What drives Segregation of Household Municipal Solid Waste? A Case in Powai

US 603

Research Methods in Urban Sciences

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Outline of the Presentation

1. Introduction
2. Literature Review
3. Methodology
4. Results
5. Conclusion

Introduction

- Motivation

Background

- **Constraints** – course project, Powai area, Household survey based

- **Objective** – To understand what the hindrances to adoption of household level waste segregation practices are.

- **Hypothesis** –

- Waste segregation practices are limited due to limited awareness and knowledge and limited access to facilities and institutional pressures.

- Alternatively, the low level of segregation might be due to low enforcement of segregation at the institutional level.
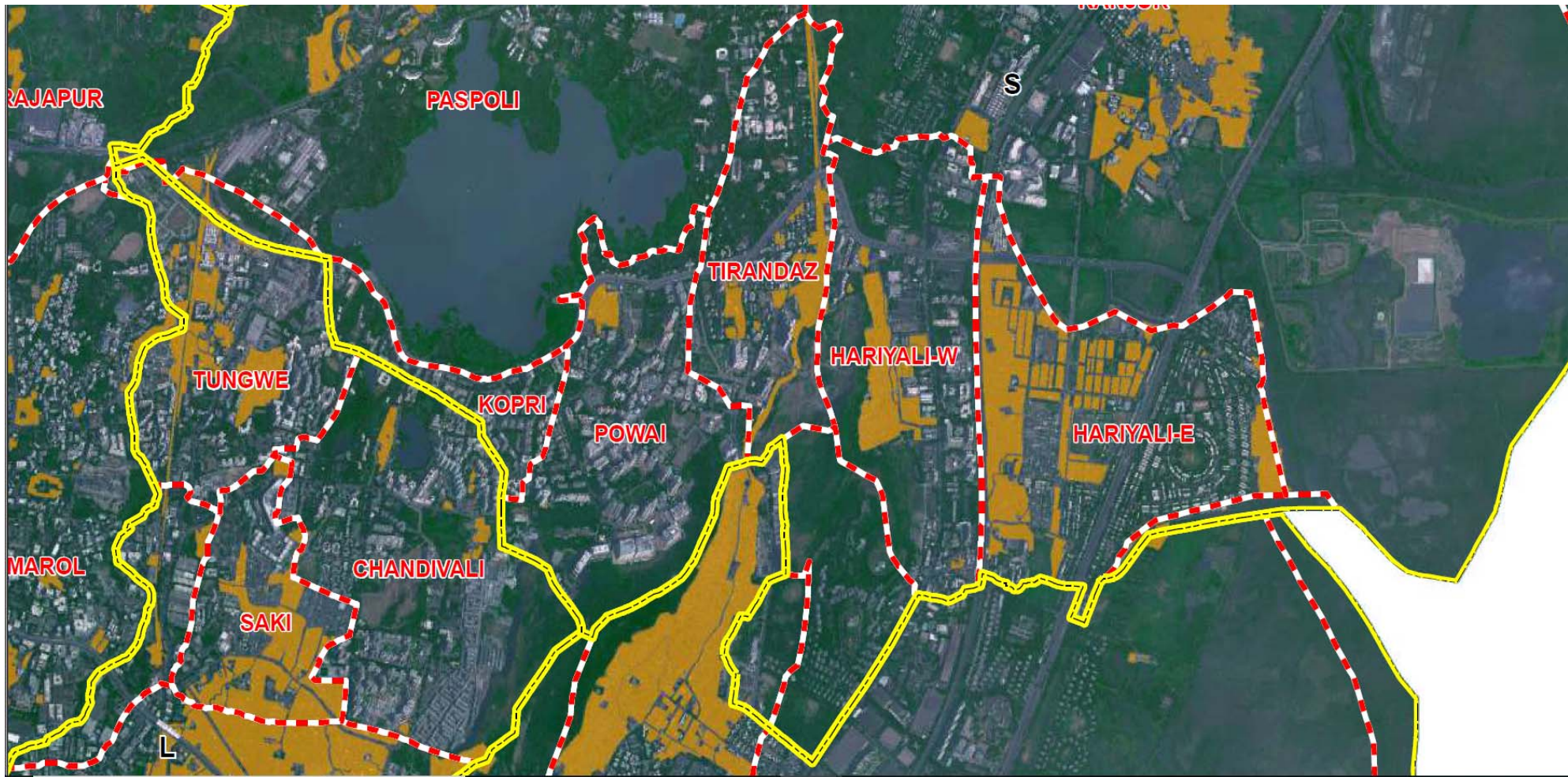
Literature Review

