The Economics Society

Project Jaankari

Solid Waste Management System in Delhi

Shri Ram College of Commerce

TESTIMONIALS

The project is truly a lot of Jaankari! It masterfully paints an image of what Delhi's residents perceive and observe the 'waste problem' and how to go about adapting and overcoming. The project goes beyond figures and into analysis, yet it remains lucid for the lay man. For those in the policy field, reading it is definitely not time 'wasted'.

Noel Jackson Therattil
Lawyer, LAMP fellow (2019-20)
and Current Schwarzman
Scholar

TESTIMONIALS

Facts. Figures. Solutions. A brilliant project that deserves a place on the shelves of policy makers. It is more than a list a problem and more than a set of statistics. It is finally refreshing to see a multi-dimensional analysis of the issue and a report that offers pragmatic solutions that authorities can actually implement.

Aswathy Gopinath
Assistant Editor, ORF
and Freelance Editor & Writer

TESTIMONIALS

I complement the Economics Society of Shri Ram College of Commerce, Delhi University for this innovative and adventurous project and their team work. I appreciate the concept, methodology, the analysis and the presentation that speak volumes about their sincerity and commitment. I think this report would be found useful even by senior policymakers and experts. This project by ES of SRCC testifies role of youth in Nation Building and engagement of youth for achieving the SDGs globally.

Sabyasachi Saha
Associate Professor at RIS for Developing Countries

TABLE OF CONTENTS

01
INTRODUCTION

ABOUT WASTE MANAGEMENT

Solid Waste Management is a problem seen by many developing and developed countries due to ongoing industrialisation and urbanisation. As waste generation has been picking pace, so have the problems related to waste disposal. With all the global attention focused on this topic, India has also been overburdened by this for decades.

The Government of India (GOI) enacts various SWM acts, rules, and regulations. The Ministry of Environment, Forest and Climate Change Government of India has notified The Solid Waste Management Rules 2016, in supersession to the Municipal Solid Waste (Management and Handling) Rules 2000. The new rules now apply beyond municipal areas and include urban agglomerations, census towns, notified industrial townships, areas under the control of Indian Railways, airports, special economic zones, places of pilgrimage, religious and historical importance, and state and central government organisations in their ambit. A new category of hazardous domestic waste was also brought

under the ambit of this legislation.

According to the 12th Schedule of the Constitution of India, urban local bodies (ULBs) are responsible for keeping cities and towns clean. However, most ULBs lack adequate infrastructure, financial incentives, regulatory oversight, political will, coordination between the Centre and states, and awareness among the masses. These problems cause hurdles to the sustainable SWM. The government is taking steps to overcome the problems through various policies, programs, and community participation.

ABOUT MUNICIPAL CORPORATION DELHI

The Municipal Corporation of Delhi (MCD) is responsible for municipal solid waste management in the national capital. The organisation is responsible for the collection, transportation, and disposal of solid waste in the city. The Municipal Solid Waste (MSW) operation under MCD is by far the biggest in the Union Territory, with more than 50,000 employees. The characterization of MSW has indicated that the waste consists of 30%–45% organic matter, 6%–10% recyclables, and the rest is inert matter.

The comprehensive operation of street cleaning; waste transportation, and waste disposal is done by MCD. The secondary collection and transportation of MSW from the receptacles (dalaos) are done through private concessionaires in six zones, and in four zones, the secondary collection and transportation of garbage are done by the corporation, involving a large number of staff; mobile equipment, and a plant.

The primary collection of garbage is done by the residents themselves. According to the MCD report for the years 2022-23, waste generation in Delhi is estimated to be around 11,144 metric tons per day. The heights of the three prominent landfills in Delhi, namely the Bhalswa landfill site, the Ghazipur landfill site, and the Okhla landfill site, are increasing dangerously.

This tremendous increase in the amount of municipal solid waste generated

is due to the changing lifestyles, food habits and living standards of the urban population.

MAJOR UNDERTAKINGS OF MCD

The major provision under the Solid Waste Management Rules 2016 is that they mandate the waste generator to segregate the waste into biodegradable and non-biodegradable waste before it is collected, thus shifting the onus of segregation onto the household. MCD has implemented the “Two-Bin System," where households are provided with two bins for segregating dry and wet waste.

The dry waste is further segregated into recyclable and non-recyclable waste. The recyclable waste is sent to recycling units, while the non-recyclable waste is sent to the landfill or waste processing facility.

MCD has been implementing various measures to improve waste management in the city, including setting up waste-to-energy plants, composting facilities, and recycling centres. The government has even launched several campaigns to promote waste segregation at the source, reduce single-use plastic, and promote the use of biodegradable products.

Despite these efforts, the load on landfill sites is increasing day by day, and the bearing capacity of these sites is decreasing with time, thus, we have to find a way forward. Technological development in handling municipal solid waste has been fairly modest, and no significant breakthrough has been achieved. Landfilling of waste, which has been the dominant waste disposal option for centuries, remains the dominant waste disposal method in Delhi.

