	45
OTHERS	gm	0	0	0	0	120	0	0	0
Street 2 (Latitude = 22.38133 Longitude = 91.80928))									
Day		0	1	2	3	4	5	6	7
Organic waste	gm	7435	8645	8590	9430	11030	8750	7535	8920
PETE/PETEE	gm	165	130	175	120	235	210	190	175
HDPE	gm	0	0	50	0	35	0	20	0
PVC	gm	0	0	0	120	0	0	0	45
LDPE	gm	325	475	435	410	590	450	480	375
PP	gm	85	100	60	40	85	65	40	55
PS	gm	85	105	55	30	95	40	35	25
OTHERS	gm	0	0	0	0	0	0	0	0
Street 3 (Latitude = 22.38133 Longitude = 91.80928))									
Day		0	1	2	3	4	5	6	7
Organic waste	gm	9100	4350	7690	8530	5000	8630	8735	6500
PETE/PETEE	gm	120	100	115	90	135	220	100	120
HDPE	gm	0	0	0	0	0	0	0	0
PVC	gm	0	0	0	50	0	0	0	0
LDPE	gm	315	270	365	415	395	490	380	260
PP	gm	55	40	25	40	40	55	70	55
PS	gm	30	65	10	0	60	75	30	100
OTHERS	gm	0	0	0	0	0	0	0	0

Ward no. : 02						
Facilities Type : Office						

Office no = 1 (Latitude = 22.38132 Longitude = 91.80922)						
Day		1	2	3	4	5
Nos of population		14	14	14	14	14
Organic waste	gm	2035	1890	1420	1745	3450
PETE/PETEE	gm	115	150	80	170	250
HDPE	gm	0	0	20	0	0
PVC	gm	0	0	0	0	0
LDPE	gm	10	5	5	5	10
PP	gm	30	45	20	25	55
PS	gm	0	25	40	0	0
OTHERS	gm	0	0	0	0	20
Office no = 2 (Latitude = 22.381050 Longitude = 91.809040)						
Day		1	2	3	4	5
Nos of population		9	9	9	9	9
Organic waste	gm	1250	1145	930	1275	1070
PETE/PETEE	gm	85	135	65	95	45
HDPE	gm	0	0	35	0	0
PVC	gm	0	0	0	0	0
LDPE	gm	15	0	0	10	0
PP	gm	0	25	0	0	10
PS	gm	0	0	20	0	0
OTHERS	gm	0	0	0	0	0
Office no = 3 (Latitude = 22.38128 Longitude = 91.80862)						
Day		1	2	3	4	5
Nos of population		12	12	12	12	12
Organic waste	gm	1720	875	1150	1295	1365
PETE/PETEE	gm	150	85	130	20	55
HDPE	gm	0	0	0	0	0
PVC	gm	0	0	10	0	0
LDPE	gm	5	0	5	5	5
PP	gm	15	0	0	10	25
PS	gm	40	0	0	0	0
OTHERS	gm	0	0	0	0	0

Ward no. : 02						
Facilities Type : Market						
Market no = 1 (Latitude = 22.38144 Longitude = 91.80938)						
Day		1	2	3	4	5
Organic waste	gm	11560	15635	10545	12240	14575
PETE/PETEE	gm	580	785	645	550	750
HDPE	gm	20	55	30	0	0
PVC	gm	0	65	0	0	0
LDPE	gm	525	590	645	580	765
PP	gm	40	75	85	35	25
PS	gm	0	0	55	25	30
OTHERS	gm	0	0	0	55	0
Market no = 2 (Latitude = 22.38144 Longitude = 91.80938)						
Day		1	2	3	4	5
Organic waste	gm	12150	8390	10035	12070	10130
PETE/PETEE	gm	430	535	715	575	455
HDPE	gm	0	0	100	130	0
PVC	gm	150	0	0	0	55
LDPE	gm	440	225	435	650	420
PP	gm	75	80	55	90	45
PS	gm	60	40	30	75	35
OTHERS	gm	0	0	105	0	0

Table A.2 Detailed Survey data of households, Street, office and Restaurants at Ward no. 07.

Ward no. : 07									
Facilities Type: Household (HH)									
Group :High Income Group									

House no = 1		Latitude = 22.374579				Longitude = 91.809021			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	1105	1590	1250	1225	1320	1680	665	1890
PETE/PETEE	gm	85	50				110	90	
HDPE	gm							150	
PVC	gm				50				
LDPE	gm	45	30	60	45	130	125	135	45
PP	gm							120	
PS	gm							45	
OTHERS	gm								
House no = 2		Latitude = 22.375661				Longitude = 91.823142			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	4
Organic waste	gm	2005	1180	790	960	820	1170	975	1720
PETE/PETEE	gm			55	85				
HDPE	gm				85				
PVC	gm					50			
LDPE	gm	30	45	95	70	75	90	45	35
PP	gm						115		
PS	gm			40					
OTHERS	gm								
House no = 3		Latitude = 22.375661				Longitude = 91.823142			
Day		0	1	2	3	4	5	6	7
Nos of population		7	7	7	6	6	6	6	6
Organic waste	gm	2300	3130	1890	2270	1680	1470	2260	1780
PETE/PETEE	gm		75	55	85				
HDPE	gm							100	70
PVC	gm					70			
LDPE	gm	120	90	95	85	90	125	175	30
PP	gm	600			190				
PS	gm							80	
OTHERS	gm								
House no = 4		Latitude = 22.376277				Longitude = 91.821718			
Day		0	1	2	3	4	5	6	7
Nos of population		8	4	4	4	4	4	4	4

Organic waste	gm	1560	1790	1450	1380	1220	1105	1280	1650
PETE/PETEE	gm			85		70		120	
HDPE	gm			45		90		85	
PVC	gm				90				
LDPE	gm	130	95	80	90	120	75	85	55
PP	gm						180		
PS	gm							60	
OTHERS	gm								
House no = 5		Latitude = 22.376197				Longitude = 91.82203			
Day		0	1	2	3	4	5	6	7
Nos of population		6	6	3	3	3	3	3	3
Organic waste	gm	1280	1780	1680	975	890	980	920	890
PETE/PETEE	gm				75				115
HDPE	gm							135	
PVC	gm			65					
LDPE	gm	80	65	95	120	85	110	95	85
PP	gm				120	90			
PS	gm			65					
OTHERS	gm								
House no = 6		Latitude = 22.376323				Longitude = 91.822722			
Day		0	1	2	3	4	5	6	7
Nos of population		9	6	6	6	6	6	6	9
Organic waste	gm	680	2200	1100	2305	1210	1160	2010	2560
PETE/PETEE	gm								225
HDPE	gm			75					65
PVC	gm						90		
LDPE	gm	85	120	130	145	120	95	180	85
PP	gm					230			
PS	gm							95	
OTHERS	gm								
House no = 7		Latitude = 22.376836				Longitude = 91.822718			
Day		0	1	2	3	4	5	6	7
Nos of population		7	4	4	3	3	3	3	3
Organic waste	gm	800	1890	1450	1120	875	890	865	980
PETE/PETEE	gm					135			
HDPE	gm							85	
PVC	gm					45			
LDPE	gm	55	85	80	70	45	40	35	45
PP	gm				125				
PS	gm						55		
OTHERS	gm						70		

House no = 8		Latitude = 22.376836				Longitude = 91.822718			
Day		0	1	2	3	4	5	6	7
Nos of population		8	8	12	4	4	4	4	8
Organic waste	gm	520	1920	1890	4315	1170	1220	1790	2360
PETE/PETEE	gm				125		110		80
HDPE	gm				95		70		75
PVC	gm				125				
LDPE	gm	65	195	125	175	165	185	165	85
PP	gm						120	245	
PS	gm							115	
OTHERS	gm							50	
House no = 9		Latitude = 22.376897				Longitude = 91.822997			
Day		0	1	2	3	4	5	6	7
Nos of population		6	4	4	4	4	4	4	4
Organic waste	gm	400	2305	1210	1580	980	1145	1225	1130
PETE/PETEE	gm				155				
HDPE	gm							125	
PVC	gm						65		
LDPE	gm	100	120	85	85	65	75	65	60
PP	gm						135		
PS	gm						60		
OTHERS	gm								

House no = 10		Latitude = 22.376897				Longitude = 91.822997			
Day		0	1	2	3	4	5	6	7
Nos of population		8	8	4	4	4	4	4	4
Organic waste	gm	600	2450	2380	990	1125	1230	1320	1350
PETE/PETEE	gm			145					170
HDPE	gm				85			75	
PVC	gm						70		
LDPE	gm		90	140	75	80	70	140	120
PP	gm				120			90	
PS	gm					75			
OTHERS	gm								

Group : Middle Income Group

House no = 1		Latitude = 22.380916				Longitude = 91.819371			
Day		0	1	2	3	4	5	6	7
Nos of population		6	4	4	4	4	4	4	4
Organic waste	gm	1190	1320	1125	1200	1585	1420	1475	1320
PETE/PETEE	gm		40		55		85		
HDPE	gm						85	75	

PVC	gm				55				
LDPE	gm	55	65	75	65	90	130	45	60
PP	gm								65
PS	gm							130	
OTHERS	gm								
House no = 2		Latitude = 22.380916				Longitude = 91.819371			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	4	4	4	4	4
Organic waste	gm	2300	1120	1050	1100	1685	1175	1380	1250
PETE/PETEE	gm			100					60
HDPE	gm					85		60	
PVC	gm					65			
LDPE	gm	210	175	95	45	120	45	55	45
PP	gm					90		80	
PS	gm					60			
OTHERS	gm								
House no = 3		Latitude = 22.380916				Longitude = 91.819371			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	3	3	4	3	4	4
Organic waste	gm	1300	1750	1285	980	1125	1210	670	955
PETE/PETEE	gm		95						50
HDPE	gm							130	
PVC	gm					55			
LDPE	gm	145	25	60	90	85	95	85	90
PP	gm	285					185		
PS	gm							45	
OTHERS	gm								

House no = 4		Latitude = 22.380916				Longitude = 91.819371			
Day		0	1	2	3	4	5	6	7
Nos of population		3	4	4	3	3	3	3	3
Organic waste	gm	1000	1555	905	1350	525	625	1225	1215
PETE/PETEE	gm			65					35
HDPE	gm								120
PVC	gm					50			
LDPE	gm	85	40	125	120	85	45	55	35
PP	gm		155						
PS	gm		60						
OTHERS	gm								
House no = 5		Latitude = 22.380994				Longitude = 91.819816			
Day		0	1	2	3	4	5	6	7

Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1290	1170	950	1310	870	875	1120	770
PETE/PETEE	gm	95			145				
HDPE	gm							90	
PVC	gm					50			
LDPE	gm	90	45	55	50	55	110	75	90
PP	gm						125		
PS	gm						55		
OTHERS	gm					35			
House no = 6		Latitude = 22.380994				Longitude = 91.819816			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	1220	1175	1230	1165	1780	970	985	1320
PETE/PETEE	gm					55	70		
HDPE	gm								105
PVC	gm					70			
LDPE	gm	85	120	125	45	65	90	45	40
PP	gm						115		
PS	gm						55		
OTHERS	gm								

House no = 7		Latitude = 22.380981				Longitude = 91.819865			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	3	3	3	3	3	3
Organic waste	gm	2105	1380	855	970	780	870	1190	1220
PETE/PETEE	gm			55				65	
HDPE	gm						95		
PVC	gm					55			
LDPE	gm	65	70	55	80	60	80	75	65
PP	gm						130		
PS	gm					50			
OTHERS	gm								
House no = 8		Latitude = 22.381389				Longitude = 91.820071			
Day		0	1	2	3	4	5	6	7
Nos of population		5	7	5	5	5	5	5	5
Organic waste	gm	890	1120	3980	1320	1085	1125	1090	1385
PETE/PETEE	gm				85		120		
HDPE	gm		145						
PVC	gm					70			
LDPE	gm	95	85	190	70	110	90	95	55
PP	gm	380					185		

PS	gm					75			
OTHERS	gm								
House no = 9		Latitude = 22.381389				Longitude = 91.820071			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	4	4	4	4
Organic waste	gm	1300	980	870	1150	830	925	1125	1205
PETE/PETEE	gm	120		85		45			
HDPE	gm				90				
PVC	gm					60			
LDPE	gm	55	65	55	65	130	75	75	45
PP	gm						145		
PS	gm						55		
OTHERS	gm								

House no = 10		Latitude = 22.380817				Longitude = 91.821219			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	3	3	3	3	3	3
Organic waste	gm	900	885	1130	985	910	970	870	1130
PETE/PETEE	gm							90	
HDPE	gm				90				
PVC	gm						35		
LDPE	gm		55	45	45	65	35	35	60
PP	gm					95			
PS	gm						40		
OTHERS	gm								

Group : Low Income Group									
House no = 1		Latitude = 22.380462				Longitude = 91.821648			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	5	3	3	3	3
Organic waste	gm	505	425	385	495	1525	750	490	520
PETE/PETEE	gm		60						
HDPE	gm					45			
PVC	gm		20						
LDPE	gm	65	25	25	20	35	25	30	20
PP	gm				55				
PS	gm				25				
OTHERS	gm								
House no = 2		Latitude = 22.380519				Longitude = 91.821946			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3

Organic waste	gm	600	490	720	870	850	710	430	550
PETE/PETEE	gm					55			
HDPE	gm			35					
PVC	gm		20						
LDPE	gm	40	20	25	35	30	15	25	35
PP	gm				50				
PS	gm							20	
OTHERS	gm								
House no = 3		Latitude = 22.380519				Longitude = 91.822484			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	5	3	3	3	3	3
Organic waste	gm	55	500	680	1130	650	775	765	430
PETE/PETEE	gm				55				
HDPE	gm	30						35	
PVC	gm				15				
LDPE	gm	55	30	15	20	25	15	25	30
PP	gm						50		
PS	gm						15		
OTHERS	gm				10				
House no = 4		Latitude = 22.380711				Longitude = 91.822859			
Day		0	1	2	3	4	5	6	7
Nos of population		4	5	7	5	5	3	3	3
Organic waste	gm	780	565	970	1670	1540	575	790	670
PETE/PETEE	gm				65				
HDPE	gm		40						
PVC	gm				25				
LDPE	gm	55	25	45	30	35	20	30	25
PP	gm			55					
PS	gm								20
OTHERS	gm								
House no = 5		Latitude = 22.380713				Longitude = 91.822852			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	785	790	885	780	1120	870	760	980
PETE/PETEE	gm			60					
HDPE	gm				25				
PVC	gm		20						
LDPE	gm	45	20	30	25	35	40	45	35
PP	gm						65		
PS	gm								25
OTHERS	gm								

House no = 6		Latitude = 22.380628				Longitude = 91.822414			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	560	375	685	875	465	875	855	720
PETE/PETEE	gm		60						
HDPE	gm				40				
PVC	gm			20					
LDPE	gm	75	25	35	20	35	25	35	30
PP	gm						55		
PS	gm							15	
OTHERS	gm								

House no = 7		Latitude = 22.379713				Longitude = 91.821415			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	650	550	1145	785	885	890	870	980
PETE/PETEE	gm							75	
HDPE	gm	70				60			
PVC	gm			25					
LDPE	gm	45	40	25	45	40	30	35	45
PP	gm						70		
PS	gm								25
OTHERS	gm								
House no = 8		Latitude = 22.379759				Longitude = 91.82163			
Day		0	1	2	3	4	5	6	7
Nos of population		4	5	5	3	3	3	3	3
Organic waste	gm	760	1220	785	890	765	445	870	450
PETE/PETEE	gm			55					
HDPE	gm					35			
PVC	gm				20				
LDPE	gm	45	25	35	35	25	20	30	40
PP	gm							60	
PS	gm				25				
OTHERS	gm								
House no = 9		Latitude = 22.379648				Longitude = 91.821161			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	410	870	820	750	990	730	875	930
PETE/PETEE	gm					45			
HDPE	gm				35				
PVC	gm			20					