Literature review approach

- As directed in the class, started with
  - Sectoral search
  - Data collection about the geography and then
  - Specific published literature about segregation and collection and informal sector
- Then looked at research philosophy, proposed methodology and strategies

- Systemic approach to keyword-based searching

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About Municipal Solid Waste

- Reviewed literature from WB, MPCB, MCGM,
  - To understand what is MSW, how it is typically managed, how much is generated in Mumbai

- Researched for information about Powai
  - S –ward, 4 villages (Kopri, Powai, Tirandaz, Hariyali W)
  - S-ward is 72 % slums though Powai seems to have lesser (from SRA maps)
  - Has one waste management chowki in Powai
  - Kanjurmarg landfill is in S ward, Mulund landfill is nearby

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Specific literature revieed

1. Exploring linkages between sustainable consumption and prevailing green practices in reuse and recycling of household waste: Case of **Bhopal** city in India (Pandey, Surjan, & Kapshe, 2018)

2. Municipal solid waste recycling and associated markets in **Delhi**, India (Agarwal, Singhmar, Kulshrestha, & Mittal, 2005)

3. Promoting public participation in household waste management: A survey based method and case study in **Xiamen** city, China (Xiao, Zhang, Zhu, & Lin, 2017)

4. Improving the informal recycling sector through segregation of waste in the household - The case of **Dhaka** Bangladesh (Matter, Dietschi, & Zurbrügg, 2013)

5. Between hype and veracity; privatization of municipal solid waste management and its impacts on the informal waste sector (Sandhu, Burton, & Dedekorkut-Howes, 2017) **Amritsar**

6. Sample Study of Informal Waste Pickers in **Bangalore** (CHF International; MSSS, 2010) and Sample Study of Informal Scrap Dealers and Recyclers in Bangalore (CHF international; MSSS, 2011)

Understanding from these papers

- **Research methods** prevalent in this field – questionnaire surveys, semi-structured interviews, case studies and group discussions with various stakeholders

- Quantitative and qualitative data collected through questionnaires and observational methods (including measurements)

- Data analysis involves simple descriptive statistics and **linear regression models**

