

A decorative graphic on the left side of the slide, consisting of white lines and circles on a blue background, resembling a circuit board or a stylized tree structure.

# THE ECONOMICS OF SOLID WASTE MANAGEMENT AND DRAINAGE: SUSTAINABLE APPROACH TO MAKING SOUTH ASIAN CITIES CLIMATE- RESILIENT

ASIAN CENTER FOR DEVELOPMENT

# CITY WASTE MANAGEMENT AND DRAINAGE CONGESTION

- Cities in low-income countries are facing increasing threats of waterlogging and water contamination from improperly managed solid waste
- Reasons
  - increased urban growth of population led to expansion of city areas into the low-lying flood-plains
  - indiscriminate dumping of untreated solid waste might clog the drainage system
  - climate change - likely to cause increased intense rainfall events which might overwhelm the city drainage systems

# POPULAR SOLUTIONS

- Investment in drainage infrastructure
- Developing (sanitary)-landfill sites
- Development or creation of market for Recycling
- Creating conditions for Reusing of waste
- Developing strategies for Reducing the volume of waste and finally
- Proper Disposal of solid wastes



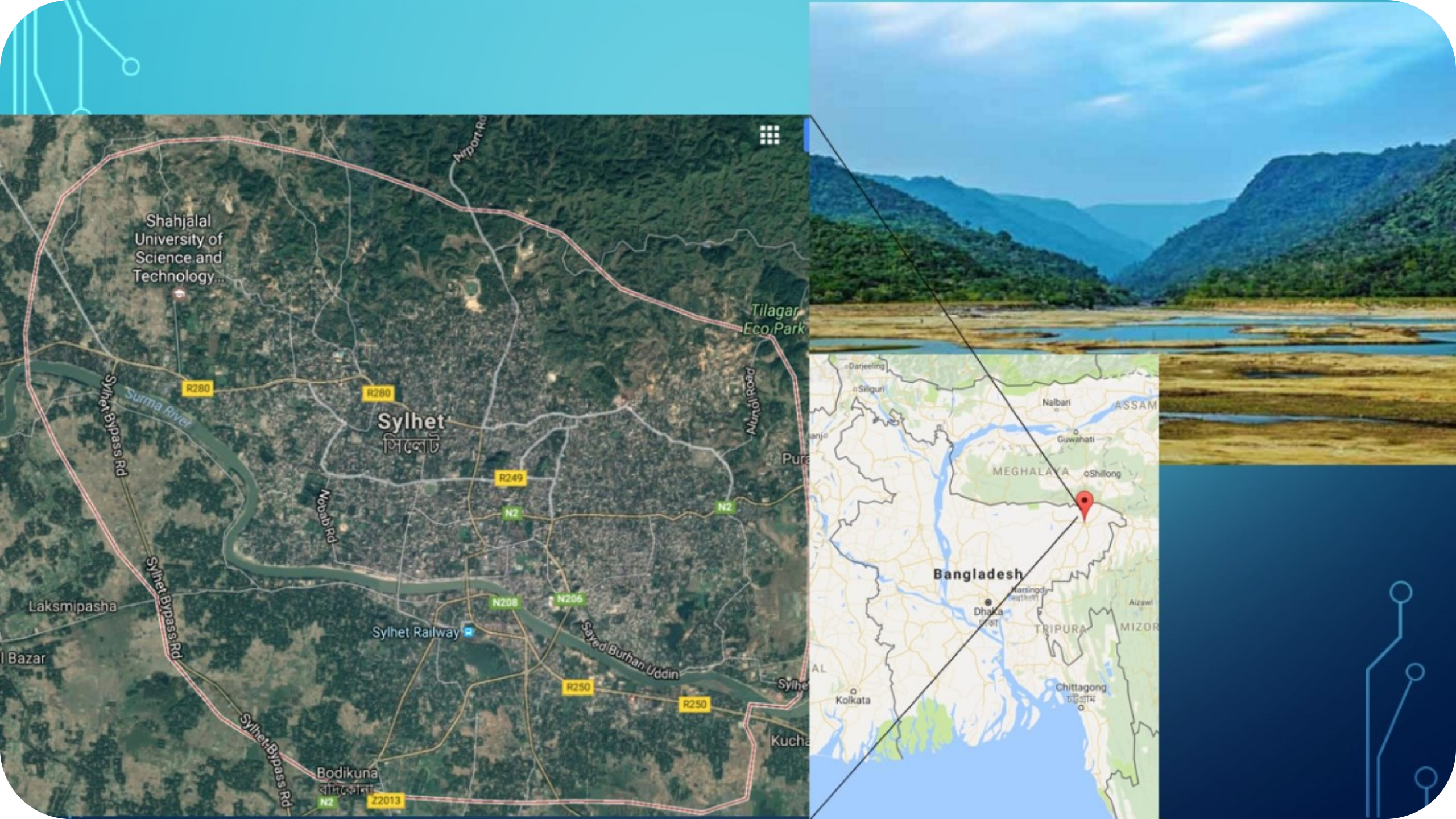
# OUR OBJECTIVES

- Organizing the dumping behavior to promote 3Rs – reduce, reuse and recycle
- Connecting the markets for promoting recycling/reusing of wastes
- Identifying sustainable mechanisms to finance these improvements in waste management
- This research will examine mechanisms for improved solid waste disposal systems