LDPE	gm	10	15	25	35	25	25	20	15
PP	gm						45		
PS	gm				15				
OTHERS	gm								
House no = 10		Latitude = 22.379626				Longitude = 91.821066			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	480	475	485	890	975	870	750	675
PETE/PETEE	gm		65						
HDPE	gm				35				
PVC	gm						20		
LDPE	gm	30	25	25	30	25	20	15	40
PP	gm					55			
PS	gm								20
OTHERS	gm								
Ward no. : 07									
Facilities Type : Hotel & Restaurant (HR)									
Restaurant no = 1 (Latitude = 22.379713					Longitude = 91.821415)				
Day		0	1	2	3	4	5	6	7
Nos of seats		70	70	70	70	70	70	70	70
Organic waste	gm	31565	32450	31155	35450	33470	25760	30490	32520
PETE/PETEE	gm	1590	2000	1850	2950	2375	1620	1955	1745
HDPE	gm	0	0	0	50	0	0	0	0
PVC	gm	0	0	0	0	0	0	0	0
LDPE	gm	90	105	75	80	115	75	90	65
PP	gm	175	245	180	255	175	180	130	195
PS	gm	180	115	90	215	175	135	270	235
OTHERS	gm	0	0	0	0	0	0	0	0
Restaurant no = 2 (Latitude = 22.379648					Longitude = 91.821161)				
Day		0	1	2	3	4	5	6	7
Nos of seats		58	58	58	58	58	58	58	58
Organic waste	gm	25575	32430	33445	25425	23330	33435	30570	29345
PETE/PETEE	gm	1750	1975	2225	1700	1835	1850	2340	1730
HDPE	gm	0	0	0	0	0	0	75	0
PVC	gm	0	0	0	0	45	0	0	0
LDPE	gm	65	90	75	45	100	75	105	50
PP	gm	145	160	215	115	180	255	175	245
PS	gm	135	110	195	135	215	175	180	140
OTHERS	gm	0	0	0	0	105	0	0	0
Restaurant no = 3 (Latitude = 22.380462					Longitude = 91.821648)				
Day		0	1	2	3	4	5	6	7
Nos of seats		65	65	65	65	65	65	65	65

Organic waste	gm	32000	25490	19470	22455	17450	20565	28900	22350
PETE/PETEE	gm	2150	1950	1200	1790	1855	1475	2100	1450
HDPE	gm	0	0	0	0	0	80	0	0
PVC	gm	0	0	0	0	0	0	65	0
LDPE	gm	45	85	105	145	130	65	110	90
PP	gm	215	195	155	185	155	190	225	175
PS	gm	190	145	130	115	95	105	125	195
OTHERS	gm	0	0	0	0	0	0	0	0

Ward no. : 07									
Facilities Type : Street									
Street 1 (Latitude = 22.381389					Longitude = 91.820071)				
Day		0	1	2	3	4	5	6	7
Organic waste	gm	11930	11735	14520	10590	10450	12470	12690	11875
PETE/PETEE	gm	225	170	135	155	285	320	255	190
HDPE	gm	0	0	0	0	0	0	0	0
PVC	gm	0	0	0	35	0	0	0	0
LDPE	gm	480	465	745	385	570	640	520	610
PP	gm	95	65	105	75	115	150	85	75
PS	gm	85	95	85	50	75	75	130	55
OTHERS	gm	0	0	55	0	0	0	0	0
Street 2 (Latitude = 22.381389					Longitude = 91.820071)				
Day		0	1	2	3	4	5	6	7
Organic waste	gm	8550	9230	10520	8770	9450	10000	8965	11540
PETE/PETEE	gm	145	110	155	140	225	185	170	155
HDPE	gm	0	0	0	0	85	50	0	0
PVC	gm	0	0	0	120	0	0	0	45
LDPE	gm	335	455	400	345	675	555	495	435
PP	gm	105	80	50	25	55	100	55	75
PS	gm	95	115	60	45	105	55	45	40
OTHERS	gm	0	0	0	0	0	75	0	0
Street 3 (Latitude = 22.381389					Longitude = 91.820071)				
Day		0	1	2	3	4	5	6	7
Organic waste	gm	8700	6570	7945	9620	8500	7390	5445	8245
PETE/PETEE	gm	100	80	85	60	95	135	50	115
HDPE	gm	0	30	0	0	0	0	0	0
PVC	gm	0	0	0	0	0	0	0	0
LDPE	gm	290	250	345	395	320	475	365	225
PP	gm	45	30	45	55	55	90	65	70
PS	gm	40	75	25	30	70	35	95	25
OTHERS	gm	0	0	0	0	0	0	0	0
Ward no. : 07									
Facilities Type : Office									
Office no = 1 (Latitude = 22.376323 Longitude = 91.822722)									
Day		1	2	3	4	5			
Nos of population		19	19	19	19	19			
Organic waste	gm	2540	2320	1875	1900	2570			
PETE/PETEE	gm	125	165	90	180	165			
HDPE	gm	0	0	0	45	0			
PVC	gm	0	0	0	0	0			

LDPE	gm	20	5	5	5	15
PP	gm	20	35	15	25	45
PS	gm	35	0	50	0	0
OTHERS	gm	0	0	0	0	0
Office no = 2 (Latitude = 22.380817 Longitude = 91.821219)						
Day		1	2	3	4	5
Nos of population		13	13	13	13	13
Organic waste	gm	1450	1245	1045	1120	985
PETE/PETEE	gm	95	145	70	105	55
HDPE	gm	0	0	0	0	0
PVC	gm	0	0	0	0	0
LDPE	gm	10	10	10	10	5
PP	gm	30	35	0	20	20
PS	gm	0	25	0	0	0
OTHERS	gm	0	0	0	0	35
Office no = 3 (Latitude = 22.380713 Longitude = 91.822852)						
Day		1	2	3	4	5
Nos of population		10	10	10	10	10
Organic waste	gm	750	1135	1240	1350	1295
PETE/PETEE	gm	85	125	145	80	75
HDPE	gm	0	0	0	0	0
PVC	gm	0	0	0	15	0
LDPE	gm	5	5	15	5	5
PP	gm	0	0	10	0	15
PS	gm	0	0	0	30	0
OTHERS	gm	0	0	0	0	0
Ward no.: 07						
Facilities Type: Market						
Market no = 1 (Latitude = 22.376197 Longitude = 91.82203)						
Day		1	2	3	4	5
Organic waste	gm	10750	12420	11540	14450	8645
PETE/PETEE	gm	410	335	665	590	365
HDPE	gm	0	0	85	30	0
PVC	gm	0	0	0	55	45
LDPE	gm	715	570	750	885	735
PP	gm	35	90	75	40	35
PS	gm	0	50	0	0	65
OTHERS	gm	0	0	0	0	0
Market no = 2 (Latitude = 22.381389 Longitude = 91.820071)						
Day		1	2	3	4	5
Organic waste	gm	9150	7450	9885	11570	9535

PETE/PETEE	gm	375	425	695	640	555
HDPE	gm	0	55	0	75	0
PVC	gm	0	115	0	0	80
LDPE	gm	460	235	450	625	515
PP	gm	85	90	60	95	50
PS	gm	75	55	40	85	45
OTHERS	gm	0	0	0	0	235

Table A.3 Detailed Survey data of households, Street, office and Restaurants at Ward no. 31.

Ward: 31	Group : Middle Income Group
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House no = 1		Latitude = 22.328043				Longitude = 91.833034			
Day		0	1	2	3	4	5	6	7
Nos of population		6	5	4	4	5	5	4	4
Organic waste	gm	945	1450	1450	1355	1055	1620	1295	1450
PETE/PETEE	gm	45			60	20	55		
HDPE	gm				20		45		25
PVC	gm					75			
LDPE	gm	70	65	55	50	70	75	45	60
PP	gm	20			45		30	70	
PS	gm	55	10	25			15		
OTHERS	gm				20				50
SUP	gm	65	55	50	40	65	75	45	55
MLP	gm	5	10	5	10	5	0	0	5
House no = 2		Latitude = 22.328043				Longitude = 91.833034			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	3	4	4
Organic waste	gm	870	1145	1015	1455	1245	1275	1490	1120
PETE/PETEE	gm				55		30	45	
HDPE	gm	55		25				20	35
PVC	gm							120	
LDPE	gm	25	70	70	65	50	35	75	45
PP	gm				20	45	30	25	
PS	gm				50			20	
OTHERS	gm	70	50			15			
SUP	gm	25	70	65	55	50	35	65	45
MLP	gm	0	0	5	10	0	0	10	0
House no = 3		Latitude = 22.328043				Longitude = 91.833034			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	4	4	3	3	4

Organic waste	gm	870	915	1230	1245	1575	920	745	1020
PETE/PETEE	gm	35	55			60			20
HDPE	gm					25	40		
PVC	gm	25		35					
LDPE	gm	40	45	60	80	65	55	40	60
PP	gm	15	20	35		80			
PS	gm							85	
OTHERS	gm								
SUP	gm	30	45	55	70	50	55	40	50
MLP	gm	10	0	5	10	15	0	0	10

House no = 4		Latitude = 22.328043				Longitude = 91.833034			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	2	3	3	3	3
Organic waste	gm	520	1290	935	870	1255	1330	960	1000
PETE/PETEE	gm	45				65		35	20
HDPE	gm	65	25		15	35			
PVC	gm					30		20	
LDPE	gm	45	55	40	30	55	75	55	50
PP	gm	85				55	35	15	5
PS	gm						55		
OTHERS	gm	155			85				
SUP	gm	40	40	35	30	55	65	55	45
MLP	gm	5	15	5	0	0	10	0	5
House no = 5		Latitude = 22.328043				Longitude = 91.833034			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	3	4	4	4	3	4
Organic waste	gm	1345	1170	885	1035	1425	1250	1030	975
PETE/PETEE	gm	55	65	25		35			
HDPE	gm		30	25				30	
PVC	gm					25			55
LDPE	gm	50	65	40	45	60	55	50	65
PP	gm	15	45	20		50			
PS	gm		35					25	
OTHERS	gm						30		
SUP	gm	50	60	35	45	55	55	45	60
MLP	gm	0	5	5	0	5	0	5	5
House no = 6		Latitude = 22.328043				Longitude = 91.833034			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	1165	1570	1090	1245	1220	1295	1045	1070

PETE/PETEE	gm				50		25		65
HDPE	gm		40	25		35	10		
PVC	gm		50						
LDPE	gm	35	50	60	55	75	35	65	55
PP	gm			65	40		10		25
PS	gm	20		55				45	
OTHERS	gm	85				50			
SUP	gm	35	40	60	50	65	35	60	45
MLP	gm	0	10	0	5	10	0	5	10

House no = 7		Latitude = 22.328163				Longitude = 91.832519			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	4	4	4	5
Organic waste	gm	1220	1245	1365	1435	1190	1155	1265	1435
PETE/PETEE	gm	100				55	100		
HDPE	gm	55		65		45			
PVC	gm		35		25				
LDPE	gm	25	70	55	90	55	75	50	80
PP	gm	45			55	40	65		
PS	gm							15	35
OTHERS	gm	65							
SUP	gm	25	65	50	75	45	70	50	65
MLP	gm	0	5	5	15	10	5	0	15
House no = 8		Latitude = 22.328163				Longitude = 91.832519			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	2	3	2	2	1
Organic waste	gm	720	1345	1215	855	1330	820	1040	825
PETE/PETEE	gm		30	55		25			
HDPE	gm	10	25						45
PVC	gm							135	
LDPE	gm	35	55	60	40	65	50	50	20
PP	gm	50	25	45		15		35	
PS	gm		35						
OTHERS	gm								
SUP	gm	30	50	45	35	65	50	45	20
MLP	gm	5	5	15	5	0	0	5	0
House no = 9		Latitude = 22.328145				Longitude = 91.832377			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	5	5	5	4	4
Organic waste	gm	1145	1065	1390	1275	1125	1240	1355	1320
PETE/PETEE	gm	75	45			80	15		

HDPE	gm	45		40		25			55
PVC	gm				50				
LDPE	gm	60	50	75	65	80	85	70	45
PP	gm	30	25	45		70			20
PS	gm				40			15	
OTHERS	gm								
SUP	gm	50	40	70	65	70	85	70	35
MLP	gm	10	10	5	0	10	0	0	10

House no = 10		Latitude = 22.328145				Longitude = 91.832377			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	3	3	2	3	2	3
Organic waste	gm	1060	850	930	965	745	860	750	875
PETE/PETEE	gm		55						45
HDPE	gm				25		10	10	35
PVC	gm	45		30					
LDPE	gm	30	35	55	45	30	55	30	65
PP	gm		25	45					
PS	gm		55						
OTHERS	gm								
SUP	gm	15	30	50	45	25	55	30	60
MLP	gm	15	5	5	0	5	0	0	5

Ward : 31					Group : Low Income Group				
House no = 1		Latitude = 22.328139				Longitude = 91.833694			
Day		0	1	2	3	4	5	6	7
Nos of population		3	4	4	4	4	3	4	3
Organic waste	gm	625	875	1020	535	980	605	1070	820
PETE/PETEE	gm			45		25		15	
HDPE	gm	20	20					35	
PVC	gm			50					
LDPE	gm	35	25	45	20	35	20	55	30
PP	gm			35	10	30			
PS	gm							25	10
OTHERS	gm								
SUP	gm	35	25	35	20	35	15	50	30
MLP	gm	0	0	10	0	0	5	5	0
House no = 2		Latitude = 22.328139				Longitude = 91.833694			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	850	725	790	675	1060	935	775	870
PETE/PETEE	gm					25		40	35
HDPE	gm		55			20			
PVC	gm								
LDPE	gm	20	25	35	15	65	55	20	55
PP	gm					30		45	15
PS	gm								
OTHERS	gm			20					
SUP	gm	20	25	35	15	50	45	20	50
MLP	gm	0	0	0	0	15	10	0	5
House no = 3		Latitude = 22.328143				Longitude = 91.833665			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	3	3	5
Organic waste	gm	1045	965	930	1155	1020	835	875	955
PETE/PETEE	gm	65						20	65
HDPE	gm					55			
PVC	gm				20				15
LDPE	gm	95	35	40	75	65	15	25	55
PP	gm				50				
PS	gm	30	10			10			
OTHERS	gm				45		15		
SUP	gm	85	35	40	75	65	15	25	55
MLP	gm	10	5	0	10	0	0	0	0

House no = 4		Latitude = 22.328143				Longitude = 91.833665			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	6	6	4
Organic waste	gm	875	915	885	800	835	1245	1175	940
PETE/PETEE	gm	20			45	20		20	
HDPE	gm				10		25	35	
PVC	gm	70					55		
LDPE	gm	25	15	10	40	20	35	60	35
PP	gm				35	10	15	10	
PS	gm			20				15	
OTHERS	gm								
SUP	gm	25	15	10	40	20	35	50	35
MLP	gm	0	0	0	0	0	0	10	0
House no = 5		Latitude = 22.328159				Longitude = 91.833632			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	450	570	585	470	620	475	555	605
PETE/PETEE	gm					20			40
HDPE	gm			15				25	
PVC	gm		30						
LDPE	gm	10	25	15	20	15	15	20	35
PP	gm					50			
PS	gm								20
OTHERS	gm								
SUP	gm	10	25	15	20	5	15	10	30
MLP	gm	0	0	0	0	10	0	10	5
House no = 6		Latitude = 22.328159				Longitude = 91.833632			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	2	2	2	4	4	2
Organic waste	gm	650	975	320	375	435	990	755	875
PETE/PETEE	gm		35						25
HDPE	gm								40
PVC	gm								
LDPE	gm	55	45	20	15	20	45	25	15
PP	gm		50						5
PS	gm	45					25		
OTHERS	gm								
SUP	gm	50	35	20	15	10	45	25	15
MLP	gm	5	10	0	0	10	0	0	0

House no = 7		Latitude = 22.328165				Longitude = 91.833603			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	895	825	730	745	775	1055	765	1250
PETE/PETEE	gm				20		10		35
HDPE	gm	40			10			35	
PVC	gm								
LDPE	gm	20	30	25	35	15	40	10	55
PP	gm			35	5		70		25
PS	gm						15		
OTHERS	gm	75	15						55
SUP	gm	20	30	25	35	15	35	10	45
MLP	gm	0	0	0	0	0	5	0	10
House no = 8		Latitude = 22.328165				Longitude = 91.833603			
Day		0	1	2	3	4	5	6	7
Nos of population		4	3	4	4	4	3	4	4
Organic waste	gm	650	725	845	800	835	540	675	790
PETE/PETEE	gm	50	15			35			
HDPE	gm			30					
PVC	gm				45				
LDPE	gm	10	20	45	30	15	25	25	20
PP	gm	15	5			45			
PS	gm	25		25					
OTHERS	gm							25	
SUP	gm	10	20	45	25	15	25	25	20
MLP	gm	0	0	0	10	0	0	0	0
House no = 9		Latitude = 22.32815				Longitude = 91.833589			
Day		0	1	2	3	4	5	6	7
Nos of population		6	6	6	6	6	6	6	6
Organic waste	gm	1260	1050	1135	1275	1240	1015	1000	1385
PETE/PETEE	gm	40		35	20		25		50
HDPE	gm		10				20		45
PVC	gm								
LDPE	gm	55	40	75	85	25	55	20	40
PP	gm	10		15	55		10		25
PS	gm				35				20
OTHERS	gm								
SUP	gm	45	40	55	75	25	50	20	40
MLP	gm	10	0	20	10	0	5	0	0

House no = 10		Latitude = 22.32815				Longitude = 91.833589			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	655	865	950	915	845	810	920	885
PETE/PETEE	gm			25		40			
HDPE	gm				45	15			
PVC	gm			40					
LDPE	gm	25	15	55	20	45	30	35	20
PP	gm			20		15		45	
PS	gm					25			
OTHERS	gm								
SUP	gm	25	15	45	20	40	25	35	20
MLP	gm	0	0	10	0	5	5	0	0