- Some other papers do systems dynamic analysis of waste flow and propose managerial solutions. Similar approach to visualise a system can be done, though data collection for the model will be difficult.
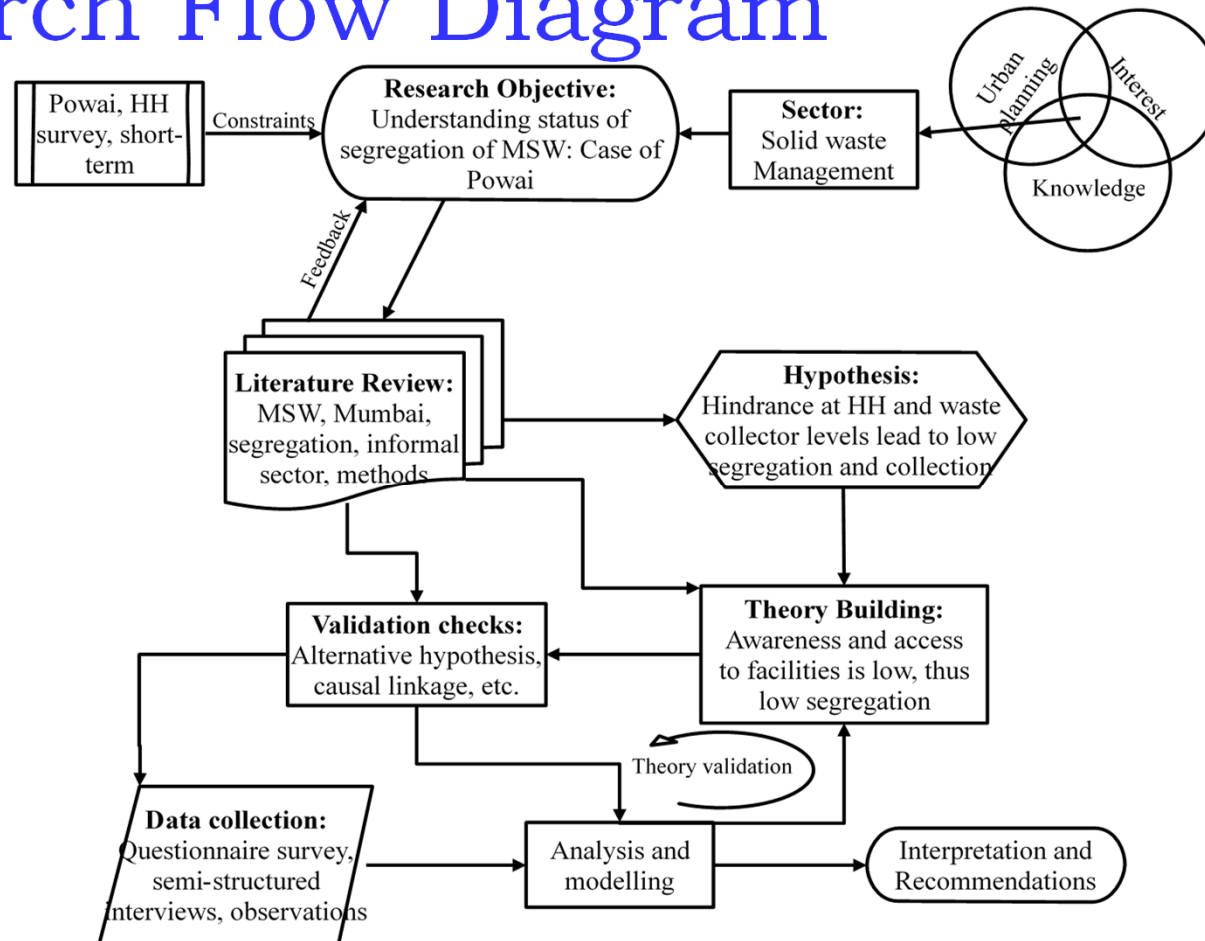
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Methodology

Research Flow Diagram

Data Required

- **Primary data**
  - Demographic profile of HH/ respondent
  - Information on waste segregation and disposal practices at HH level
  - Awareness about segregation (existing knowledge) of respondent
  - Willingness and importance of enablers for better segregation (knowledge, institutions, and social motivation)
  - Demographic profile of waste picker/collector,
  - Work details
  - Opinions on segregation, level of existing knowledge about waste flows, markets, etc.

Data Required

- **Secondary data**
  - Population, no. of societies, and their waste management employees,
  - Number of informal waste pickers in the area
  - SMPA, NGO and MCGM workers, Number of spots for waste pickup in the area
  - Existing waste flow chain - issues
  - Segregated waste/ recyclables flow chain – issues
  - Areas covered by segregated collection, societies expected to segregate/ dispose own waste
  - Systemic efforts to create awareness/ knowledge, institutionalise segregation

- Information about current practices obtained through interview with S-ward Superintendent Engineer for MSW and a service provider

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Questionnaire

- Based on feedback received, many questions removed from first version

- Most questions converted into binaries or 3 point Likert scale

- All questions not directly related to hypothesis removed

- Common set of household descriptive questions planned to be used

- Wrong combination of research question and method

Results

Sample population statistics

- Middle class, well educated, white collared job respondents.

- Negligible representation of economically weaker sections or high income groups

- Not representative sample of Powai, which has 76% of people living in slums

Primary Analysis

- 31 families have multiple dustbins but only 13 use them for segregation.