MORE INFORMATION

There is an extensive network of informal and formal stakeholders in the process who collect wastes like paper/cardboard, plastic, metal, glass, rubber, leather, textiles, etc. Recyclables are collected by ragpickers and passed into the recycling stream. Households also sell recyclables to itinerant buyers.

There are 80,000 to 1,00,000 rag pickers, and assuming that a rag picker picks up 50 kg of waste daily, it reduces the load for treatment and disposal by 1200-1500 metric tons per day.

In Delhi, the recycling of MSW is currently carried out by an informal sector comprising recyclists at the lowest end and a succession of dealers. The process creates a market of recyclables, and value addition occurs for the various recyclables in the recycle stream. It is possible to formally organize the recyclable activity so that the recyclists lead a secure and better life. Though such attempts may be financially viable, they would not be bereft of the socio-economic impacts.

This research project involves an in-depth analysis of the waste disposal and collection system in Delhi with a special emphasis on:

- Analysing the state of the waste management system in Delhi.
- Judging the waste management steps- collection, storage, and dumping.
- The problems relating to the formalization of the rag-picking process.

02
POLICY REVIEW

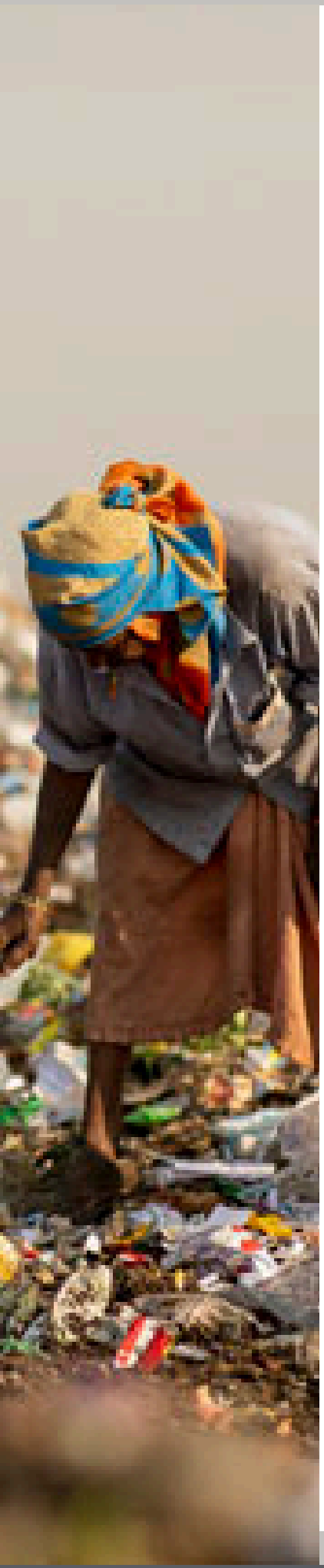
This section includes many policies and initiatives that have been undertaken by the Municipal Corporation Delhi.

1. Collection, Segregation & Transportation of Municipal Solid Waste:

- Five Local Bodies in Delhi are responsible for the implementation of the Solid Waste Management Rules, 2016. The majority of responsibility is on the MCD (Municipal Corporation of Delhi), apart from the New Delhi Municipal Council (NDMC) and the Delhi Cantonment Board (DCB).
- For proper treatment and disposal of municipal solid waste, waste segregation is a pre-requisite and the local bodies are implementing a detailed plan of waste segregation at source, door-to-door collection, intermediate storage, and transport facility with GPS for the segregated waste.

2. Municipal Solid Waste Processing and Disposal Facilities:

- There exists one Integrated Solid Waste Management Facility at Bawana for processing 2000 TPD (tons per day) of municipal solid waste. It consists of a Waste to Energy Plant, Compost Plant, and Engineered Sanitary Landfill.
- An Engineered Sanitary Landfill is proposed to be developed by the South Delhi Municipal Corporation (SDMC) at Tehkhand. There is a Centralised Compost Plant at Okhla as well with a 200 TPD capacity.



3. Waste to energy plants:

- Delhi has three Waste Energy Plants (WTE Plants) of capacity 5250 TPD at three different locations namely Okhla, Ghazipur, and Bawana.
- A New Waste to Energy Plant with a capacity of about 2000 TPD is proposed to be developed at Tehkhand and another in the Integrated Waste Complex at Ghonda Gujran.

Municipal Solid Wastes (Management and Handling) Rules, 2000 (MSW Rules)

Indicative action points for implementation of MSW Rule :

1. Receiving annual reports from ULBs in Form-II

SPCBs to ensure receipt of information before 30th June every year from ULBs. This could be done through the efforts of the Board or may engage an Agency to ensure the job.

2. Forwarding Annual report (consolidated) to CPCB before September 15th every year

SPCBs may ensure that the Annual report is sent to CPCB before 15th Sept. In addition to forwarding the report in Form-IV by SPCB, attempts may also be made to give details on other aspects like; no. of ULBs applied for authorizations, no. of authorizations granted, quantities of waste generation, composition, collection efficiency of ULB, transportation, etc.