Ward : 31					Group : High Income Group				
House no = 1		Latitude = 22.329033				Longitude = 91.831517			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	3	3	4	3	5
Organic waste	gm	995	1360	1475	930	1185	1365	945	1030
PETE/PETEE	gm	45	20		30		55		35
HDPE	gm	25	55		30			15	
PVC	gm			55					
LDPE	gm	70	85	75	45	65	55	60	75
PP	gm	15	10		35		40		55
PS	gm		55						
OTHERS	gm	35				60	15		
SUP	gm	60	80	65	45	65	45	55	70
MLP	gm	10	5	10	0	0	10	5	5
House no = 2		Latitude = 22.329033				Longitude = 91.831517			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	4	4	4	4	2	4
Organic waste	gm	845	930	1225	1075	1330	1040	995	1115
PETE/PETEE	gm		75	20				55	
HDPE	gm				45	50			
PVC	gm	35						90	
LDPE	gm	55	40	65	55	75	80	45	50
PP	gm	35	50	15				75	
PS	gm			45					
OTHERS	gm								
SUP	gm	50	35	65	55	50	75	45	50
MLP	gm	5	5	0	0	15	5	0	0
House no = 3		Latitude = 22.329033				Longitude = 91.831517			
Day		0	1	2	3	4	5	6	7
Nos of population		5	4	2	3	3	3	5	4
Organic waste	gm	1545	1320	965	1135	1240	1270	1390	1395
PETE/PETEE	gm	40		35	45			50	15
HDPE	gm					80			
PVC	gm		45						30
LDPE	gm	65	75	50	65	70	60	75	60
PP	gm	25		55	30			20	35
PS	gm							70	
OTHERS	gm	125		40					75
SUP	gm	50	55	45	65	55	60	65	60
MLP	gm	15	20	5	0	15	0	10	0

House no = 4		Latitude = 22.328903				Longitude = 91.832016			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	2
Organic waste	gm	1020	945	1085	1290	820	970	1030	745
PETE/PETEE	gm	110		55	15		80		
HDPE	gm	90	20		40			35	
PVC	gm	25					40		
LDPE	gm	40	55	70	55	50	45	65	35
PP	gm	55		45	55		35		
PS	gm				30			50	
OTHERS	gm								
SUP	gm	40	55	60	55	50	45	60	30
MLP	gm	0	0	10	0	0	0	5	5
House no = 5		Latitude = 22.328903				Longitude = 91.832016			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	2	2	2	2	2	2
Organic waste	gm	320	590	825	675	845	735	1090	835
PETE/PETEE	gm			25			55	20	
HDPE	gm				35			25	
PVC	gm	45	60						
LDPE	gm	20	35	55	40	50	40	55	45
PP	gm			35			65		
PS	gm					35			
OTHERS	gm	20						50	
SUP	gm	15	35	50	35	45	40	45	45
MLP	gm	5	0	5	5	5	0	10	0
House no = 6		Latitude = 22.328903				Longitude = 91.832016			
Day		0	1	2	3	4	5	6	7
Nos of population		4	3	4	4	4	1	3	3
Organic waste	gm	960	770	855	830	975	330	1035	995
PETE/PETEE	gm			40			50		55
HDPE	gm	70			15	25		10	10
PVC	gm						25		
LDPE	gm	40	45	50	70	55	20	50	45
PP	gm			70			10		25
PS	gm				30				
OTHERS	gm								
SUP	gm	30	35	45	60	50	20	50	35
MLP	gm	10	10	5	10	5	0	0	10

House no = 7		Latitude = 22.328903				Longitude = 91.832016			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	3	3	2	2	3	3
Organic waste	gm	1075	900	775	845	235	820	850	1045
PETE/PETEE	gm	65		45	35		50		
HDPE	gm		25					15	20
PVC	gm					35			
LDPE	gm	25	25	45	55	15	35	45	60
PP	gm	45	50	5	20		15		
PS	gm					25			20
OTHERS	gm	65						55	
SUP	gm	25	25	40	50	15	35	45	50
MLP	gm	0	0	5	5	0	0	0	10
House no = 8		Latitude = 22.327871				Longitude = 91.831976			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	5	5	5	3
Organic waste	gm	540	1175	920	945	1245	1430	1595	1125
PETE/PETEE	gm		75			15		45	
HDPE	gm			20	65				
PVC	gm		60				45		
LDPE	gm	15	45	55	60	70	95	65	50
PP	gm		40	35				55	
PS	gm					80			
OTHERS	gm								
SUP	gm	15	45	50	55	55	75	60	45
MLP	gm	0	0	5	5	15	20	5	5
House no = 9		Latitude = 22.327871				Longitude = 91.831976			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1160	1220	1045	1275	1135	1115	1350	1000
PETE/PETEE	gm		15	25		40		35	20
HDPE	gm		20			30		25	
PVC	gm				145				
LDPE	gm	40	60	45	75	60	60	65	40
PP	gm		45	10		50		30	5
PS	gm						40		
OTHERS	gm	190		40	55				
SUP	gm	35	50	35	70	50	55	65	35
MLP	gm	5	10	10	5	10	5	0	5
House no = 10		Latitude = 22.327871				Longitude = 91.831976			

Day		0	1	2	3	4	5	6	7
Nos of population		4	2	2	3	3	3	2	3
Organic waste	gm	1330	685	520	1130	1055	855	745	935
PETE/PETEE	gm	65				40			50
HDPE	gm		45			65	35		
PVC	gm							50	
LDPE	gm	70	35	45	60	55	55	30	45
PP	gm	20			65	15			25
PS	gm		40						
OTHERS	gm								
SUP	gm	50	35	50	60	45	35	30	45
MLP	gm	20	0	5	0	10	10	0	0

Ward no. : 31									
Facilities Type : Hotel & Restaurant (HR)									
Restaurant no = 1		Latitude = 22.337				Longitude = 91.832881			
Day		0	1	2	3	4	5	6	7
Nos of seats		64	64	64	64	64	64	64	64
Organic waste	gm	31420	35850	30710	41750	35620	27660	31365	31135
PETE/PETEE	gm	1790	2235	1710	2470	2075	1500	1850	1955
HDPE	gm	15	0	20	25	0	0	10	0
PVC	gm	0	10	0	0	0	25	0	0
LDPE	gm	115	90	125	170	100	90	60	75
PP	gm	200	185	150	230	100	165	130	155
PS	gm	130	100	85	170	125	115	185	200
OTHERS	gm	20	0	0	35	100	0	0	0
SUP	gm	105	90	100	160	100	85	50	75
MLP	gm	10	0	25	10	0	5	10	0
Restaurant no = 2		Latitude = 22.333376				Longitude = 91.833927			
Day		0	1	2	3	4	5	6	7
Nos of seats		60	60	60	60	60	60	60	60
Organic waste	gm	33100	30380	32765	31960	32635	30150	30985	31470
PETE/PETEE	gm	1880	2520	1890	2135	1850	1965	2000	1735
HDPE	gm	0	0	15	0	0	55	0	0
PVC	gm	0	0	0	0	0	0	0	0
LDPE	gm	95	105	75	65	130	50	130	80
PP	gm	175	145	200	115	140	195	170	210
PS	gm	110	85	170	120	185	140	160	115
OTHERS	gm	0	0	50	0	0	0	0	75
SUP	gm	95	100	75	50	115	50	95	80
MLP	gm	0	5	0	15	15	0	35	0
Restaurant no = 3		Latitude = 22.334504				Longitude = 91.830909			
Day		0	1	2	3	4	5	6	7
Nos of seats		48	48	48	48	48	48	48	48
Organic waste	gm	29330	26920	20500	24740	27985	19570	19365	24645
PETE/PETEE	gm	1500	1650	1575	1485	1635	1160	1200	2090
HDPE	gm	0	55	0	0	0	0	0	0
PVC	gm	0	0	0	40	0	0	0	25
LDPE	gm	40	85	55	90	125	80	65	100
PP	gm	190	165	135	155	120	145	130	170
PS	gm	175	125	100	90	110	70	115	165
OTHERS	gm	0	0	35	0	0	50	0	0
SUP	gm	35	70	55	90	105	80	60	90
MLP	gm	5	15	0	0	20	0	5	10

Ward no. : 31									
Facilities Type : Street									

Street 1 (Latitude = 22.329033 Longitude = 91.831517)									
Day		0	1	2	3	4	5	6	7
Organic waste	gm	11300	10930	15235	7480	11960	13380	15340	12445
PETE/PETEE	gm	210	185	120	185	175	215	290	155
HDPE	gm	20	55	0	0	0	35	0	0
PVC	gm	0	0	0	80	0	0	125	0
LDPE	gm	500	540	655	360	590	750	930	810
PP	gm	80	65	95	50	115	80	125	85
PS	gm	95	90	70	35	80	75	140	65
OTHERS	gm	0	0	0	175	0	0	0	140
SUP	gm	465	490	605	315	555	795	840	745
MLP	gm	35	50	50	45	35	55	90	65
Street 2 (Latitude = 22.329033 Longitude = 91.831517)									
Day		0	1	2	3	4	5	6	7
Organic waste	gm	9470	9520	8540	7390	8730	7665	10144	8952
PETE/PETEE	gm	140	105	75	90	155	50	140	85
HDPE	gm	0	0	185	0	0	55	0	0
PVC	gm	0	75	45	0	0	0	0	25
LDPE	gm	445	570	490	425	535	370	590	415
PP	gm	100	55	70	45	45	65	55	75
PS	gm	70	80	65	30	80	45	55	25
OTHERS	gm	0	0	0	0	0	0	0	0
SUP	gm	415	505	465	395	490	355	520	375
MLP	gm	30	65	25	30	45	15	70	40
Street 3 (Latitude = 22.329033 Longitude = 91.831517)									
Day		0	1	2	3	4	5	6	7
Organic waste	gm	7090	4330	6760	8520	7057	8680	8265	6615
PETE/PETEE	gm	155	70	95	85	205	165	100	80
HDPE	gm	0	30	0	0	0	0	0	0
PVC	gm	0	0	0	0	0	0	0	0
LDPE	gm	395	340	380	450	415	535	495	325
PP	gm	50	35	20	45	35	55	75	45
PS	gm	35	55	20	60	55	85	40	95
OTHERS	gm	0	0	0	0	0	0	0	0
SUP	gm	370	310	365	415	395	480	445	305
MLP	gm	25	10	15	35	20	55	40	20

Ward no. : 31						
Facilities Type : Office						
Office no = 1	Latitude = 22.33475			Longitude =91.832736		
Day		1	2	3	4	5
Nos of population		9	9	9	9	9
Organic waste	gm	2065	1820	1600	1945	2530
PETE/PETEE	gm	220	85	45	175	115
HDPE	gm	0	20	0	0	0
PVC	gm	0	0	0	20	0
LDPE	gm	5	5	0	15	10
PP	gm	20	10	35	55	15
PS	gm	0	0	20	0	45
OTHERS	gm	0	0	0	0	10
SUP	gm	5	0	0	15	5
MLP	gm	0	5	0	0	5

Office no = 2	Latitude = 22.334722			Longitude =91.832819		
Day		1	2	3	4	5
Nos of population		13	13	13	13	13
Organic waste	gm	1655	1225	1265	1540	1845
PETE/PETEE	gm	105	140	70	100	80
HDPE	gm	0	35	0	0	0
PVC	gm	0	0	0	0	0
LDPE	gm	5	10	5	15	5
PP	gm	20	10	25	25	15
PS	gm	0	0	20	0	30
OTHERS	gm	0	0	20	0	30
SUP	gm	5	5	0	5	0
MLP	gm	0	5	5	10	5
Office no = 3	Latitude = 22.334362			Longitude =91.831619		
Day		1	2	3	4	5
Nos of population		7	7	7	7	7
Organic waste	gm	890	630	1020	985	845
PETE/PETEE	gm	55	90	75	35	25
HDPE	gm	0	15	0	5	5
PVC	gm	0	0	0	0	0
LDPE	gm	5	10	5	5	5
PP	gm	15	35	0	20	0
PS	gm	10	0	0	30	0
OTHERS	gm	0	0	10	0	0

SUP	gm	0	0	0	0	0
MLP	gm	5	10	5	5	5

Ward no. : 31
Facilities Type : Market

Market no = 1		Latitude = 22.335202		Longitude =91.830039		
Day		1	2	3	4	5
Organic waste	gm	13595	11250	11275	13230	12240
PETE/PETEE	gm	785	655	495	425	360
HDPE	gm	45	65	0	0	20
PVC	gm	140	0	55	95	50
LDPE	gm	525	430	445	570	710
PP	gm	80	75	90	55	40
PS	gm	45	55	35	20	45
OTHERS	gm	0	0	0	80	45
SUP	gm	450	375	415	525	615
MLP	gm	65	55	30	45	95
Market no = 2		Latitude = 22.334513		Longitude =91.833489		
Day		1	2	3	4	5
Organic waste	gm	12040	8270	9920	11010	9495
PETE/PETEE	gm	435	550	395	445	360
HDPE	gm	40	35	70	35	55
PVC	gm	345	0	0	220	0
LDPE	gm	410	210	260	670	335
PP	gm	55	65	25	95	45
PS	gm	40	25	55	30	20
OTHERS	gm	75	0	0	0	0
SUP	gm	390	165	205	545	295
MLP	gm	20	45	55	85	40

Table A.4 Detailed Survey data of households, Street, office and Restaurants at Ward no. 41.

Ward no. :41
Facilities Type : Household (HH)
Group :High Income Group

House no = 1		Latitude = 22.24811				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	2	2	5

Organic waste	gm	1120	1585	1245	1220	1190	700	985	1795
PETE/PETEE	gm						65	85	
HDPE	gm							105	
PVC	gm				45				
LDPE	gm	55	35	65	40	115	25	120	35
PP	gm					125			
PS	gm					45			
OTHERS	gm	1560							
House no = 2		Latitude = 22.24811				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	3	3	3	3	3	3
Organic waste	gm	2100	1095	780	895	900	1210	1020	1590
PETE/PETEE	gm				85			55	
HDPE	gm					95			
PVC	gm			50					
LDPE	gm	55	50	90	80	65	85	40	45
PP	gm		125						
PS	gm		55						
OTHERS	gm								
House no = 3		Latitude = 22.24811				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		8	6	6	6	6	6	6	6
Organic waste	gm	2500	3250	1795	1895	1780	1520	2363	1585
PETE/PETEE	gm		75					120	
HDPE	gm					150			
PVC	gm				55				
LDPE	gm	120	90	95	85	90	125	95	30
PP	gm	150	155						
PS	gm							65	

OTHERS	gm				90				
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House no = 4		Latitude = 22.24811				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1560	790	850	980	1025	1035	980	690
PETE/PETEE	gm		90						
HDPE	gm							85	
PVC	gm			35					
LDPE	gm	80	45	40	65	45	35	55	25
PP	gm		95						
PS	gm		40						
OTHERS	gm								
House no = 5		Latitude = 22.24811				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		6	6	6	3	3	3	3	3
Organic waste	gm	1280	1975	1870	1980	890	980	920	890
PETE/PETEE	gm			95	75				
HDPE	gm							95	
PVC	gm		45						
LDPE	gm	120	55	65	80	45	85	75	55
PP	gm		130						
PS	gm		55						
OTHERS	gm					60			
House no = 6		Latitude = 22.24811				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	7	5	5	5	5	5
Organic waste	gm	680	1790	1120	2960	1320	1230	1780	1695
PETE/PETEE	gm				185				

HDPE	gm			75					65
PVC	gm					70			
LDPE	gm	85	55	75	185	145	85	35	85
PP	gm				190				
PS	gm		65						
OTHERS	gm								

House no = 7		Latitude = 22.24811				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	800	890	1450	1120	875	890	865	980
PETE/PETEE	gm							110	
HDPE	gm					75			
PVC	gm		35						
LDPE	gm	55	45	40	40	35	50	55	45
PP	gm				95				
PS	gm					40			
OTHERS	gm				120				
House no = 8		Latitude = 22.23754				Longitude = 91.81354			
Day		0	1	2	3	4	5	6	7
Nos of population		5	5	5	5	5	5	5	5
Organic waste	gm	955	1870	1790	2135	1220	1190	1875	1985
PETE/PETEE	gm						90		30
HDPE	gm				95				
PVC	gm					55			
LDPE	gm	25	95	45	55	85	75	65	85
PP	gm		155						
PS	gm				60				
OTHERS	gm					90			

House no = 9		Latitude = 22.23754				Longitude = 91.81354			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	500	1780	1250	1780	1230	1145	1225	1220
PETE/PETEE	gm				125				
HDPE	gm							115	
PVC	gm					45			
LDPE	gm	100	70	85	55	65	75	65	60
PP	gm		135						
PS	gm		50						
OTHERS	gm								