- Women responsible or segregation of waste

- 70% people sell some waste to scrap, but only 20% regularly sell dry waste into recycling chain.

- 90% people have good knowledge level and awareness

Data processing

- Responses converted to 0-1 coding based on undesired-desired responses

- Opinion based and practise of segregation based questions divided into -1,0,1 scale

- 2 data points deleted.

- Data from both groups used to create composite scoring

- Composite scoring done to avoid binomial/multinomial probit regressions

Model

- Composite scores constructed
    - *Level of Knowledge (average of responses to wet-dry questions, 0,1)*
    - *Level of Awareness (average of responses, -1,1)*
    - *Response to Institutional enforcement (-1,1)*
    - *Willingness to segregate (-1,1)*
    - *Current level of Segregation (0,1)*

Descriptive statistics of constructs

Statistics	*Willingness to Segregate*	*Current level of segregation*	*Level of Knowledge*	*Level of Awareness*	*Response to institutional enforcement*
Mean	0.633	0.179	0.888	0.383	0.556
Std Error	0.062	0.053	0.021	0.069	0.070
Median	0.667	0.167	0.900	0.333	0.625
Mode	1.000	0.167	0.900	0.333	1.000
Std Deviation	0.391	0.334	0.130	0.437	0.440
Variance	0.153	0.112	0.017	0.191	0.194
Range	1.667	1.333	0.700	1.333	1.500
Minimum	-0.667	-0.333	0.300	-0.333	-0.500
Maximum	1.000	1.000	1.000	1.000	1.000

Estimation

- Current level of segregation against knowledge, awareness, and response to institutional enforcement

- Willingness to segregate against knowledge, awareness, and response to institutional enforcement

- Using MS excel data analysis plugin

- Linear regression

Level of segregation

SUMMARY OUTPUT

	Regression Statistics
Multiple R	0.391
R Square	0.153
Adjusted R Square	0.082
Standard Error	0.320
Observations	40

ANOVA

	df	SS	MS	F	Significance F
Regression	3	0.665	0.222	2.162	0.110
Residual	36	3.690	0.103		
Total	39	4.355			

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.141	0.357	-0.395	0.695	-0.866	0.584
level of knowledge	0.162	0.405	0.400	0.692	-0.660	0.984
level of awareness	0.129	0.120	1.072	0.291	-0.115	0.372
institutional enforcement	0.229	0.123	1.862	0.071	-0.020	0.477

Willingness to Segregate

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.524
R Square	0.275
Adjusted R Square	0.214
Standard Error	0.346
Observations	40

ANOVA

	df	SS	MS	F	Significance F
Regression	3	1.636	0.545	4.544	0.008
Residual	36	4.320	0.120		
Total	39	5.956			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.238	0.387	-0.616	0.542	-1.023	0.546
Level of Knowledge	0.792	0.439	1.805	0.079	-0.098	1.681
Level of Awareness	-0.076	0.130	-0.583	0.564	-0.339	0.188
Institutional enforcement	0.356	0.133	2.680	0.011	0.087	0.625

- Only significant variable is response to institutional enforcement with a high value of 0.229 and 0.356 respectively.

- Willingness to segregate is also correlated to Knowledge at 10% significance, with a high value (0.792).

Conclusion

Discussion

- In Mumbai, where segregation is not institutionalised or enforced, institutional enforcement is crucial, compared to case studies where segregation was already enforced and thus knowledge mattered.

- 22% still practise individual/ society level wet waste management and send dry waste to recycling. Thus scope for individual led adoption, in tandem with institutional efforts.

- Working with women is important.

- Simplistic modelling, Multinomial Probit model, weighted average composite scoring, etc. should have been explored.

- Hypothesis failed, alternative hypothesis more likely

Learning

- Need to learn R statistical tool

- Establish better connection between aim, hypothesis and collected data to draw relevant conclusions

- Chose the right methods of data collection based on the nature of the study

- Better understanding of research flow

Thank You