# SYLHET CITY CORPORATION

- Sylhet city in Bangladesh has 500,000 residents and is one of the fastest growing cities in the country. Surrounded by tea-estates and rain forests, it is a leading tourist attraction. It is located just south of the Meghalaya hills of India and is one of the wettest cities in Bangladesh. While annual average rainfall has declined in the last 30 years, heavy rainfall events in upstream areas contribute to flooding, flash floods and soil erosion. The city's 450 km of cemented drains and 520 km of earthen drains channel rainwater from the city to the Surma River.
- Drainage system is inadequate, and a large part of the city frequently goes under water during heavy rainfall events. Estimates suggest that around 200-250 tons of solid waste are generated in Sylhet City Corporation every day, while the Corporation has the capacity to collect around 150 tons. The City Corporation spends approximately 3% of its budget for management of solid waste.





Shahjalal  
University of  
Science and  
Technology...

Tilagar  
Eco Park

Sylhet  
সিলেট

Bangladesh

Dhaka  
ঢাকা

TRIPURA

MIZOR

Chittagong  
চট্টগ্রাম

ASSAM

Meghalaya

Guwahati

Shillong

Nalbari

Siliguri

Darjeeling

Kolkata

Aizawl

Imphal

Dispur

Tezpur

Jorhat

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur

Tezpur



# RELEVANCE OF THE RESEARCH

- The Government of Bangladesh has requested the Ministry of Water Resources to study mitigation of drainage congestion and water-logging in Sylhet Metropolitan area (27 square km area) – IWM along with ACD researchers are part of the team.
- Initial study of the rainfall pattern has shown that the return period of maximum rainfall is rising.
- The Institute of Water Modeling along with researchers of the Asian Center for Development are now engaged in the studying the pattern of garbage disposal and the drainage systems to develop an appropriate mitigation strategy for the city corporation.

# SOCIO-ECONOMIC PROFILE – IWM STUDY (EXCLUDING SLUMS)

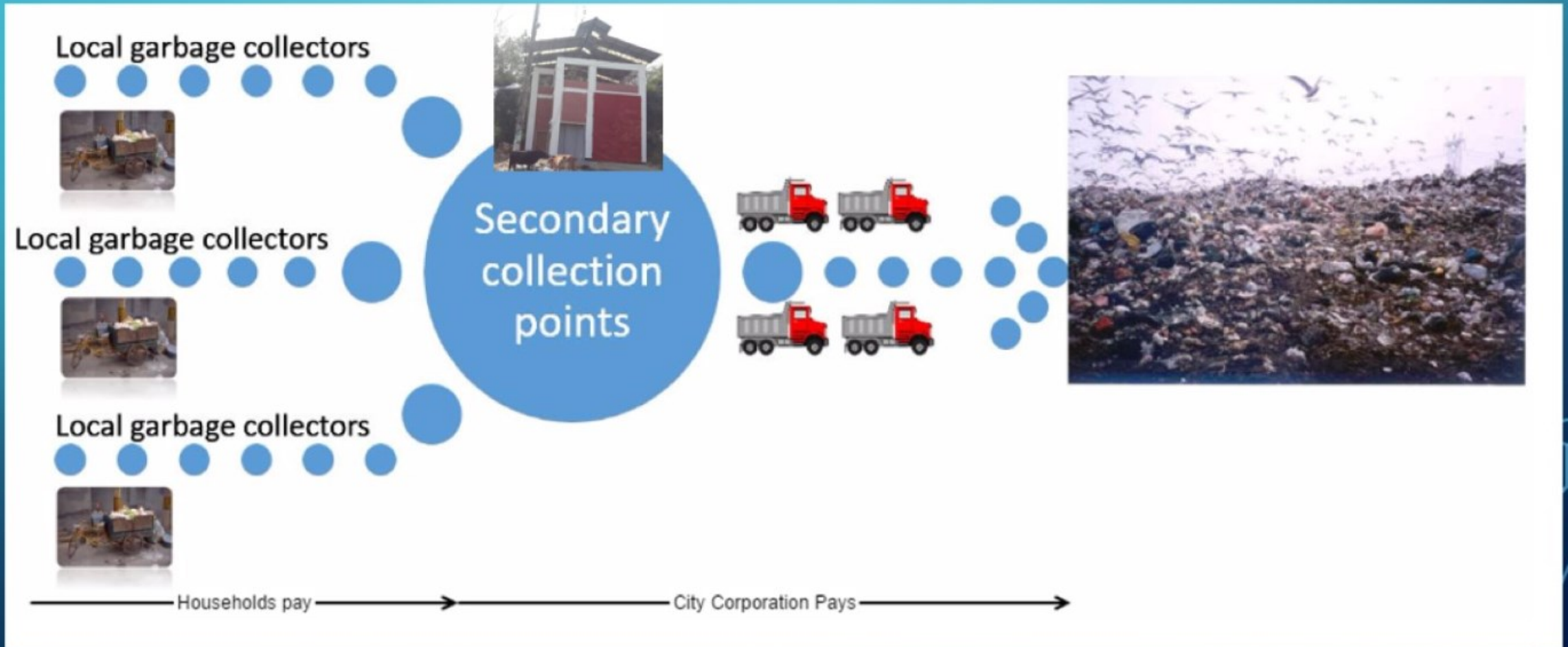
Variable	Mean	Unit
Age of Head of HH	48.45	years
Mean age of members	33.58	years
Income (monthly)	38,201	BDT
Expenditure (monthly)	38,917	BDT
HH size	6.13	person
Number of male per hh	3.07	Number
Number of female per hh	3.07	Number
Female headed hh	13.04	Percent
Average monthly rent per hh	10,374	BDT