House no = 10		Latitude = 22.23754				Longitude = 91.81354			
Day		0	1	2	3	4	5	6	7
Nos of population		8	4	4	4	4	4	4	4
Organic waste	gm	600	2450	1230	990	1125	1230	1320	1350
PETE/PETEE	gm			145					
HDPE	gm							95	
PVC	gm					65			
LDPE	gm	45	85	75	80	75	80	95	75
PP	gm						135		
PS	gm						60		
OTHERS	gm								

Group : Middle Income Group									
House no = 1		Latitude = 22.248114				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1300	920	980	1125	990	995	885	1025

PETE/PETEE	gm						85	55	
HDPE	gm				55			75	
PVC	gm								
LDPE	gm	55	35	45	35	60	65	55	45
PP	gm								
PS	gm							110	
OTHERS	gm	1560							
House no = 2		Latitude = 22.248114				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1650	1120	1050	1100	1125	1175	1020	980
PETE/PETEE	gm						95		60
HDPE	gm					85		90	
PVC	gm								
LDPE	gm	120	65	45	55	55	65	75	35
PP	gm								
PS	gm								
OTHERS	gm								
House no = 3		Latitude = 22.248114				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	5	5
Organic waste	gm	1290	955	780	775	980	910	1670	1590
PETE/PETEE	gm				65			75	
HDPE	gm							115	
PVC	gm								
LDPE	gm	125	25	35	55	65	45	75	85
PP	gm	120							
PS	gm							45	
OTHERS	gm								

House no = 4		Latitude = 22.248114				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1000	1445	910	1290	620	725	1125	1230
PETE/PETEE	gm			95			120		65
HDPE	gm								135
PVC	gm								
LDPE	gm	90	45	95	65	75	35	35	45
PP	gm								
PS	gm								
OTHERS	gm								
House no = 5		Latitude = 22.248114				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1290	1170	950	1310	870	875	1120	770
PETE/PETEE	gm	95					90	45	
HDPE	gm							70	
PVC	gm								
LDPE	gm	70	45	50	45	55	35	65	45
PP	gm								
PS	gm								
OTHERS	gm								
House no = 6		Latitude = 22.248114				Longitude = 91.822449			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	2	2	2	2	2	2
Organic waste	gm	600	475	590	665	495	670	685	620
PETE/PETEE	gm					55	70		
HDPE	gm								55
PVC	gm								

LDPE	gm	40	30	25	45	35	20	25	20
PP	gm								
PS	gm								
OTHERS	gm								

House no = 7		Latitude = 22.237445				Longitude = 91.809461			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	2	2	2	2	2	2
Organic waste	gm	305	680	490	570	780	570	690	630
PETE/PETEE	gm			55			35		
HDPE	gm			55			75		
PVC	gm								
LDPE	gm	65	30	40	45	55	25	35	25
PP	gm								
PS	gm								
OTHERS	gm								
House no = 8		Latitude = 22.237445				Longitude = 91.809461			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	890	1120	1120	1320	1085	1125	1090	1385
PETE/PETEE	gm				85		120	170	
HDPE	gm						165		
PVC	gm								
LDPE	gm	95	85	190	70	90	85	95	55
PP	gm	380							
PS	gm								
OTHERS	gm								
House no = 9		Latitude = 22.237445				Longitude = 91.809461			
Day		0	1	2	3	4	5	6	7

Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	1300	980	870	590	830	925	1125	1205
PETE/PETEE	gm			85		75			95
HDPE	gm				90			50	
PVC	gm								
LDPE	gm	55	50	55	50	60	75	50	45
PP	gm								
PS	gm								
OTHERS	gm								

House no = 10		Latitude = 22.237535				Longitude = 91.81354			
Day		0	1	2	3	4	5	6	7
Nos of population		5	3	3	3	3	3	3	3
Organic waste	gm	900	885	1130	985	910	970	870	1130
PETE/PETEE	gm		60	160		70		90	
HDPE	gm				90			185	
PVC	gm								
LDPE	gm		55	45	45	65	35	35	60
PP	gm								
PS	gm								
OTHERS	gm								

Group : Low Income Group									
House no = 1		Latitude = 22.237082				Longitude = 91.811246			
Day		0	1	2	3	4	5	6	7
Nos of population		3	5	3	3	3	3	3	3
Organic waste	gm	220	425	1325	495	555	750	490	520
PETE/PETEE	gm								
HDPE	gm					35			

PVC	gm								
LDPE	gm	45	25	35	55	35	35	45	35
PP	gm								
PS	gm								
OTHERS	gm								
House no = 2		Latitude = 22.237082				Longitude = 91.811246			
Day		0	1	2	3	4	5	6	7
Nos of population		2	2	2	2	2	2	2	2
Organic waste	gm	600	490	320	470	450	310	430	550
PETE/PETEE	gm					45			
HDPE	gm				30				
PVC	gm				10				
LDPE	gm	30	15	10	15	15	20	25	20
PP	gm				30				
PS	gm			15					
OTHERS	gm								
House no = 3		Latitude = 22.237082				Longitude = 91.811246			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	55	485	595	530	690	780	690	580
PETE/PETEE	gm				45				
HDPE	gm	45						35	
PVC	gm				20				
LDPE	gm	55	35	20	25	35	45	25	25
PP	gm				40				
PS	gm					20			
OTHERS	gm								

House no = 4		Latitude = 22.237082				Longitude = 91.811246			
Day		0	1	2	3	4	5	6	7
Nos of population		4	4	4	4	4	4	4	4
Organic waste	gm	780	565	970	990	1540	575	790	670
PETE/PETEE	gm				80				
HDPE	gm		55						
PVC	gm				30				
LDPE	gm	50	45	45	35	35	55	45	25
PP	gm		70						
PS	gm		35						
OTHERS	gm								
House no = 5		Latitude = 22.237082				Longitude = 91.811246			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	785	660	785	780	920	770	760	680
PETE/PETEE	gm			55					
HDPE	gm			25					
PVC	gm				10				
LDPE	gm	45	25	55	40	25	35	45	55
PP	gm				15				
PS	gm				10				
OTHERS	gm								
House no = 6		Latitude = 22.237082				Longitude = 91.811246			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	600	425	645	775	525	675	755	690
PETE/PETEE	gm				65				
HDPE	gm			45					
PVC	gm		25						

LDPE	gm	55	25	15	25	35	25	35	30
PP	gm			45					
PS	gm		20						
OTHERS	gm								

House no = 7		Latitude = 22.237445				Longitude = 91.809461			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	4	4	4	4
Organic waste	gm	650	550	945	785	885	890	870	980
PETE/PETEE	gm							85	
HDPE	gm					35			
PVC	gm			25					
LDPE	gm	45	45	25	45	30	40	35	35
PP	gm		60						
PS	gm		30						
OTHERS	gm								
House no = 8		Latitude = 22.237445				Longitude = 91.809461			
Day		0	1	2	3	4	5	6	7
Nos of population		4	5	5	3	3	3	3	3
Organic waste	gm	760	970	785	890	765	445	870	450
PETE/PETEE	gm			65					
HDPE	gm					40			
PVC	gm						20		
LDPE	gm	45	25	35	35	45	35	25	20
PP	gm			45					
PS	gm			25					
OTHERS	gm								
House no = 9		Latitude = 22.237445				Longitude = 91.809461			
Day		0	1	2	3	4	5	6	7

Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	410	870	720	650	790	725	875	905
PETE/PETEE	gm		55						
HDPE	gm			35					
PVC	gm					20			
LDPE	gm	10	15	25	35	25	25	20	35
PP	gm							55	
PS	gm							25	
OTHERS	gm								

House no = 10		Latitude = 22.237445				Longitude = 91.809461			
Day		0	1	2	3	4	5	6	7
Nos of population		3	3	3	3	3	3	3	3
Organic waste	gm	480	475	485	690	675	870	750	675
PETE/PETEE	gm					55			
HDPE	gm				40				
PVC	gm			25					
LDPE	gm	30	35	25	30	25	40	35	20
PP	gm				60				
PS	gm			20					
OTHERS	gm								

Ward no. : 41								
Facilities Type : Hotel & Restaurant (HR)								
HR 01 (Latitude = 22.248114 Longitude = 91.822449)								
Day	0	1	2	3	4	5	6	7
Nos of seats	38	38	38	38	38	38	38	38
Organic waste	30875	35305	30165	41205	35075	27115	30820	30590
PETE/PETEE	1620	2340	1615	3000	2225	1840	1765	1755
HDPE	0	0	45	0	0	0	0	15

PVC	0	0	0	0	0	0	0	0
LDPE	95	115	125	135	105	70	85	100
PP	185	205	170	215	115	150	145	180
PS	145	115	100	185	140	130	200	215
OTHERS	40	135	0	0	0	0	0	0
HR 02 (Latitude = 22.237082 Longitude = 91.811246)								
Day	0	1	2	3	4	5	6	7
Nos of seats	64	64	64	64	64	64	64	64
Organic waste	32150	34560	31550	30955	31360	35070	29985	30475
PETE/PETEE	1900	2430	1990	2335	2045	2570	1785	1920
HDPE	0	0	0	0	0	0	0	90
PVC	0	0	55	0	30	0	0	0
LDPE	80	85	60	35	130	70	75	55
PP	160	165	215	130	155	210	185	215
PS	100	75	160	105	170	130	145	105
OTHERS	0	0	0	0	0	0	0	0
HR 03 (Latitude = 22.237082 Longitude = 91.811246)								
Day	0	1	2	3	4	5	6	7
Nos of seats	52	52	52	52	52	52	52	52
Organic waste	29310	25920	21555	24745	27960	19540	19555	24630
PETE/PETEE	1800	1750	1560	1465	1640	1175	1150	2135
HDPE	0	0	0	0	0	0	0	0
PVC	0	0	0	0	0	0	0	0
LDPE	25	60	45	80	95	70	50	80
PP	200	175	145	165	130	155	140	180
PS	165	110	90	80	105	60	105	155
OTHERS	0	0	0	95	0	0	0	0
Ward no. : 41								
Facilities Type : Street								
Street 1 (Latitude = 22.248114 Longitude = 91.822449)								

0		1	2	3	4	5	6	7
Organic waste	11250	11930	14335	7670	12935	15575	14395	11570
PETE/PETEE	225	200	135	200	245	230	305	170
HDPE	0	45	0	0	25	0	0	0
PVC	0	0	0	0	0	0	75	0
LDPE	480	505	595	300	570	780	815	730
PP	75	55	85	45	100	65	110	75
PS	85	80	60	25	70	65	130	55
OTHERS	0	0	0	55	0	0	0	60
Street 2 (Latitude = 22.248114 Longitude = 91.822449)								
0		1	2	3	4	5	6	7
Organic waste	8470	9635	7590	8475	8935	7530	9990	10450
PETE/PETEE	155	120	85	100	165	60	130	95
HDPE	0	0	0	65	0	70	20	0
PVC	0	75	45	0	0	0	0	0
LDPE	425	495	450	405	475	360	500	390
PP	80	75	80	65	70	60	25	40
PS	95	115	65	55	100	65	75	45
OTHERS	0	0	0	40	0	0	0	0
Street 3 (Latitude = 22.248114 Longitude = 91.822449)								
0		1	2	3	4	5	6	7
Organic waste	8095	5345	7785	7520	6050	8685	8000	6675
PETE/PETEE	145	80	85	70	220	140	80	100
HDPE	0	0	0	0	0	0	0	0
PVC	0	0	0	0	0	0	0	0
LDPE	335	295	380	435	415	505	400	275
PP	50	35	20	45	35	55	75	45
PS	35	55	20	60	55	85	40	95
OTHERS	0	0	0	0	0	0	0	0

Ward No. : 41						
Facilities Type : Office						

Office no = 1 (Latitude = 22.24811 Longitude = 91.822449)						
Day		1	2	3	4	5
Nos of population		11	11	11	11	11
Organic waste	gm	1960	1735	1550	1940	2300
PETE/PETEE	gm	205	95	35	185	105
HDPE	gm	0	0	45	0	0
PVC	gm	0	0	0	0	0
LDPE	gm	15	10	5	15	5
PP	gm	10	0	25	45	10
PS	gm	0	10	0	0	30
OTHERS	gm	0	0	0	0	0
Office no = 2 (Latitude = 22.237445 Longitude = 91.809461)						
Day		1	2	3	4	5
Nos of population		15	15	15	15	15
Organic waste	gm	1555	1320	1260	1445	1750
PETE/PETEE	gm	115	150	85	115	95
HDPE	gm	0	0	0	0	0
PVC	gm	0	0	0	0	15
LDPE	gm	10	5	5	10	5
PP	gm	20	10	15	5	15
PS	gm	0	0	0	0	20
OTHERS	gm	0	0	0	0	0
Office no = 3 (Latitude = 22.237082 Longitude = 91.811246)						
Day		1	2	3	4	5
Nos of population		10	10	10	10	10
Organic waste	gm	995	615	985	1055	945
PETE/PETEE	gm	55	100	85	45	35
HDPE	gm	0	15	0	0	0

PVC	gm	0	0	0	0	0
LDPE	gm	5	10	10	5	5
PP	gm	10	25	15	15	10
PS	gm	0	40	0	0	0
OTHERS	gm	0	0	0	15	0
Ward no. : 41						
Facilities Type : Market						

Market no = 1 (Latitude = 22.237445 Longitude = 91.809461)					
Organic waste	12590	11275	11455	12250	13445
PETE/PETEE	680	695	590	325	385
HDPE	35	75	0	25	0
PVC	155	55	0	0	75
LDPE	615	450	570	555	740
PP	65	80	75	55	65
PS	40	0	90	20	40
OTHERS	0	0	55	0	55
Market no = 2 (Latitude = 22.237082 Longitude = 91.811246)					
Organic waste	13155	7375	9975	12075	10045
PETE/PETEE	455	590	495	475	435
HDPE	55	20	85	45	70
PVC	245	100	180	0	40
LDPE	390	190	375	545	320
PP	60	55	40	65	35
PS	55	35	20	45	30
OTHERS	0	0	65	0	0

Appendix B

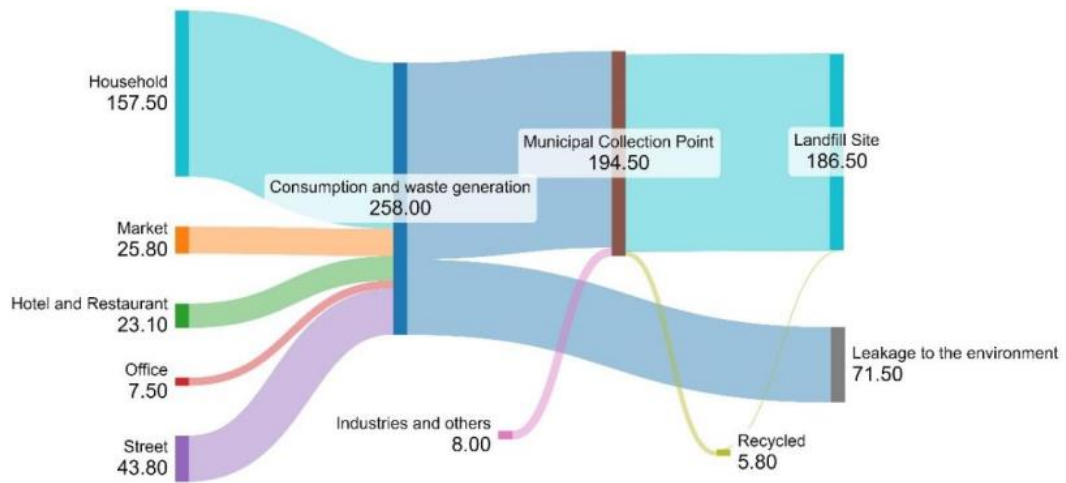


Fig. B.1 Solid Waste Flow at 31 no Alkaran ward using SankeyMatic (All data in tons/month).

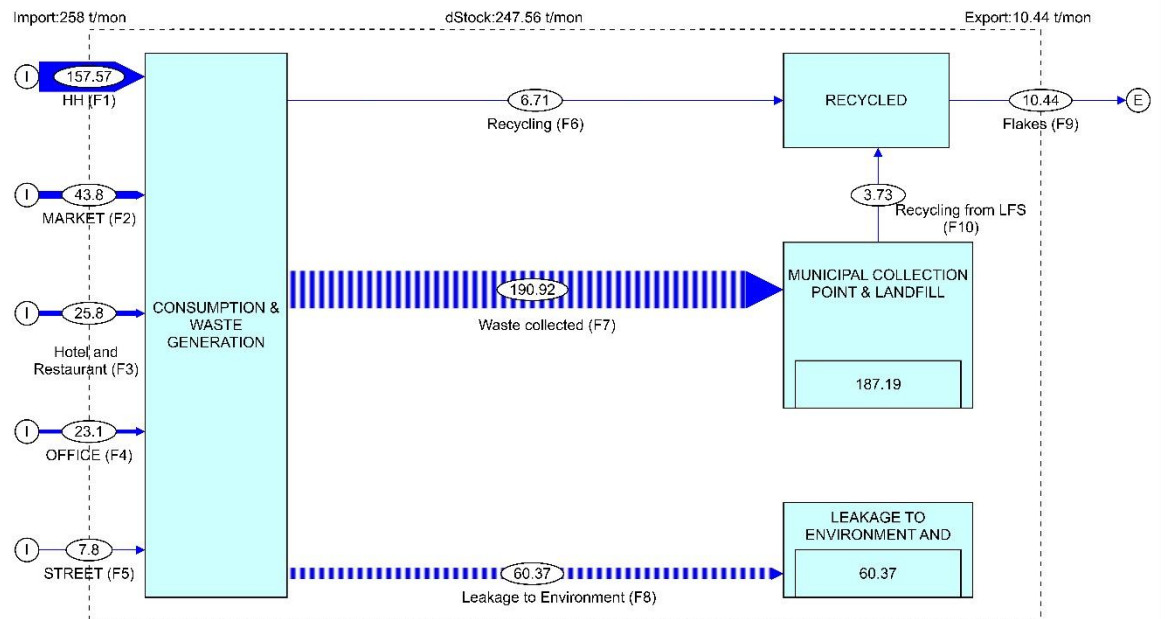


Fig. B.2 Solid Waste Flow at 31 no Alkaran ward using STAN (All data in tons/month).

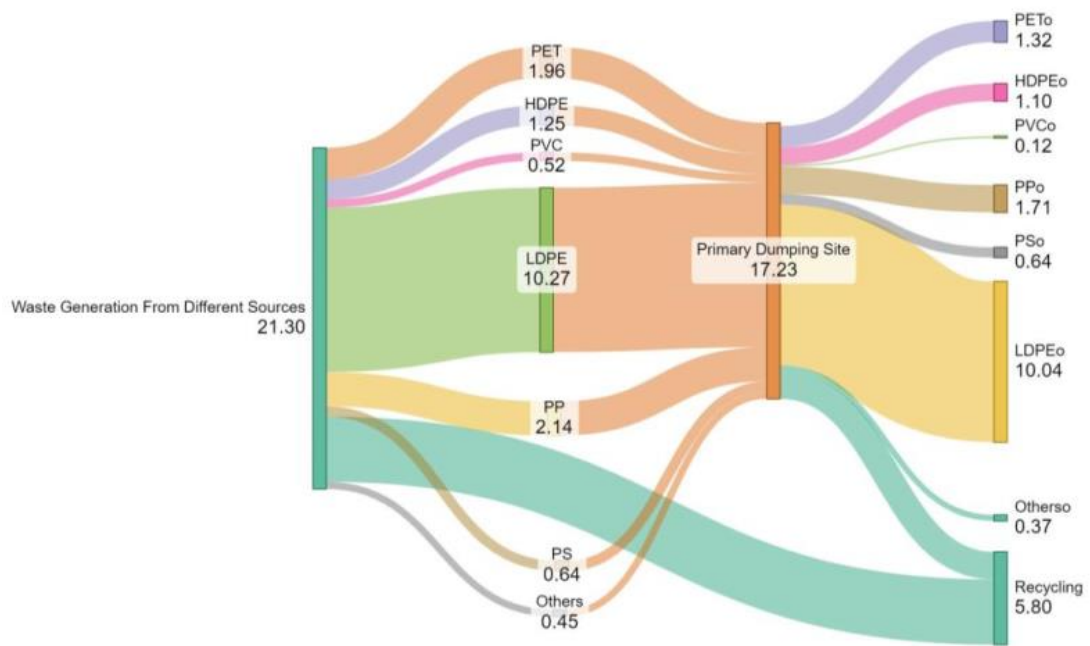


Fig. B.3 Plastic Waste Flow at 31 no Alkaran ward.

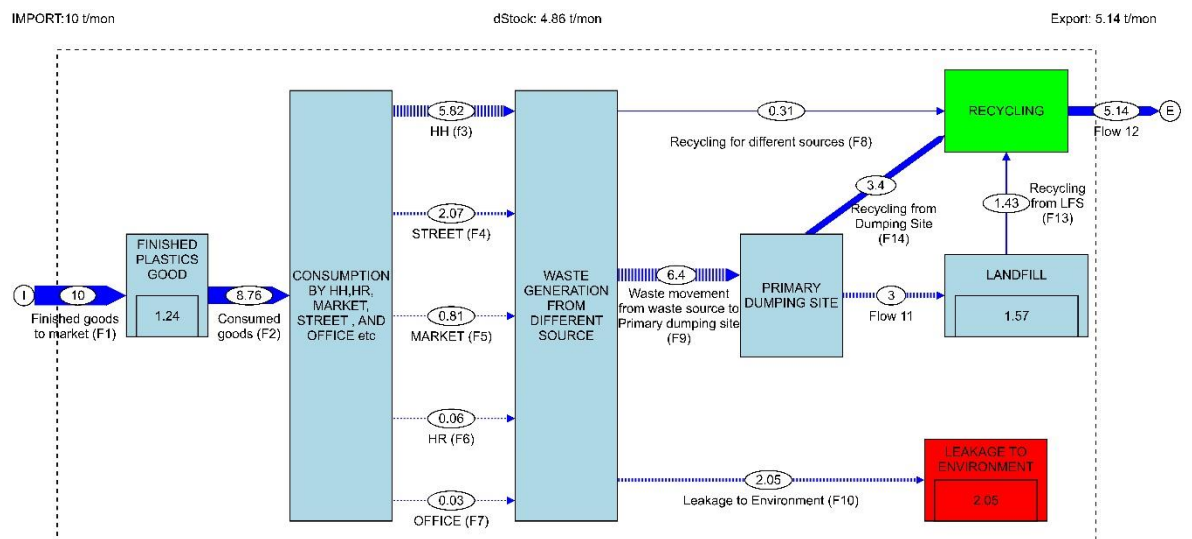


Fig. B.4 Single-use plastic Flow at 31 no Alkaran ward, Chattogram

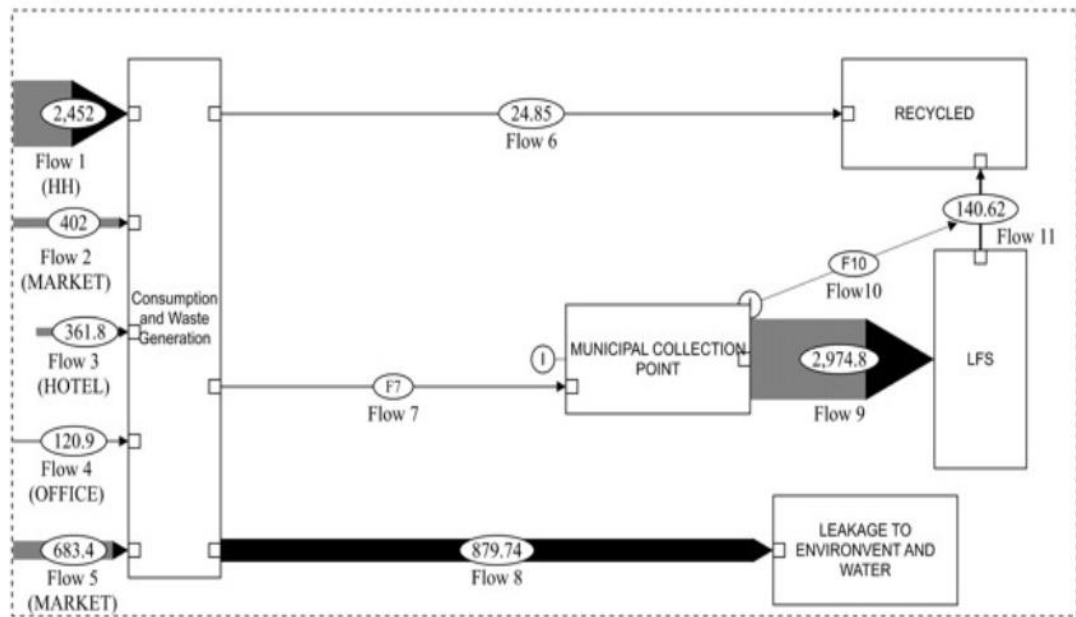


Fig. B.5 The solid waste flow of 39 no. South Haliashahar ward.

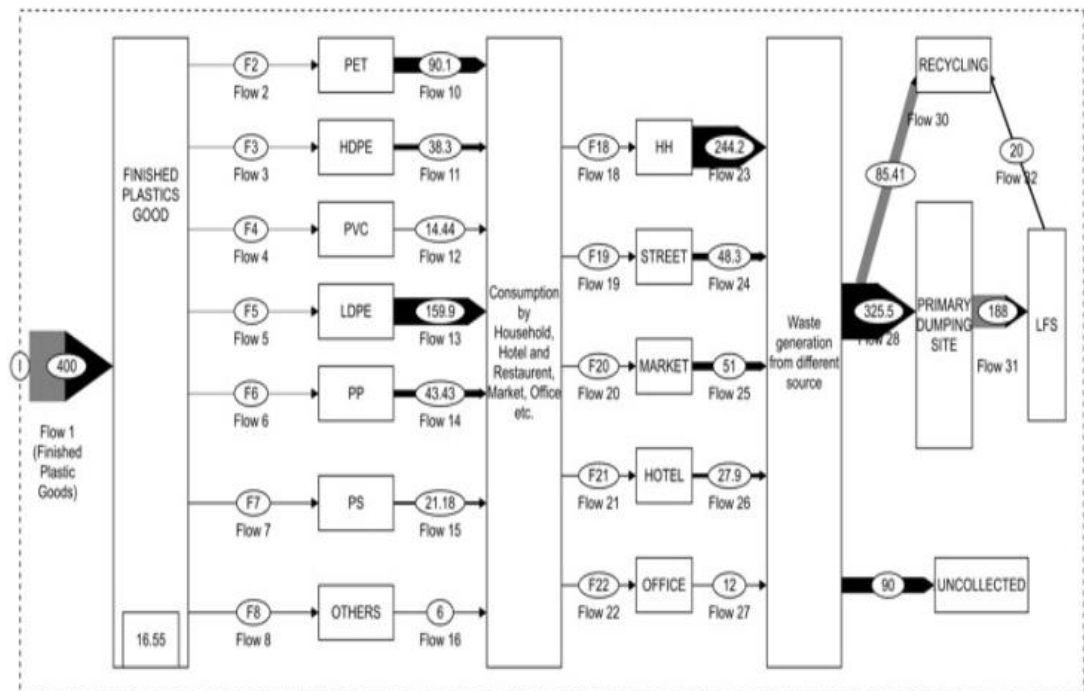


Fig. B.6 Flow of different plastic wastes of 39 no. South Haliashahar ward, Chattogram.

Appendix C

Table C.1 Summary of Ward wise Waste Collection from Municipal Dumping Site.

Ward no.	Latitude	Longitude	Organic Waste	PET	HD PE	PVC	SUP	MLP	PP	PS	OTHERS
1	22.40986	91.81784	18200	155	95	55	730	250	165	60	20
2	22.38128	91.80862	18455	145	45	0	970	120	95	95	50
3	22.39703	91.83268	17985	130	95	40	650	210	185	70	35
4	22.37346	91.85136	17900	210	145	55	585	90	175	55	40
5	22.39496	91.8712	15670	100	70	30	460	150	130	50	80
6	22.3661	91.84932	18600	220	150	55	605	95	180	55	40
7	22.37382	91.83311	18900	170	115	40	540	200	110	35	10
8	22.3649	91.84296	17400	125	90	40	575	190	160	65	0
9	22.37372	91.77692	18045	205	145	55	585	95	175	50	55
10	22.36923	91.7773	17990	140	65	35	610	115	210	55	0
11	22.356	91.77573	18550	195	105	0	690	105	195	60	100
12	22.34427	91.78801	18640	55	70	35	575	215	155	85	0
13	22.35301	91.80453	18500	195	105	45	720	135	240	45	15
14	22.35022	91.8214	18335	185	135	0	735	150	235	0	35
15	22.3499	91.82491	18790	125	85	35	560	180	160	65	0
16	22.36103	91.83681	19010	140	100	15	685	90	150	35	20
17	22.35938	91.8517	19015	90	70	30	755	150	125	50	15
18	22.35176	91.8522	19100	175	80	55	590	115	170	40	0
19	22.34509	91.84858	18480	125	65	25	660	230	155	25	65
20	22.34459	91.83769	17780	220	135	70	525	160	250	65	15
21	22.34557	91.82656	18220	220	125	75	615	95	185	0	95
22	22.34674	91.82419	18615	180	100	40	615	125	245	55	0
23	22.33264	91.81508	18550	165	40	55	510	100	140	20	90
24	22.32769	91.80802	18175	115	80	35	595	175	155	55	0
25	22.3447	91.7954	18820	150	75	135	525	140	70	60	70

Ward no.	Latitude	Longitude	Organic Waste	PET	HD PE	PVC	SUP	MLP	PP	PS	OTHERS
26	22.33747	91.77704	18850	185	125	45	555	115	150	45	25
27	22.32783	91.79883	18225	115	125	0	545	85	165	60	180
28	22.32516	91.81802	18640	170	80	45	675	135	195	35	25
29	22.3245	91.81982	18780	120	125	30	540	110	170	90	35
30	22.32439	91.82449	18455	135	105	45	745	165	240	45	0
31	22.32585	91.83068	18670	145	75	85	595	185	95	55	30
32	22.3388	91.83529	17115	230	155	55	625	100	185	0	45
33	22.32743	91.83878	18265	150	100	40	470	95	195	45	20
34	22.33707	91.8411	18975	85	70	30	525	115	175	80	0
35	22.33972	91.8411	18975	150	85	25	615	95	140	35	10
36	22.31603	91.79411	18360	205	140	65	505	110	125	65	55
37	22.32311	91.79459	18600	175	105	50	695	100	180	55	40
38	22.29827	91.7918	18640	210	145	0	585	95	155	105	65
39	22.27345	91.78695	18380	155	65	75	610	145	110	50	30
40	22.26631	91.78927	18555	145	100	0	665	100	190	75	10
41	22.24605	91.82264	18040	170	75	60	570	175	315	0	25

Ward no.	%Organic & Other Waste	% PLASTIC	average %organic waste	average % plastic
1	91.00	9.00	92.77	7.23
2	92.28	7.72		
3	89.93	10.08		
4	89.50	10.50		
5	92.35	7.65		
6	93.00	7.00		
7	94.50	5.50		
8	93.20	6.80		
9	90.23	9.78		
10	94.95	5.05		
11	92.75	7.25		
12	93.20	6.80		
13	92.50	7.50		
14	91.68	8.33		
15	93.95	6.05		
16	95.05	4.95		
17	95.08	4.93		
18	95.50	4.50		
19	92.40	7.60		
20	92.90	7.10		
21	91.10	8.90		
22	93.08	6.93		
23	92.75	7.25		
24	93.88	6.13		
25	94.10	5.90		
26	94.25	5.75		
27	91.13	8.88		

Ward no.	%Organic & Other Waste	% PLASTIC	average %organic waste	average % plastic
28	93.20	6.80		
29	93.90	6.10		
30	92.28	7.72		
31	93.35	6.65		
32	90.58	9.43		
33	91.33	8.68		
34	94.88	5.13		
35	94.88	5.13		
36	91.80	8.20		
37	93.00	7.00		
38	93.20	6.80		
39	91.90	8.10		
40	92.78	7.22		
41	90.20	9.80		

PET	HDPE	PVC	SUP	MLP	PP	PS	OTHERS
12.10	7.58	3.18	47.01	10.46	13.07	3.90	2.70

Table C.2 Summary of the waste sample from Landfill Site

Sample no	Total Waste	Organic Waste	PET	HDPE	PVC	SUP	MLP	PP	PS	OTHERS		
1	25000	22800	115	105	20	555	150	175	35	10		
2	25000	22895	135	95	0	660	120	130	10	0		
3	25000	22580	130	120	15	700	170	185	0	25		
Sample no		%Organic Waste		% PLASTIC		avg %organic waste			avg % plastic			
1		91.2		4.66		91.03			4.88			
2		91.58		4.6								
3		90.32		5.38								
PET		HDPE		PVC		SUP		MLP		PP	PS	OTHERS

10.38	8.74	0.96	52.32	12.02	13.39	1.23	0.96
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Table C.3 Ward-wise solid waste generation (source basis)

(All the data in ton/day)