## MAJOR SOURCES OF INCOME (PERCENT)

	Tin-roof houses	2-6 storied	High-rise Apartments	All
<b>Agriculture and Fisheries</b>	4.84	1.51	0	1.91
<b>Business</b>	48.39	40.06	37.5	41.15
<b>Salary</b>	33.87	45.78	58.33	44.74
<b>Pension</b>	4.84	6.33	4.17	5.98
<b>Remittance</b>	24.19	31.63	54.17	31.82
<b>Professional income</b>	8.06	6.02	8.33	6.46
<b>Others</b>	1.61	3.01	0	2.63

# GARBAGE DISPOSAL SYSTEM – AT PRESENT





# OTHER PLAYERS IN THE MARKET



RECYCLING AND THE JUNK MAN



WASTE PICKERS IN THE DUMP SITE



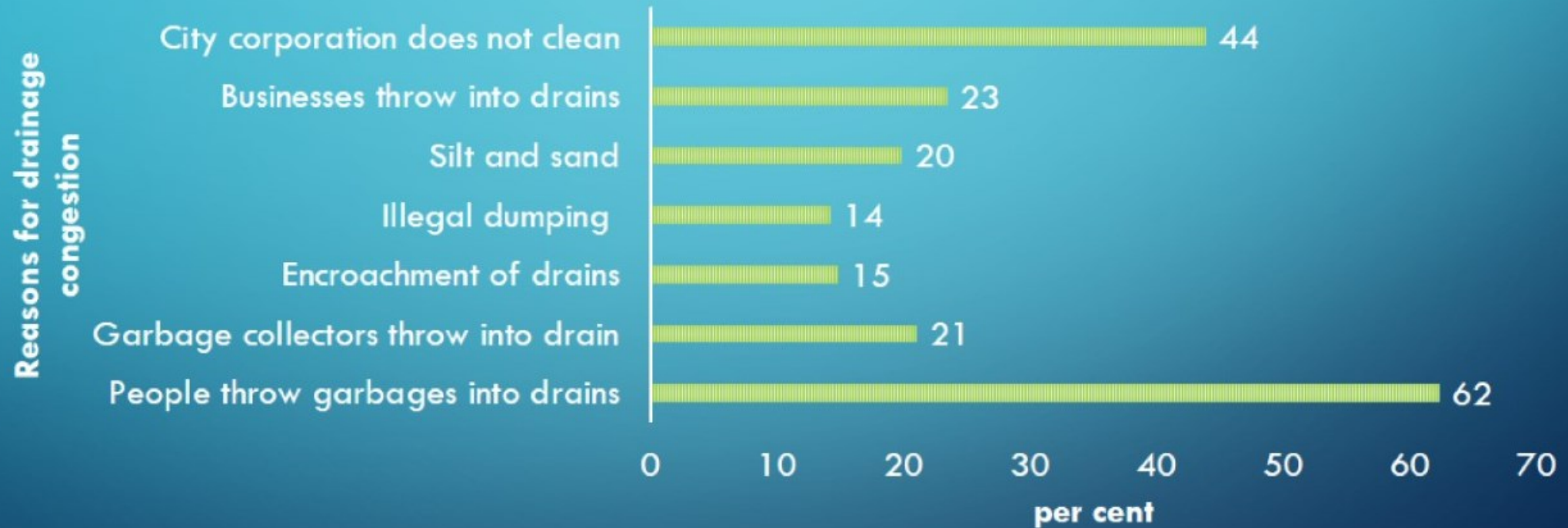
OPEN AIR BURNING

Collecting for market

Non-degradables

Expanding dumpsite

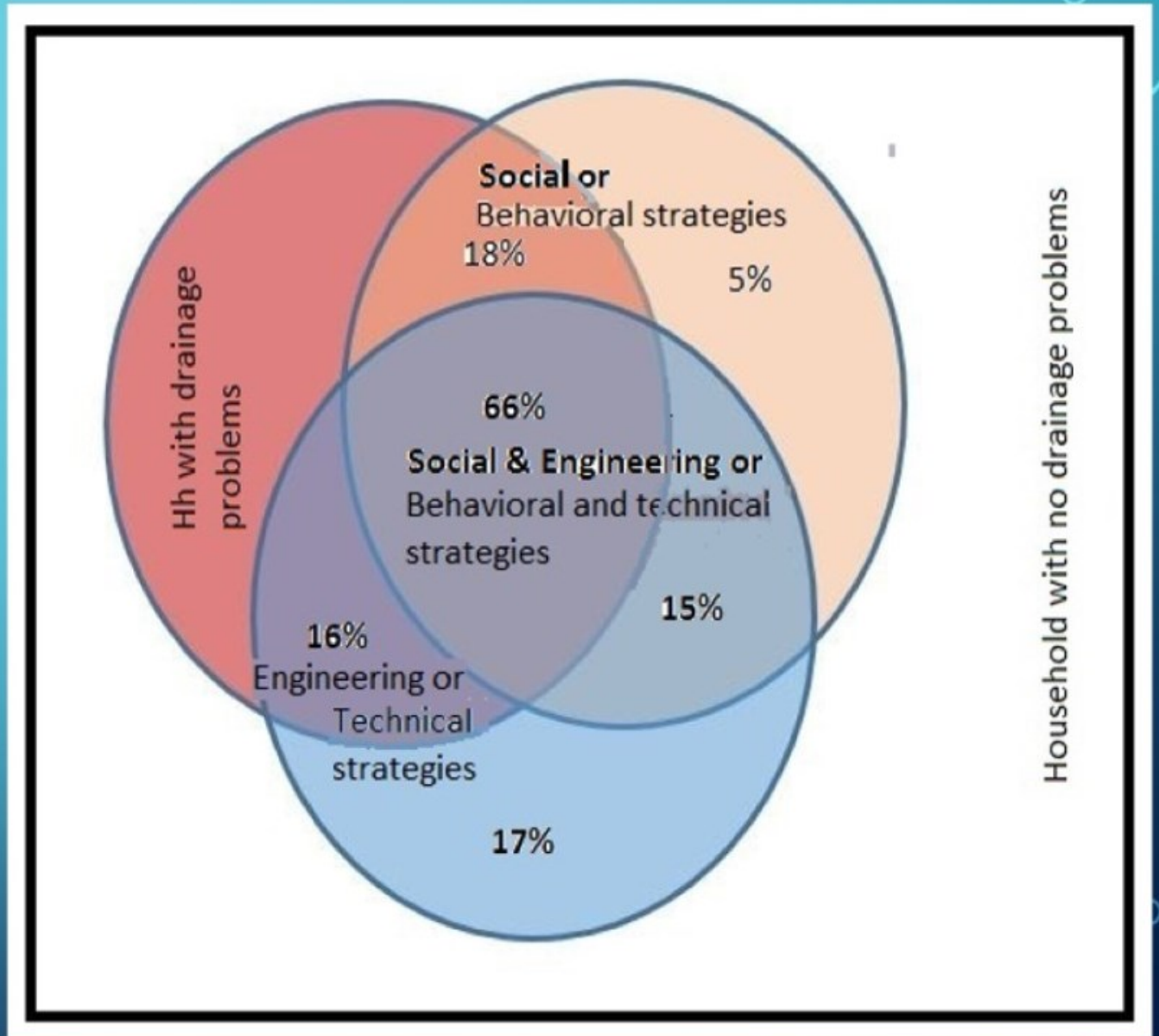
# CAUSES OF DRAINAGE CONGESTION



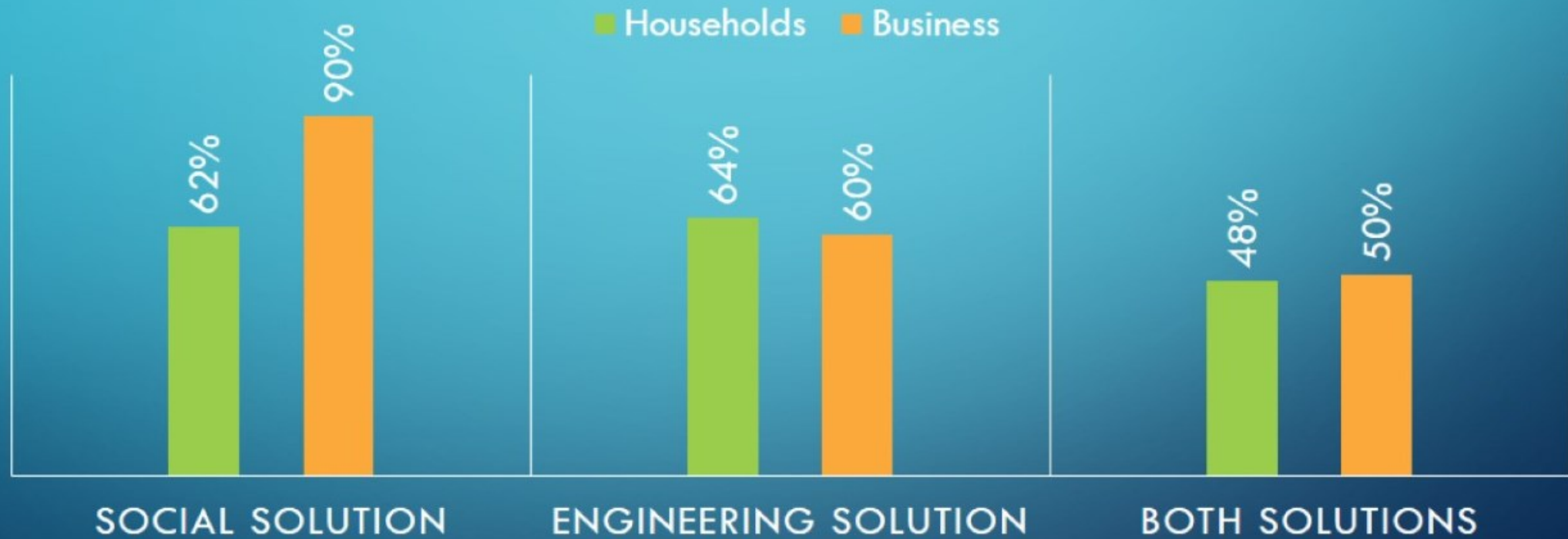


# WHAT TO DO?

- **ENGINEERING SOLUTION – HARD CORE STRATEGY OF DRAINAGE CONSTRUCTION OR EXPANSION – 33% FOR ONLY ENGINEERING SOLUTION**
- **SOCIAL SOLUTION – AUGMENT HUMAN BEHAVIOUR – 23% FOR ONLY SOCIAL SOLUTION**
- **SOCIAL + ENGINEERING SOLUTIONS – 81%**