Name	Solid Waste Generation (HH)	Solid Waste Generation (HR)	Solid Waste Generation (Office)	Solid Waste Generation (Street)	Total Solid Waste Generation
Ward No. 01	18.9903175	2.8018501	0.93395	5.2923836	31.131668
Ward No. 02	50.416843	7.4385506	2.4795169	14.050596	82.650562
Ward No. 03	31.2944023	4.6172069	1.539069	8.7213908	51.302299
Ward No. 04	48.5292373	7.1600514	2.3866838	13.524542	79.556127
Ward No. 05	33.2414481	4.9044759	1.6348253	9.2640101	54.494177
Ward No. 06	19.6139758	2.8938653	0.9646218	5.46619	32.154059
Ward No. 07	50.6786255	7.4771742	2.4923914	14.123551	83.079714
Ward No. 08	43.61481	6.434972	2.1449907	12.154947	71.499689
Ward No. 09	32.1268706	4.7400301	1.58001	8.9533902	52.667001
Ward No. 10	19.0405181	2.8092568	0.9364189	5.3063739	31.213964
Ward No. 11	33.7939631	4.9859946	1.6619982	9.4179897	55.399939
Ward No. 12	26.7375392	3.9448828	1.3149609	7.4514453	43.832031
Ward No. 13	27.5660038	4.0671153	1.3557051	7.6823289	45.19017
Ward No. 14	21.4563085	3.1656849	1.0552283	5.979627	35.174276
Ward No. 15	15.0937622	2.2269485	0.7423162	4.2064583	24.743872
Ward No. 16	17.3481714	2.5595663	0.8531888	4.8347363	28.439625
Ward No. 17	34.2346816	5.0510186	1.6836729	9.5408129	56.122429

Name	Solid Waste Generation (HH)	Solid Waste Generation (HR)	Solid Waste Generation (Office)	Solid Waste Generation (Street)	Total Solid Waste Generation
Ward No. 18	23.4052021	3.4532265	1.1510755	6.5227612	38.369184
Ward No. 19	17.2138923	2.5397546	0.8465849	4.7973143	28.219496
Ward No. 20	10.7749671	1.5897492	0.5299164	3.0028597	17.663881
Ward No. 21	14.1464176	2.0871764	0.6957255	3.9424442	23.190848
Ward No. 22	10.4639079	1.7153947	1.5438553	0.5146184	2.9161711
Ward No. 23	10.9089382	1.7883505	1.6095155	0.5365052	3.0401959
Ward No. 24	46.9132694	7.6906999	6.9216299	2.30721	13.07419
Ward No. 25	21.0343767	3.4482585	3.1034326	1.0344775	5.8620394
Ward No. 26	20.926276	3.430537	3.0874833	1.0291611	5.831913
Ward No. 27	17.8815917	2.9314085	2.6382676	0.8794225	4.9833944
Ward No. 28	15.649665	2.5655189	2.308967	0.7696557	4.361382
Ward No. 29	11.3367215	1.8584789	1.672631	0.5575437	3.1594142
Ward No. 30	12.6391664	2.0719945	1.864795	0.6215983	3.5223906
Ward No. 31	4.75674176	0.7797937	0.7018144	0.2339381	1.3256493
Ward No. 32	9.39953114	1.5409067	1.3868161	0.462272	2.6195415
Ward No. 33	8.74907866	1.4342752	1.2908477	0.4302826	2.4382678
Ward No. 34	10.0546033	1.6482956	1.4834661	0.4944887	2.8021026
Ward No. 35	9.1968807	1.5076854	1.3569168	0.4523056	2.5630651
Ward No. 36	13.5310747	2.218209	1.9963881	0.6654627	3.7709553
Ward No. 37	15.9000522	2.6065659	2.3459093	0.7819698	4.4311621

Name	Solid Waste Generation (HH)	Solid Waste Generation (HR)	Solid Waste Generation (Office)	Solid Waste Generation (Street)	Total Solid Waste Generation
Ward No. 38	36.7748957	6.0286714	5.4258043	1.8086014	10.248741
Ward No. 39	78.906169	12.935438	11.641894	3.8806313	21.990244
Ward No. 40	29.8305762	4.8902584	4.4012326	1.4670775	8.3134393
Ward No. 41	20.6826643	3.3906007	3.0515406	1.0171802	5.7640212
	994.854137	163.09084	146.78176	48.927253	277.25443

Table C.4 Ward wise plastic waste generation source basis

(All the data in ton/day)

Ward No.	Plastic Waste Generation (HH)	Plastic Waste Generation (Market)	Plastic Waste Generation (HR)	Plastic Waste Generation (Office)	Plastic Waste Generation (Street)	Total Plastic Waste Generation
01	1.8071689	0.34918244	0.2155614	0.0875418	0.3933873	2.8528417
02	4.7978002	0.92703433	0.5722876	0.2324122	1.0443924	7.5739268
03	2.9780581	0.57542249	0.3552265	0.1442613	0.6482682	4.7012367
04	4.6181707	0.89232618	0.5508612	0.2237107	1.0052904	7.2903591
05	3.1633442	0.61122358	0.3773277	0.1532368	0.6886015	4.9937338
06	1.8665178	0.36064989	0.2226406	0.0904167	0.4063064	2.9465315
07	4.8227121	0.93184783	0.5752592	0.233619	1.0498153	7.6132533
08	4.1505008	0.80196267	0.4950769	0.2010561	0.9034873	6.5520838
09	3.057278	0.59072941	0.364676	0.1480988	0.6655129	4.8262952
10	1.8119461	0.3501055	0.2161312	0.0877732	0.3944272	2.8603832
11	3.215923	0.6213829	0.3835993	0.1557838	0.700047	5.076736
12	2.544415	0.49163365	0.303501	0.123255	0.5538721	4.0166768

Ward No.	Plastic Waste Generation (HH)	Plastic Waste Generation (Market)	Plastic Waste Generation (HR)	Plastic Waste Generation (Office)	Plastic Waste Generation (Street)	Total Plastic Waste Generation
13	2.6232539	0.50686696	0.312905	0.1270741	0.5710339	4.1411338
14	2.0418391	0.39452559	0.2435531	0.0989096	0.4444706	3.223298
15	1.4363624	0.27753494	0.1713311	0.0695794	0.3126695	2.2674774
16	1.6508979	0.31898765	0.1969212	0.0799718	0.35937	2.6061485
17	3.2578629	0.62948656	0.388602	0.1578155	0.7091765	5.1429434
18	2.227301	0.43036066	0.2656753	0.1078936	0.4848422	3.5160727
19	1.6381196	0.31651861	0.195397	0.0793528	0.3565883	2.5859763
20	1.0253744	0.19812356	0.1223079	0.0496706	0.223205	1.6186815
21	1.3462105	0.26011575	0.1605777	0.0652123	0.2930451	2.1251614
22	0.9957732	0.19240399	0.1187771	0.0482367	0.2167614	1.5719523
23	1.0381234	0.20058694	0.1238287	0.0502882	0.2259803	1.6388075
24	4.4643909	0.86261274	0.5325182	0.2162614	0.9718154	7.0475985
25	2.001687	0.38676736	0.2387637	0.0969645	0.4357302	3.1599128
26	1.9913998	0.38477967	0.2375367	0.0964662	0.4334909	3.1436733
27	1.7016596	0.32879586	0.2029761	0.0824308	0.3704198	2.6862822
28	1.4892635	0.28775655	0.1776412	0.072142	0.3241851	2.3509885
29	1.0788324	0.20845276	0.1286845	0.0522602	0.2348419	1.7030717
30	1.2027765	0.23240133	0.1434687	0.0582642	0.2618222	1.8987329
31	0.4526641	0.08746408	0.0539943	0.0219277	0.0985366	0.7145869
32	0.8944843	0.17283288	0.1066952	0.0433301	0.1947127	1.4120551
33	0.8325855	0.16087275	0.0993118	0.0403316	0.1812385	1.3143402

Ward No.	Plastic Waste Generation (HH)	Plastic Waste Generation (Market)	Plastic Waste Generation (HR)	Plastic Waste Generation (Office)	Plastic Waste Generation (Street)	Total Plastic Waste Generation
34	0.9568227	0.18487795	0.114131	0.0463498	0.2082826	1.5104641
35	0.8751995	0.16910666	0.1043949	0.0423959	0.1905148	1.3816117
36	1.2876529	0.24880119	0.1535929	0.0623757	0.2802982	2.0327209
37	1.5130911	0.29236052	0.1804834	0.0732963	0.329372	2.3886032
38	3.4995964	0.67619448	0.4174363	0.1695254	0.7617974	5.5245499
39	7.5089199	1.45087877	0.8956734	0.3637426	1.634553	11.853768
40	2.8387566	0.54850654	0.3386105	0.1375134	0.6179448	4.4813318
41	1.9682171	0.38030029	0.2347714	0.0953432	0.4284445	3.1070764
	94.672953	18.2927744	11.292709	4.5860908	20.608552	149.45308

Table C.5 Ward-wise categorization of different plastic waste

(All the data in ton/day)

Ward No.	TOTAL PET	TOTAL HDPE	TOTAL PVC	TOTAL LDPE	TOTAL (PP)	TOTAL PS	TOTAL OTHERS
01	0.74709	0.207235	0.122589	1.248221	0.310427	0.156854	0.1212166
02	1.983428	0.550182	0.325459	3.313864	0.824145	0.416428	0.3218145
03	1.23114	0.341505	0.202017	2.05696	0.511558	0.258483	0.1997545
04	1.909168	0.529583	0.313274	3.189793	0.793289	0.400837	0.3097657
05	1.307738	0.362752	0.214585	2.184938	0.543385	0.274565	0.2121826
06	0.771625	0.214041	0.126615	1.289213	0.320622	0.162006	0.1251975
07	1.993726	0.553038	0.327149	3.331071	0.828424	0.41859	0.3234854
08	1.715832	0.475953	0.281549	2.866772	0.712954	0.360245	0.2783966
09	1.26389	0.350589	0.20739	2.111677	0.525166	0.265358	0.2050682
10	0.749065	0.207783	0.122913	1.25152	0.311248	0.157269	0.1215370
11	1.329474	0.368782	0.218152	2.221254	0.552417	0.279128	0.2157094

Ward No.	TOTAL PET	TOTAL HDPE	TOTAL PVC	TOTAL LDPE	TOTAL (PP)	TOTAL PS	TOTAL OTHERS
12	1.05187	0.291777	0.1726	1.75744	0.437068	0.220844	0.1706677
13	1.084463	0.300818	0.177948	1.811894	0.450611	0.227687	0.1759559
14	0.844104	0.234145	0.138508	1.410308	0.350738	0.177223	0.1369572
15	0.593797	0.164713	0.097436	0.992103	0.246732	0.12467	0.0963446
16	0.682487	0.189315	0.111989	1.140283	0.283584	0.143291	0.1107347
17	1.346812	0.373591	0.220997	2.250222	0.559621	0.282768	0.2185225
18	0.920774	0.255413	0.151089	1.538408	0.382596	0.19332	0.1493972
19	0.677204	0.187849	0.111122	1.131457	0.281389	0.142182	0.1098776
20	0.423893	0.117583	0.069556	0.708231	0.176134	0.088998	0.0687774
21	0.556528	0.154375	0.09132	0.929834	0.231246	0.116845	0.0902976
22	0.411656	0.114189	0.067548	0.687785	0.171049	0.086429	0.0667919
23	0.429164	0.119045	0.070421	0.717037	0.178324	0.090105	0.0696326
24	1.845595	0.511948	0.302842	3.083577	0.766873	0.38749	0.2994509
25	0.827505	0.229541	0.135784	1.382575	0.343841	0.173738	0.1342640
26	0.823252	0.228361	0.135087	1.37547	0.342074	0.172845	0.1335740
27	0.703472	0.195136	0.115432	1.175345	0.292303	0.147697	0.1141395
28	0.615667	0.170779	0.101024	1.028642	0.255819	0.129262	0.0998930
29	0.445993	0.123714	0.073183	0.745155	0.185317	0.093638	0.0723631
30	0.497232	0.137927	0.08159	0.830764	0.206608	0.104396	0.0806767
31	0.187133	0.051909	0.030706	0.312657	0.077757	0.039289	0.0303626
32	0.369783	0.102574	0.060677	0.617825	0.153651	0.077637	0.0599979
33	0.344194	0.095476	0.056478	0.575071	0.143018	0.072265	0.0558460
34	0.395554	0.109722	0.064906	0.660882	0.164359	0.083048	0.0641793
35	0.361811	0.100362	0.059369	0.604505	0.150338	0.075964	0.0587044
36	0.53232	0.14766	0.087348	0.889388	0.221187	0.111763	0.0863699
37	0.625517	0.173512	0.102641	1.0451	0.259912	0.13133	0.1014912
38	1.446746	0.401312	0.237395	2.417189	0.601145	0.30375	0.2347369
39	3.104214	0.861076	0.509368	5.186448	1.289849	0.651742	0.5036640

Ward No.	TOTAL PET	TOTAL HDPE	TOTAL PVC	TOTAL LDPE	TOTAL (PP)	TOTAL PS	TOTAL OTHERS
40	1.173552	0.325531	0.192567	1.960743	0.487629	0.246392	0.1904108
41	0.813668	0.225703	0.133514	1.359457	0.338092	0.170833	0.1320190
	39.13814	10.8565	6.422141	65.39108	16.2625	8.217201	6.3502281

Table C.6 Plastic waste generation according to type

PET (All the data in ton/day)

Ward No.	PET (HH)	PET (MARKET)	PET (HR)	PET (OFFICE)	PET (STREET)	TOTAL PET
01	0.2846291	0.136455	0.1749798	0.06638829	0.084638	0.74709
02	0.7556535	0.362271	0.46454879	0.17625234	0.224703	1.983428
03	0.4690442	0.224866	0.28835159	0.10940216	0.139476	1.23114
04	0.7273619	0.348707	0.44715609	0.16965345	0.21629	1.909168
05	0.4982267	0.238857	0.30629198	0.11620884	0.148154	1.307738
06	0.2939766	0.140936	0.18072628	0.06856854	0.087417	0.771625
07	0.7595772	0.364152	0.4669609	0.17716751	0.225869	1.993726
08	0.6537039	0.313395	0.40187378	0.1524731	0.194387	1.715832
09	0.4815213	0.230848	0.29602208	0.11231239	0.143186	1.26389
10	0.2853815	0.136816	0.17544235	0.06656378	0.084862	0.749065
11	0.5065079	0.242827	0.31138294	0.11814038	0.150616	1.329474
12	0.4007454	0.192123	0.24636393	0.09347182	0.119166	1.05187
13	0.4131625	0.198076	0.25399753	0.09636805	0.122859	1.084463
14	0.3215897	0.154174	0.19770183	0.07500915	0.095628	0.844104
15	0.2262271	0.108456	0.13907632	0.05276631	0.067271	0.593797
16	0.2600164	0.124655	0.1598488	0.06064751	0.077319	0.682487
17	0.5131134	0.245994	0.31544379	0.11968109	0.15258	1.346812
18	0.3507999	0.168178	0.21565925	0.08182229	0.104314	0.920774
19	0.2580038	0.123691	0.15861154	0.06017808	0.07672	0.677204
20	0.1614965	0.077424	0.09928226	0.03766823	0.048023	0.423893

Ward No.	PET (HH)	PET (MARKET)	PET (HR)	PET (OFFICE)	PET (STREET)	TOTAL PET
21	0.2120282	0.101649	0.13034734	0.04945449	0.063049	0.556528
22	0.1568343	0.075188	0.09641611	0.0365808	0.046637	0.411656
23	0.1635044	0.078386	0.10051669	0.03813658	0.04862	0.429164
24	0.7031416	0.337096	0.43226631	0.16400419	0.209087	1.845595
25	0.3152657	0.151143	0.19381408	0.07353412	0.093748	0.827505
26	0.3136455	0.150366	0.19281803	0.07315621	0.093266	0.823252
27	0.2680114	0.128488	0.16476382	0.06251229	0.079696	0.703472
28	0.234559	0.112451	0.1441985	0.05470969	0.069749	0.615667
29	0.1699161	0.08146	0.10445835	0.03963207	0.050527	0.445993
30	0.1894373	0.090819	0.11645928	0.04418529	0.056331	0.497232
31	0.0712946	0.03418	0.04382937	0.0166291	0.0212	0.187133
32	0.1408813	0.06754	0.08660877	0.03285984	0.041893	0.369783
33	0.1311322	0.062867	0.0806154	0.03058592	0.038994	0.344194
34	0.1506996	0.072247	0.09264471	0.03514991	0.044812	0.395554
35	0.1378439	0.066084	0.08474152	0.03215139	0.04099	0.361811
36	0.2028053	0.097228	0.12467747	0.04730331	0.060307	0.53232
37	0.2383118	0.11425	0.1465056	0.05558502	0.070865	0.625517
38	0.5511864	0.264246	0.33884972	0.12856143	0.163902	1.446746
39	1.1826549	0.566981	0.72705396	0.27584823	0.351676	3.104214
40	0.4471042	0.214348	0.27486366	0.10428477	0.132952	1.173552
41	0.3099942	0.148615	0.19057335	0.07230457	0.09218	0.813668
	14.91099	7.148531	9.16674386	3.47791251	4.433959	39.13814

HDPE (All the data in ton/day)

Ward No	HDPE (HH)	HDPE (MARKET)	HDPE (HR)	HDPE (OFFICE)	HDPE (STREET)	TOTAL HDPE
01	0.19413	0.0073376	0.00071419	0.00169474	0.00336211	0.207235
02	0.51538	0.0194805	0.00189607	0.0044993	0.00892598	0.550182