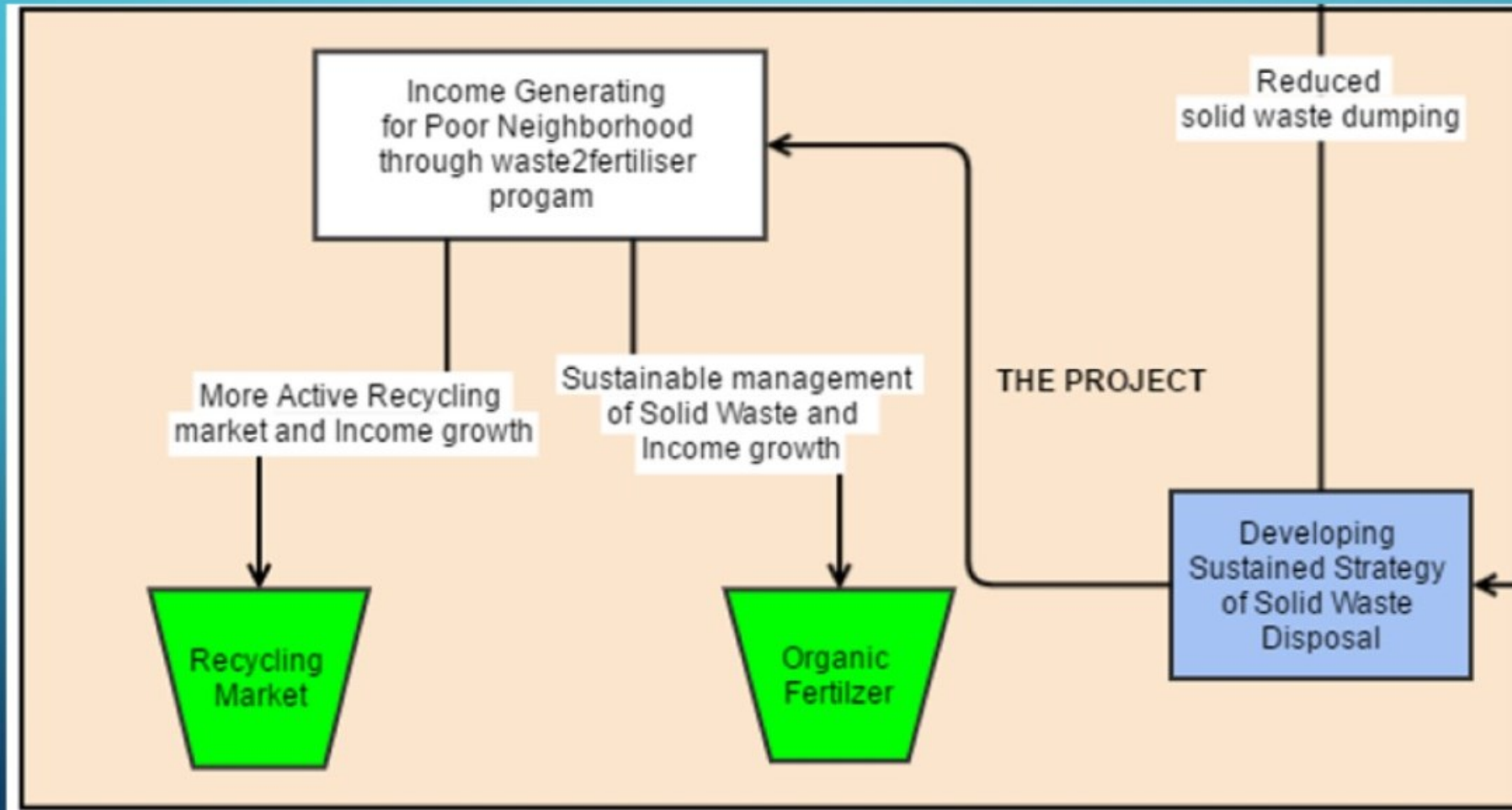


# PERCEPTION OF HOME VS BUSINESS UNITS





# SUSTAINABLE STRATEGY FOR SWM



# RESEARCH TOOLS

- Understand the behavior of economic agents during 'at source separation of organic materials' through an experiment using Randomized Controlled Trials
- Understand the markets for reusable and recyclable materials to transform informal markets for reusable and recyclable products into formal or organized markets
- Develop financing strategies to ensure proper collection and disposal of solid wastes so that city drainage systems can withstand the increasing pressure of population without unnecessarily expanding the infrastructure



# STUDY ELEMENTS

- PILOTING
  - A] SEGREGATION AT SOURCE
  - B] COMPOSTING AT HOME/LOCALITY BY SLUM DWELLERS
- STUDY INCLUDES
  - GIS SURVEY ON DRAINAGE SYSTEM
  - MARKET – AGENT SURVEY FOR REUSE AND RECYCLING
  - SIMULATED MODELLING ON WASTE DISPOSAL AND DRAINAGE CONGESTION
  - WTP SURVEY FOR GARBAGE DISPOSAL SYSTEM – HH SURVEY
  - RCT ON SEGREGATION – HH SURVEY
  - SIMULATED MODELS FOR FINANCING