Ward No	HDPE (HH)	HDPE (MARKET)	HDPE (HR)	HDPE (OFFICE)	HDPE (STREET)	TOTAL HDPE
03	0.3199	0.0120918	0.00117692	0.00279278	0.00554047	0.341505
04	0.49608	0.0187511	0.00182508	0.00433085	0.00859179	0.529583
05	0.33981	0.0128441	0.00125014	0.00296654	0.00588518	0.362752
06	0.2005	0.0075786	0.00073764	0.00175039	0.00347253	0.214041
07	0.51806	0.0195816	0.00190592	0.00452267	0.00897232	0.553038
08	0.44585	0.0168523	0.00164026	0.00389228	0.00772172	0.475953
09	0.32841	0.0124134	0.00120822	0.00286707	0.00568786	0.350589
10	0.19464	0.007357	0.00071607	0.00169922	0.003371	0.207783
11	0.34545	0.0130576	0.00127092	0.00301584	0.005983	0.368782
12	0.27332	0.0103311	0.00100554	0.00238611	0.00473371	0.291777
13	0.28179	0.0106512	0.0010367	0.00246005	0.00488038	0.300818
14	0.21933	0.0082905	0.00080693	0.00191481	0.0037987	0.234145
15	0.15429	0.0058321	0.00056764	0.001347	0.00267225	0.164713
16	0.17734	0.0067031	0.00065243	0.00154819	0.00307138	0.189315
17	0.34996	0.0132279	0.00128749	0.00305517	0.00606103	0.373591
18	0.23926	0.0090435	0.00088022	0.00208873	0.00414374	0.255413
19	0.17597	0.0066512	0.00064738	0.0015362	0.00304761	0.187849
20	0.11015	0.0041633	0.00040522	0.00096158	0.00190764	0.117583
21	0.14461	0.005466	0.00053202	0.00126246	0.00250453	0.154375
22	0.10697	0.0040431	0.00039353	0.00093382	0.00185257	0.114189
23	0.11152	0.0042151	0.00041026	0.00097354	0.00193136	0.119045
24	0.47956	0.0181267	0.00176431	0.00418664	0.00830569	0.511948
25	0.21502	0.0081274	0.00079106	0.00187715	0.003724	0.229541
26	0.21392	0.0080857	0.00078699	0.0018675	0.00370486	0.228361
27	0.18279	0.0069092	0.00067249	0.00159579	0.00316582	0.195136
28	0.15998	0.0060468	0.00058855	0.00139661	0.00277067	0.170779
29	0.11589	0.0043804	0.00042635	0.00101171	0.00200709	0.123714

Ward No	HDPE (HH)	HDPE (MARKET)	HDPE (HR)	HDPE (OFFICE)	HDPE (STREET)	TOTAL HDPE
30	0.1292	0.0048836	0.00047533	0.00112795	0.00223768	0.137927
31	0.04863	0.0018379	0.00017889	0.0004245	0.00084215	0.051909
32	0.09609	0.0036319	0.0003535	0.00083883	0.00166413	0.102574
33	0.08944	0.0033805	0.00032903	0.00078079	0.00154897	0.095476
34	0.10278	0.003885	0.00037813	0.00089729	0.0017801	0.109722
35	0.09401	0.0035536	0.00034588	0.00082075	0.00162825	0.100362
36	0.13832	0.0052282	0.00050887	0.00120754	0.00239559	0.14766
37	0.16254	0.0061436	0.00059797	0.00141895	0.002815	0.173512
38	0.37593	0.0142094	0.00138303	0.00328187	0.00651076	0.401312
39	0.80661	0.0304884	0.00296749	0.00704175	0.01396983	0.861076
40	0.30494	0.0115262	0.00112186	0.00266214	0.00528131	0.325531
41	0.21143	0.0079915	0.00077783	0.00184576	0.00366173	0.225703
	10.1698	0.3844	0.03741435	0.08878287	0.17613252	10.8565

PVC (All the data in ton/day)

Name	PVC (HH)	PVC (MARKET)	PVC (HR)	PVC (OFFICE)	PVC (STREET)	TOTAL PVC
Ward No. 01	0.10546638	0.0111656	0.00042996	0.00058187	0.00494552	0.122589
Ward No. 02	0.27999962	0.0296432	0.00114148	0.00154479	0.01312973	0.325459
Ward No. 03	0.17379947	0.0183999	0.00070853	0.00095887	0.00814979	0.202017
Ward No. 04	0.26951644	0.0285334	0.00109874	0.00148696	0.01263815	0.313274
Ward No. 05	0.18461277	0.0195447	0.00075262	0.00101853	0.00865685	0.214585
Ward No. 06	0.10892998	0.0115323	0.00044408	0.00060098	0.00510794	0.126615
Ward No. 07	0.28145348	0.0297971	0.00114741	0.00155282	0.0131979	0.327149

Name	PVC (HH)	PVC (MARKET)	PVC (HR)	PVC (OFFICE)	PVC (STREET)	TOTAL PVC
Ward No. 08	0.24222322	0.0256439	0.00098748	0.00133638	0.01135832	0.281549
Ward No. 09	0.17842275	0.0188894	0.00072738	0.00098438	0.00836659	0.20739
Ward No. 10	0.10574517	0.0111951	0.00043109	0.00058341	0.0049586	0.122913
Ward No. 11	0.18768126	0.0198696	0.00076512	0.00103546	0.00880074	0.218152
Ward No. 12	0.14849206	0.0157207	0.00060536	0.00081925	0.00696308	0.1726
Ward No. 13	0.1530931	0.0162078	0.00062412	0.00084463	0.00717883	0.177948
Ward No. 14	0.11916173	0.0126155	0.00048579	0.00065743	0.00558772	0.138508
Ward No. 15	0.08382611	0.0088746	0.00034174	0.00046248	0.00393077	0.097436
Ward No. 16	0.0963464	0.0102001	0.00039278	0.00053156	0.00451787	0.111989
Ward No. 17	0.19012888	0.0201287	0.0007751	0.00104897	0.00891551	0.220997
Ward No. 18	0.12998529	0.0137614	0.00052991	0.00071715	0.00609526	0.151089
Ward No. 19	0.09560066	0.0101211	0.00038974	0.00052744	0.0044829	0.111122
Ward No. 20	0.05984085	0.0063353	0.00024395	0.00033015	0.00280605	0.069556
Ward No. 21	0.07856485	0.0083176	0.00032029	0.00043345	0.00368406	0.09132
Ward No. 22	0.05811332	0.0061524	0.00023691	0.00032062	0.00272505	0.067548
Ward No. 23	0.06058488	0.006414	0.00024699	0.00033425	0.00284094	0.070421
Ward No. 24	0.26054185	0.0275832	0.00106216	0.00143744	0.01221731	0.302842
Ward No. 25	0.11681845	0.0123674	0.00047624	0.0006445	0.00547784	0.135784

Name	PVC (HH)	PVC (MARKET)	PVC (HR)	PVC (OFFICE)	PVC (STREET)	TOTAL PVC
Ward No. 26	0.11621809	0.0123039	0.00047379	0.00064119	0.00544969	0.135087
Ward No. 27	0.09930885	0.0105137	0.00040485	0.0005479	0.00465678	0.115432
Ward No. 28	0.08691342	0.0092014	0.00035432	0.00047951	0.00407554	0.101024
Ward No. 29	0.06296066	0.0066656	0.00025667	0.00034736	0.00295235	0.073183
Ward No. 30	0.07019404	0.0074314	0.00028616	0.00038727	0.00329153	0.08159
Ward No. 31	0.02641748	0.0027968	0.0001077	0.00014575	0.00123877	0.030706
Ward No. 32	0.0522021	0.0055266	0.00021281	0.00028801	0.00244786	0.060677
Ward No. 33	0.04858969	0.0051441	0.00019809	0.00026808	0.00227846	0.056478
Ward No. 34	0.05584017	0.0059117	0.00022764	0.00030808	0.00261845	0.064906
Ward No. 35	0.05107664	0.0054074	0.00020823	0.0002818	0.00239508	0.059369
Ward No. 36	0.07514742	0.0079558	0.00030636	0.0004146	0.00352381	0.087348
Ward No. 37	0.08830399	0.0093486	0.00035999	0.00048718	0.00414075	0.102641
Ward No. 38	0.20423645	0.0216223	0.00083262	0.0011268	0.00957704	0.237395
Ward No. 39	0.43822056	0.0463939	0.0017865	0.00241772	0.02054901	0.509368
Ward No. 40	0.16566983	0.0175393	0.00067539	0.00091402	0.00776858	0.192567
Ward No. 41	0.11486515	0.0121606	0.00046827	0.00063373	0.00538625	0.133514
	5.52511352	0.5849369	0.02252436	0.03048277	0.25908329	6.422141

LDPE (All the data in ton/day)

Name	LDPE (HH)	LDPE (MARKET)	LDPE (HR)	LDPE (OFFICE)	LDPE (STREET)	TOTAL LDPE
Ward No. 01	0.83671919	0.1655741	0.00837705	0.00384514	0.23370508	1.248221
Ward No. 02	2.2213815	0.4395778	0.02223998	0.01020835	0.62045683	3.313864
Ward No. 03	1.37884092	0.2728518	0.01380465	0.00633646	0.38512577	2.05696
Ward No. 04	2.13821301	0.42312	0.02140732	0.00982615	0.59722694	3.189793
Ward No. 05	1.46462835	0.2898278	0.01466354	0.0067307	0.40908717	2.184938
Ward No. 06	0.86419776	0.1710117	0.00865216	0.00397142	0.24138015	1.289213
Ward No. 07	2.23291571	0.4418602	0.02235546	0.01026136	0.62367847	3.331071
Ward No. 08	1.92168185	0.3802718	0.01923945	0.00883108	0.53674735	2.866772
Ward No. 09	1.41551973	0.2801099	0.01417187	0.00650502	0.39537058	2.111677
Ward No. 10	0.83893104	0.1660118	0.00839919	0.00385531	0.23432287	1.25152
Ward No. 11	1.48897233	0.2946451	0.01490726	0.00684257	0.41588671	2.221254
Ward No. 12	1.17806414	0.2331211	0.01179452	0.00541379	0.32904656	1.75744
Ward No. 13	1.21456654	0.2403443	0.01215997	0.00558154	0.33924209	1.811894
Ward No. 14	0.94537151	0.1870747	0.00946485	0.00434445	0.26405289	1.410308
Ward No. 15	0.66503577	0.1316005	0.00665819	0.00305617	0.18575197	0.992103
Ward No. 16	0.76436573	0.1512564	0.00765266	0.00351264	0.21349594	1.140283
Ward No. 17	1.50839053	0.2984877	0.01510167	0.0069318	0.42131043	2.250222

Name	LDPE (HH)	LDPE (MARKET)	LDPE (HR)	LDPE (OFFICE)	LDPE (STREET)	TOTAL LDPE
Ward No. 18	1.03124035	0.2040669	0.01032455	0.00473906	0.28803703	1.538408
Ward No. 19	0.75844935	0.1500857	0.00759343	0.00348545	0.21184343	1.131457
Ward No. 20	0.47474834	0.0939455	0.00475308	0.0021817	0.13260255	0.708231
Ward No. 21	0.62329548	0.1233407	0.0062403	0.00286435	0.17409344	0.929834
Ward No. 22	0.46104298	0.0912334	0.00461586	0.00211872	0.12877449	0.687785
Ward No. 23	0.48065115	0.0951136	0.00481217	0.00220883	0.13425127	0.717037
Ward No. 24	2.06701298	0.4090306	0.02069448	0.00949895	0.57733996	3.083577
Ward No. 25	0.92678106	0.183396	0.00927873	0.00425902	0.25886037	1.382575
Ward No. 26	0.92201811	0.1824534	0.00923104	0.00423713	0.25753002	1.37547
Ward No. 27	0.78786839	0.1559072	0.00788796	0.00362065	0.2200605	1.175345
Ward No. 28	0.68952902	0.1364474	0.00690341	0.00316873	0.19259321	1.028642
Ward No. 29	0.49949941	0.0988434	0.00500088	0.00229545	0.1395158	0.745155
Ward No. 30	0.55688553	0.1101992	0.00557541	0.00255917	0.15554439	0.830764
Ward No. 31	0.20958349	0.0414734	0.0020983	0.00096314	0.05853903	0.312657
Ward No. 32	0.41414621	0.0819533	0.00414634	0.00190321	0.11567569	0.617825
Ward No. 33	0.38548708	0.0762821	0.00385941	0.0017715	0.10767088	0.575071
Ward No. 34	0.44300889	0.0876648	0.00443531	0.00203585	0.12373736	0.660882
Ward No. 35	0.40521737	0.0801864	0.00405695	0.00186218	0.11318177	0.604505

Name	LDPE (HH)	LDPE (MARKET)	LDPE (HR)	LDPE (OFFICE)	LDPE (STREET)	TOTAL LDPE
Ward No. 36	0.59618329	0.1179757	0.00596886	0.00273976	0.16652069	0.889388
Ward No. 37	0.70056116	0.1386305	0.00701386	0.00321943	0.19567461	1.0451
Ward No. 38	1.62031313	0.3206355	0.01622222	0.00744614	0.45257168	2.417189
Ward No. 39	3.4766299	0.6879725	0.03480725	0.01597684	0.97106182	5.186448
Ward No. 40	1.3143443	0.2600889	0.01315892	0.00604007	0.36711114	1.960743
Ward No. 41	0.9112845	0.1803294	0.00912358	0.00418781	0.25453201	1.359457
	43.8335771	8.6740019	0.43885209	0.20143708	12.2432109	65.39108

PP (All the data in ton/day)

Name	PP (HH)	PP (MARKET)	PP (HR)	PP (OFFICE)	PP (STREET)	TOTAL (PP)
Ward No. 01	0.23673912	0.014848	0.0166474	0.00975332	0.03243942	0.310427
Ward No. 02	0.62851183	0.03942	0.04419669	0.0258938	0.08612247	0.824145
Ward No. 03	0.39012562	0.024468	0.02743347	0.01607262	0.05345736	0.511558
Ward No. 04	0.60498036	0.037944	0.04254197	0.02492434	0.08289805	0.793289
Ward No. 05	0.41439809	0.025991	0.0291403	0.01707262	0.05678332	0.543385
Ward No. 06	0.24451384	0.015336	0.01719411	0.01007362	0.03350476	0.320622
Ward No. 07	0.63177529	0.039625	0.04442618	0.02602825	0.08656965	0.828424
Ward No. 08	0.5437156	0.034101	0.03823386	0.02240031	0.07450318	0.712954
Ward No. 09	0.40050342	0.025119	0.02816324	0.01650018	0.05487939	0.525166

Name	PP (HH)	PP (MARKET)	PP (HR)	PP (OFFICE)	PP (STREET)	TOTAL (PP)
Ward No. 10	0.23736494	0.014887	0.0166914	0.0097791	0.03252517	0.311248
Ward No. 11	0.42128591	0.026423	0.02962465	0.01735638	0.05772713	0.552417
Ward No. 12	0.33331836	0.020906	0.02343881	0.01373225	0.04567329	0.437068
Ward No. 13	0.34364626	0.021553	0.02416506	0.01415774	0.04708848	0.450611
Ward No. 14	0.26748092	0.016776	0.01880915	0.01101984	0.03665184	0.350738
Ward No. 15	0.18816347	0.011801	0.01323158	0.00775207	0.02578329	0.246732
Ward No. 16	0.21626763	0.013564	0.01520785	0.00890992	0.02963429	0.283584
Ward No. 17	0.42678004	0.026767	0.030011	0.01758274	0.05847997	0.559621
Ward No. 18	0.29177643	0.0183	0.0205176	0.01202078	0.03998096	0.382596
Ward No. 19	0.21459366	0.013459	0.01509014	0.00884096	0.02940491	0.281389
Ward No. 20	0.13432404	0.008425	0.00944561	0.00553396	0.01840589	0.176134
Ward No. 21	0.17635358	0.011061	0.01240111	0.00726552	0.02416503	0.231246
Ward No. 22	0.13044629	0.008182	0.00917293	0.0053742	0.01787453	0.171049
Ward No. 23	0.13599417	0.008529	0.00956305	0.00560277	0.01863474	0.178324
Ward No. 24	0.5848352	0.03668	0.04112537	0.02409438	0.08013764	0.766873
Ward No. 25	0.26222099	0.016446	0.01843927	0.01080313	0.0359311	0.343841
Ward No. 26	0.26087337	0.016362	0.01834451	0.01074761	0.03574644	0.342074
Ward No. 27	0.22291741	0.013981	0.01567546	0.00918388	0.03054548	0.292303

Name	PP (HH)	PP (MARKET)	PP (HR)	PP (OFFICE)	PP (STREET)	TOTAL (PP)
Ward No. 28	0.19509352	0.012236	0.0137189	0.00803758	0.02673289	0.255819
Ward No. 29	0.14132705	0.008864	0.00993806	0.00582247	0.01936548	0.185317
Ward No. 30	0.15756372	0.009882	0.01107982	0.0064914	0.02159033	0.206608
Ward No. 31	0.059299	0.003719	0.00416988	0.00244304	0.00812551	0.077757
Ward No. 32	0.11717744	0.007349	0.00823987	0.00482755	0.01605636	0.153651
Ward No. 33	0.1090687	0.006841	0.00766967	0.00449348	0.01494525	0.143018
Ward No. 34	0.12534377	0.007861	0.00881412	0.00516399	0.01717536	0.164359
Ward No. 35	0.11465114	0.007191	0.00806222	0.00472346	0.01571019	0.150338
Ward No. 36	0.16868253	0.01058	0.01186169	0.00694948	0.02311389	0.221187
Ward No. 37	0.19821493	0.012432	0.01393839	0.00816618	0.0271606	0.259912
Ward No. 38	0.45844713	0.028754	0.03223781	0.01888737	0.06281918	0.601145
Ward No. 39	0.9836685	0.061695	0.06917116	0.04052575	0.13478817	1.289849
Ward No. 40	0.37187711	0.023324	0.02615024	0.01532081	0.05095684	0.487629
Ward No. 41	0.25783644	0.016171	0.01813095	0.0106225	0.0353303	0.338092
	12.4021568	0.777855	0.87211454	0.51095135	1.69941808	16.2625

PS (All the data in ton/day)

Name	PS (HH)	PS (MARKET)	PS (HR)	PS (OFFICE)	PS (STREET)	TOTAL PS
Ward No. 01	0.09824	0.0090656	0.0136031	0.00451506	0.0314329	0.156854
Ward No. 02	0.26081	0.0240681	0.03611449	0.01198691	0.08345031	0.416428

Name	PS (HH)	PS (MARKET)	PS (HR)	PS (OFFICE)	PS (STREET)	TOTAL PS
Ward No. 03	0.16189	0.0149394	0.02241674	0.00744043	0.05179871	0.258483
Ward No. 04	0.25104	0.023167	0.03476236	0.01153812	0.08032593	0.400837
Ward No. 05	0.17196	0.0158689	0.02381144	0.00790335	0.05502147	0.274565
Ward No. 06	0.10146	0.0093634	0.01404984	0.00466334	0.03246519	0.162006
Ward No. 07	0.26216	0.0241931	0.036302	0.01204915	0.08388361	0.41859
Ward No. 08	0.22562	0.0208209	0.03124207	0.01036968	0.07219154	0.360245
Ward No. 09	0.16619	0.0153368	0.02301305	0.00763836	0.05317662	0.265358
Ward No. 10	0.0985	0.0090896	0.01363906	0.004527	0.031516	0.157269
Ward No. 11	0.17482	0.0161326	0.02420722	0.00803472	0.055936	0.279128
Ward No. 12	0.13831	0.012764	0.01915258	0.00635701	0.04425616	0.220844
Ward No. 13	0.1426	0.0131595	0.01974602	0.00655398	0.04562744	0.227687
Ward No. 14	0.11099	0.0102429	0.01536954	0.00510137	0.03551463	0.177223
Ward No. 15	0.07808	0.0072055	0.01081193	0.00358863	0.0249833	0.12467
Ward No. 16	0.08974	0.0082817	0.01242681	0.00412463	0.02871481	0.143291
Ward No. 17	0.1771	0.016343	0.02452291	0.0081395	0.05666548	0.282768
Ward No. 18	0.12108	0.0111732	0.01676556	0.00556473	0.03874045	0.19332
Ward No. 19	0.08905	0.0082176	0.01233062	0.00409271	0.02849255	0.142182
Ward No. 20	0.05574	0.0051438	0.0077183	0.00256181	0.0178348	0.088998

Name	PS (HH)	PS (MARKET)	PS (HR)	PS (OFFICE)	PS (STREET)	TOTAL PS
Ward No. 21	0.07318	0.0067532	0.01013333	0.0033634	0.02341525	0.116845
Ward No. 22	0.05413	0.0049953	0.00749548	0.00248786	0.01731993	0.086429
Ward No. 23	0.05643	0.0052077	0.00781427	0.00259367	0.01805655	0.090105
Ward No. 24	0.24268	0.0223955	0.03360481	0.01115391	0.07765117	0.38749
Ward No. 25	0.10881	0.0100414	0.0150673	0.00500105	0.03481625	0.173738
Ward No. 26	0.10825	0.0099898	0.01498987	0.00497535	0.03463732	0.172845
Ward No. 27	0.0925	0.0085363	0.0128089	0.00425146	0.02959773	0.147697
Ward No. 28	0.08096	0.0074709	0.01121013	0.0037208	0.02590343	0.129262
Ward No. 29	0.05865	0.0054119	0.0081207	0.00269537	0.01876462	0.093638
Ward No. 30	0.06538	0.0060337	0.00905366	0.00300504	0.02092044	0.104396
Ward No. 31	0.02461	0.0022708	0.00340734	0.00113094	0.00787339	0.039289
Ward No. 32	0.04862	0.0044872	0.00673305	0.00223479	0.01555817	0.077637
Ward No. 33	0.04526	0.0041767	0.00626712	0.00208015	0.01448154	0.072265
Ward No. 34	0.05201	0.0047999	0.00720229	0.00239054	0.01664245	0.083048
Ward No. 35	0.04758	0.0043904	0.00658789	0.00218661	0.01522274	0.075964
Ward No. 36	0.07	0.0064595	0.00969255	0.00321709	0.02239673	0.111763
Ward No. 37	0.08225	0.0075904	0.01138949	0.00378033	0.02631788	0.13133
Ward No. 38	0.19024	0.0175557	0.02634251	0.00874345	0.06087006	0.30375

Name	PS (HH)	PS (MARKET)	PS (HR)	PS (OFFICE)	PS (STREET)	TOTAL PS
Ward No. 39	0.40818	0.0376684	0.0565219	0.01876042	0.13060604	0.651742
Ward No. 40	0.15431	0.0142406	0.02136817	0.0070924	0.04937578	0.246392
Ward No. 41	0.10699	0.0098735	0.01481536	0.00491743	0.03423409	0.170833
	5.14642	0.4749254	0.71263179	0.23653254	1.64668945	8.217201

Others (All the data in ton/day)

Name	OTHERS (HH)	OTHERS (MARKET)	OTHERS (HR)	OTHERS (OFFICE)	OTHERS (STREET)	TOTAL OTHERS
Ward No. 01	0.0507634	0.0047363	0.0008099	0.0620426	0.0028644	0.1212166
Ward No. 02	0.1347702	0.0125743	0.0021501	0.1647152	0.0076046	0.3218145
Ward No. 03	0.0836537	0.0078050	0.0013346	0.1022409	0.0047203	0.1997545
Ward No. 04	0.1297244	0.0121035	0.0020696	0.1585483	0.0073199	0.3097657
Ward No. 05	0.0888583	0.0082906	0.0014177	0.1086020	0.0050140	0.2121826
Ward No. 06	0.0524305	0.0048919	0.0008365	0.0640802	0.0029585	0.1251975
Ward No. 07	0.1354700	0.0126396	0.0021613	0.1655705	0.0076441	0.3234854
Ward No. 08	0.1165876	0.0108778	0.0018601	0.1424925	0.0065786	0.2783966
Ward No. 09	0.0858789	0.0080127	0.0013701	0.1049606	0.0048458	0.2050682
Ward No. 10	0.0508976	0.0047488	0.0008120	0.0622067	0.0028720	0.1215370
Ward No. 11	0.0903353	0.0084284	0.0014412	0.1104071	0.0050973	0.2157094
Ward No. 12	0.0714726	0.0066685	0.0011403	0.0873533	0.0040329	0.1706677

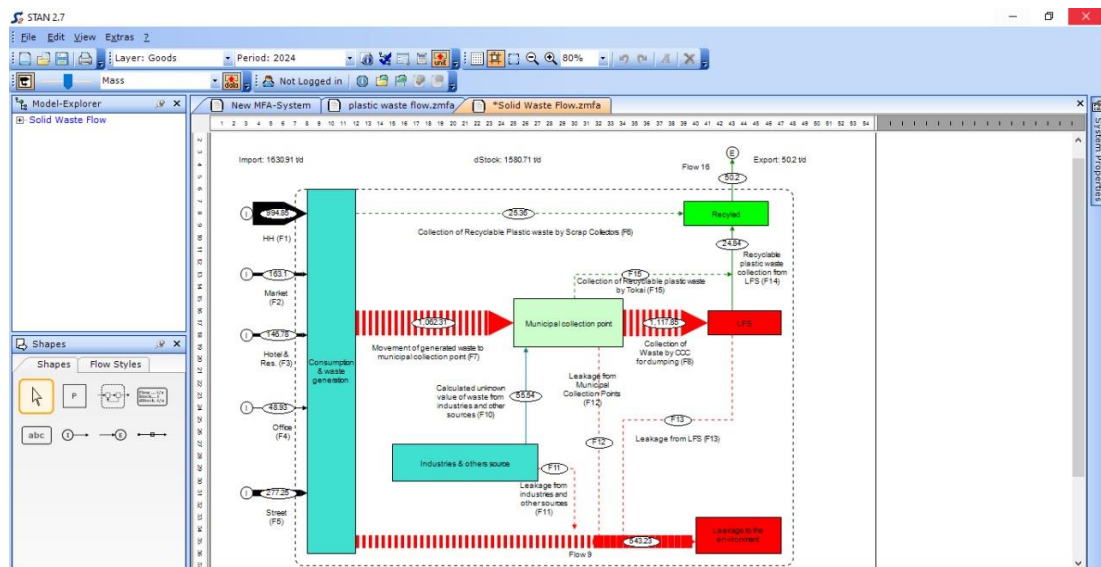
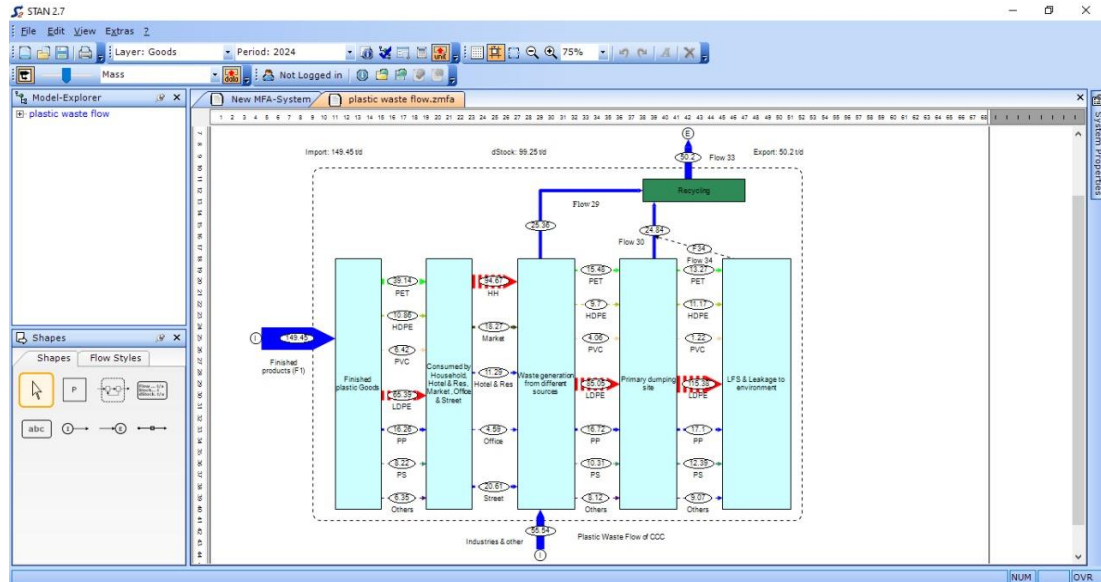
Name	OTHERS (HH)	OTHERS (MARKET)	OTHERS (HR)	OTHERS (OFFICE)	OTHERS (STREET)	TOTAL OTHERS
Ward No. 13	0.0736872	0.0068752	0.0011756	0.0900600	0.0041579	0.1759559
Ward No. 14	0.0573553	0.0053514	0.0009151	0.0700992	0.0032364	0.1369572
Ward No. 15	0.0403474	0.0037645	0.0006437	0.0493123	0.0022767	0.0963446
Ward No. 16	0.0463737	0.0043268	0.0007399	0.0566776	0.0026167	0.1107347
Ward No. 17	0.0915134	0.0085384	0.0014600	0.1118470	0.0051638	0.2185225
Ward No. 18	0.0625649	0.0058374	0.0009982	0.0764664	0.0035303	0.1493972
Ward No. 19	0.0460148	0.0042933	0.0007341	0.0562389	0.0025964	0.1098776
Ward No. 20	0.0288028	0.0026874	0.0004595	0.0352025	0.0016252	0.0687774
Ward No. 21	0.0378151	0.0035282	0.0006033	0.0462173	0.0021338	0.0902976
Ward No. 22	0.0279713	0.0026098	0.0004463	0.0341863	0.0015783	0.0667919
Ward No. 23	0.0291609	0.0027208	0.0004652	0.0356402	0.0016454	0.0696326
Ward No. 24	0.1254047	0.0117005	0.0020007	0.1532688	0.0070761	0.2994509
Ward No. 25	0.0562274	0.0052461	0.0008971	0.0687207	0.0031727	0.1342640
Ward No. 26	0.0559384	0.0052192	0.0008924	0.0683675	0.0031564	0.1335740
Ward No. 27	0.0477996	0.0044598	0.0007626	0.0584204	0.0026972	0.1141395
Ward No. 28	0.0418334	0.0039031	0.0006674	0.0511285	0.0023605	0.0998930
Ward No. 29	0.0303044	0.0028275	0.0004835	0.0370378	0.0017100	0.0723631
Ward No. 30	0.0337860	0.0031523	0.0005390	0.0412930	0.0019064	0.0806767

Name	OTHERS (HH)	OTHERS (MARKET)	OTHERS (HR)	OTHERS (OFFICE)	OTHERS (STREET)	TOTAL OTHERS
Ward No. 31	0.0127153	0.0011864	0.0002029	0.0155406	0.0007175	0.0303626
Ward No. 32	0.0251261	0.0023443	0.0004009	0.0307089	0.0014178	0.0599979
Ward No. 33	0.0233873	0.0021821	0.0003731	0.0285838	0.0013197	0.0558460
Ward No. 34	0.0268771	0.0025077	0.0004288	0.0328491	0.0015166	0.0641793
Ward No. 35	0.0245844	0.0022938	0.0003922	0.0300468	0.0013872	0.0587044
Ward No. 36	0.0361702	0.0033747	0.0005771	0.0442069	0.0020410	0.0863699
Ward No. 37	0.0425027	0.0039656	0.0006781	0.0519465	0.0023983	0.1014912
Ward No. 38	0.0983037	0.0091719	0.0015684	0.1201461	0.0055469	0.2347369
Ward No. 39	0.2109256	0.0196797	0.0033651	0.2577918	0.0119018	0.5036640
Ward No. 40	0.0797407	0.0074400	0.0012722	0.0974585	0.0044995	0.1904108
Ward No. 41	0.0552872	0.0051584	0.0008821	0.0675717	0.0031197	0.1320190
	2.6593632	0.2481234	0.0424279	3.2502553	0.1500583	6.3502281

Appendix D

Various activities during study time.

STAN work:



Zone 01



Ward #1



Ward #2



Ward #3



Ward #7



Ward #8

Zone 02



Ward #4



Ward #5



Ward #6



Ward #17



Ward #18



Ward #19



Ward #35

Zone 03



Ward #14



Ward #15



Ward #16



Ward #20



Ward #21



Ward #22



Ward #31



Ward #32



Ward #33



Ward #34

Zone 04



Ward #23



Ward #24



Ward #27



Ward #28



Ward #29



Ward #30



Ward #36

Zone 05



Ward #9



Ward #10



Ward #11



Ward #12



Ward #13



Ward #25



Ward #26

Zone 06



Ward #37



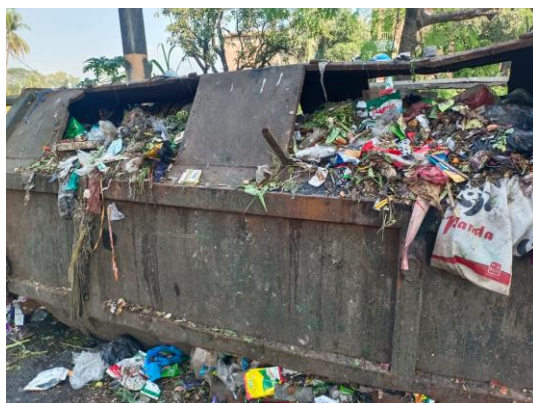
Ward #38



Ward #39



Ward #40



Ward #41





Present scenario in Arefin Nagar Dumping Site





Present scenario in Ananda Bazar Dumping Site