# TIME PERIOD

- THREE YEARS
  - 2017-2019
- RESEARCHERS FROM ASIAN CENTER FOR DEVELOPMENT
  - DR. A.K. ENAMUL HAQUE
  - DR. MUNTAHA RAKIB
  - RESEARCH STUDENTS WITH THESIS OPTIONS
- SYLHET CITY CORPORATION (COLLABORATING PARTNER)
  - MR. ENAMUL HABIB, CEO



# ACTIVITIES

- RESEARCH STUDY – SURVEY
- AWARENESS CAMPAIGN IN SELECT LOCALITIES FOR SEGREGATION AT SOURCE
- ORGANIZING THE SLUM WOMEN FOR 'LOCAL COMPOSTING'
- SENSITIZING THE CITY COUNCILLORS
- SENSITIZING THE WASTE-PICKERS
- SENSITIZING CITY COUNCIL TO MAKE THE SOLUTION SUSTAINABLE



# Activities up to date

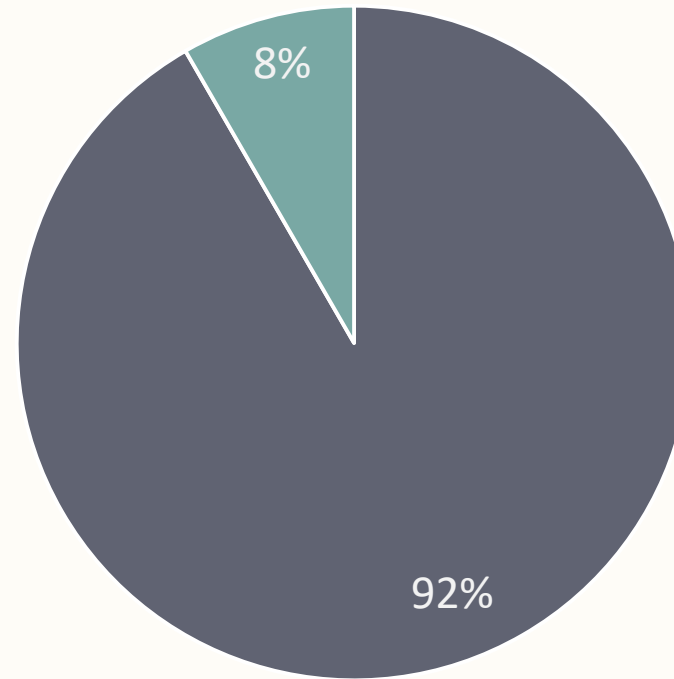
---

1. Design of Baseline Survey Instrument
2. Census (150 household) to understand disposal behavior
  - a. Mia Fazil Chist – 5 April to 18 April (2017)
  - b. Aarambag – 11-17 May (2017)
  - c. Sagar Dighir Par – 31 May – 9 June (2017)
3. Reconnaissance survey on recycling market (May-June)
4. Design of criteria for “GREEN Community AWARD”
5. Design of criteria for “GREEN HOUSEHOLD AWARD”



# Distribution between organic and inorganic

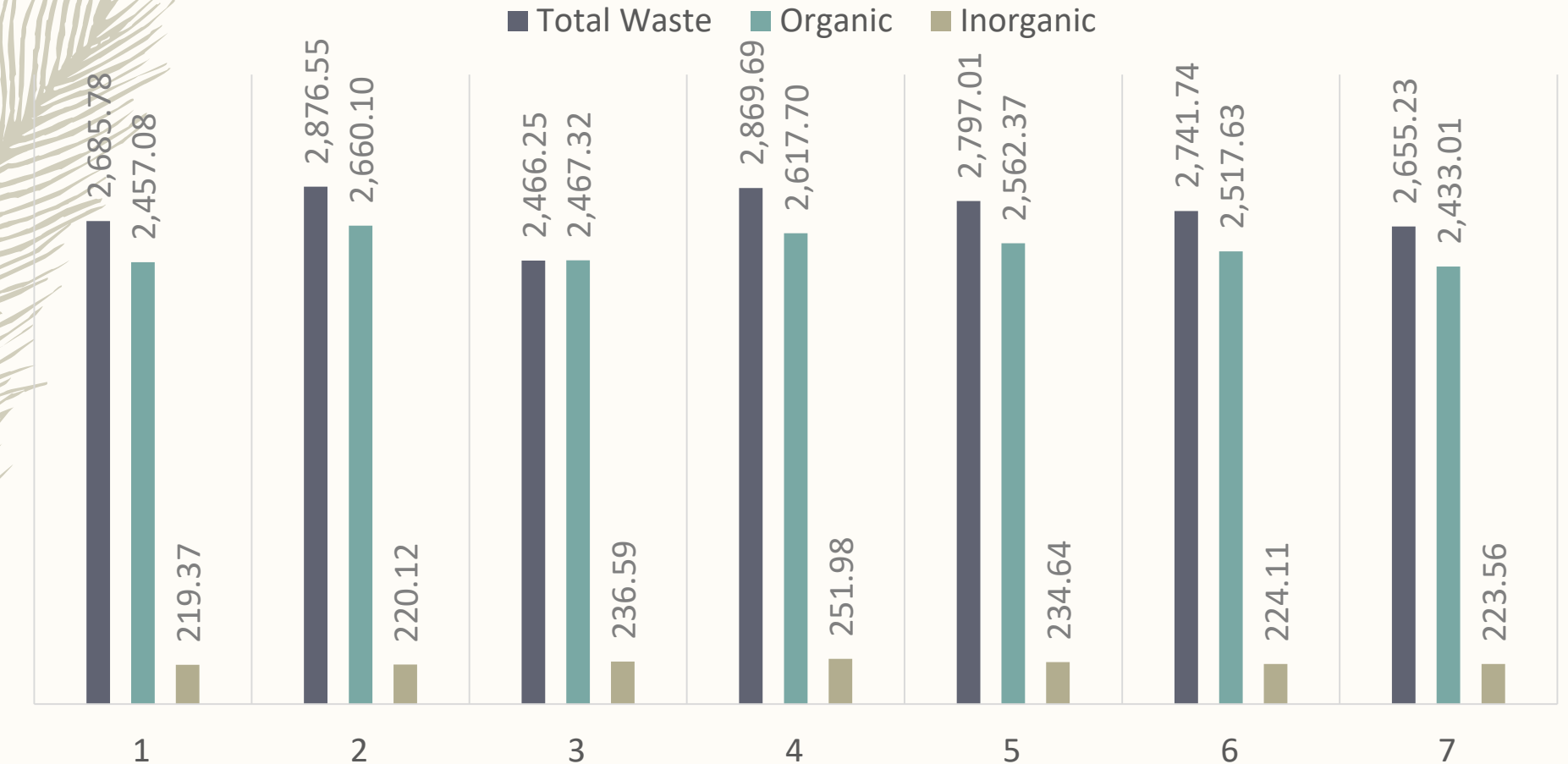
---



■ Organic ■ Inorganic

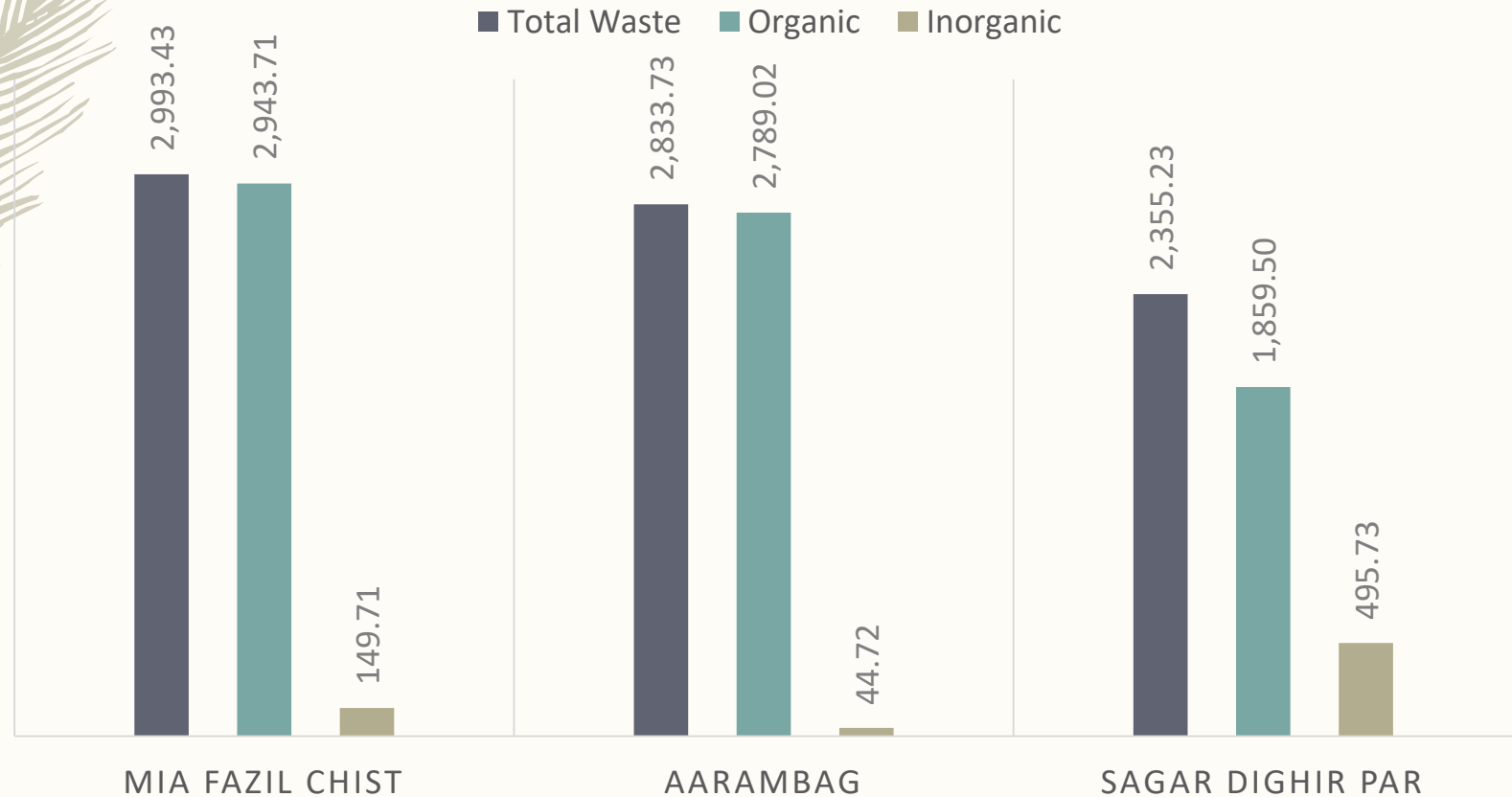


# PATTERN OF DISPOSABLE WASTE (7-DAYS in gm)

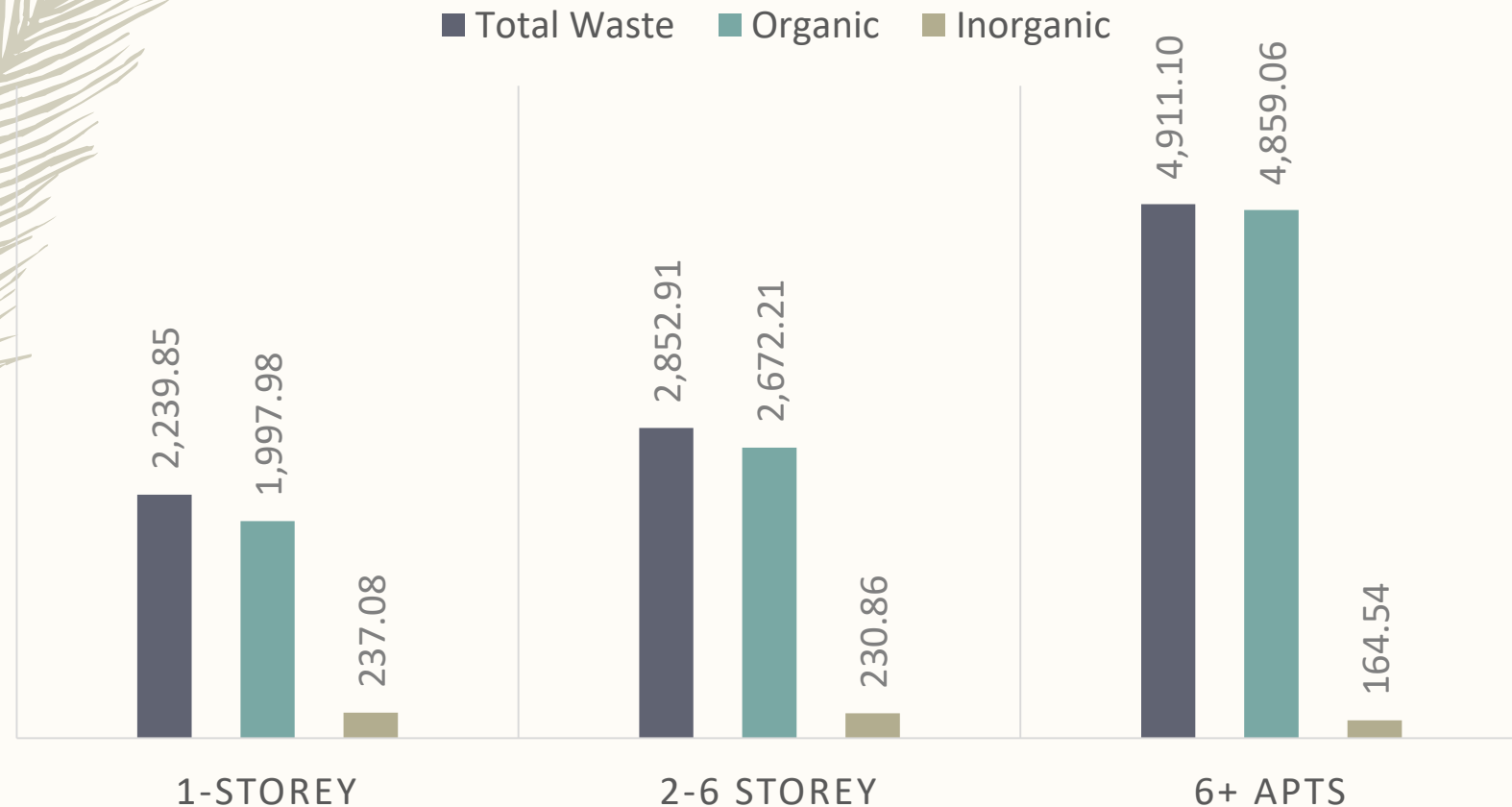




# PATTERN OF WASTE DISPOSAL BY LOCALITY (gm)



# WASTE DISPOSAL BY TYPE OF BUILDINGS (gm)





# RCT Strategy planned

---

1. ALL CLUBS WILL BE PROVIDED WITH AWARENESS MATERIALS FOR MAKING THE COMMUNITY GREEN AND CLEAN
2. 4 CLUBS WILL BE SELECTED FOR AN INTERVENTION. HOUSEHOLDS WILL BE PROVIDED WITH DISPOSABLE BAGS TO SEPARATE KITCHEN WASTE FROM OTHERS
3. GARBAGE COLLECTORS IN TWO CLUBS WILL BE PROVIDED WITH STRATEGIES TO DECOMPOSE THEIR WASTES AND WILL BE GIVEN COMPOSTING BINS