3. Training and Awareness

SPCB on its own or through a State agency may conduct regular training programs for ULBs for various cadres of staff. At least two State-level meetings may be conducted to review progress on implementation of MSW rules. Each local body should have regular awareness programs for citizens to maintain cleanliness and undertake segregation of waste. Good publicity material may be prepared so that citizens are well informed about their responsibility.

4. Storage of waste

A good number of entrepreneurs/ manufacturers be identified at the State level/ National level for better-designed storage bins for their acceptability. As far as possible, old rudimentary methods which may be causing unhygienic conditions may be dispensed off.

5. Transportation of waste

At the national level reasonably good number of waste-transporting manufacturers may be motivated to fabricate appropriate cost-effective vehicles for the transportation of waste. Manufactured vehicles should meet stipulated norms as per MSW rules and should be able to serve all types of localities. Operation and maintenance of such vehicles should be cost-effective and at the affordable cost of ULBs.

6. Waste Processing

There is a need to prepare a list of entrepreneurs (consultants and manufacturers) who can participate in setting up WPPs for ULBs through a competitive bidding system. S.No Activities/ Actions Requirements Success stories particularly concerning the performance of each technology need to be documented for the benefit of ULBs. Indicative guidelines may be necessary on the requirement of land, cost, and applicability of a particular technology with respect to the quality and quantity of waste to be processed.

7. Waste Disposal

Companies/ Agencies who can assist local bodies in the operation of landfill sites may be identified. Deliberation will be required with indigenous firms for supplying tools/ machines, liners for construction, and operation of landfills

8. Formulation of DPRs

SPCBs and concerned local bodies should prepare DPR for cities and towns including financial requirements. Though the waste collection laws are not updated frequently, and a new law comes only after years, there are several policies launched by the Union Government applicable in Delhi as well. Such policies and initiatives, though do not occupy the central position in the waste segregation and collection mechanism, they have been crucial in the aspects of awareness and cleanliness.

SWATCH SAINIK INITIATVE

The Swatch Sainik initiative, introduced by the Indian government, is an impactful program aimed at promoting cleanliness and hygiene in the country. Since its launch in 2014 as part of the Swachh Bharat Abhiyan, the scheme has utilized the strength and discipline of the armed forces to raise awareness and drive action towards cleanliness.

The program involves trained armed forces personnel known as Swatch Sainiks, who actively participate in various cleanliness drives nationwide. Through their exemplary conduct, they serve as inspiring figures, encouraging citizens to maintain a clean and healthy environment.

The Swatch Sainik scheme has achieved remarkable progress since its inception. More than 10,000 Swatch Sainiks have received training and have been deployed across the country. They have successfully organized and participated in numerous cleanliness campaigns, including community clean-ups, waste management awareness programs, and school initiatives.

The impact of the initiative has been significant, with improvements in sanitation facilities, a reduction in open defecation practices, and increased awareness of waste segregation and recycling. The program has also fostered a sense of civic responsibility and environmental consciousness among the population.

Overall, the Swatch Sainik initiative exemplifies the power of collective efforts and collaborations in bringing about positive change in society. With continued implementation and support, India moves closer to its goal of a clean and healthy nation.

11,000 metric

TONS OF SOLID WASTE GENERATED EVERYDAY

Rs 250 crore

SPENT TO REMOVE TRASH HILLS

1,50,000

ESTIMATED NUMBER OF RAGPICKERS

3

ACTIVE LANDFILLS IN DELHI

122

COMPOST PITS IN VARIOUS LOCATIONS

03
METHODOLOGY

A primary survey was undertaken to collect data for this report. A detailed questionnaire involving both qualitative and quantitative questions was prepared. The sample space constituted the waste collectors and the waste generators. The waste pickers/ collectors include both the workers of the informal sector as well as the workers of the MCD. The waste generators include the Homeowners as well as the shopkeepers of the Local Areas. The questionnaire set was structured into two sections of the sample space - the Waste Collectors and the Waste Generators since the variables studied were different for both.

The questions asked to the waste collectors focused on their working conditions and how they work daily whereas the ones for the waste generators aimed at checking their awareness levels about waste disposal and understanding their satisfaction, experience, and grievances with the current model of the MCD. The table on the next page highlights the broad categories of questions asked by each of the parties. Further segregation was done for the supply and demand sides respectively.

A team of 3-5 students was sent to each ration shop to conduct interviews with the respondents. A free-flow conversational approach was utilized to obtain accurate and honest responses.

WASTE-GENERATORS

BASIC DETAILS

- Number and Types of Dustbins
- Frequency of Waste Disposal
- Channel for waste Disposal
- Amount spent for waste disposal

AWARENESS

- Number and Types of Dustbins
- Frequency of Waste Disposal
- Channel for waste Disposal
- Amount spent for waste disposal

SUPPLY SIDE

- Regularity in waste collection
- Grievance Mechanism
- Satisfaction
  i) Hygiene and Waste disposal
  ii) Infrastructure for waste disposal

WASTE-COLLECTORS

BASIC DETAILS

- Age
- Literacy Level
- Number of working hours
- Safety/pieces of equipment- Any classes/ training

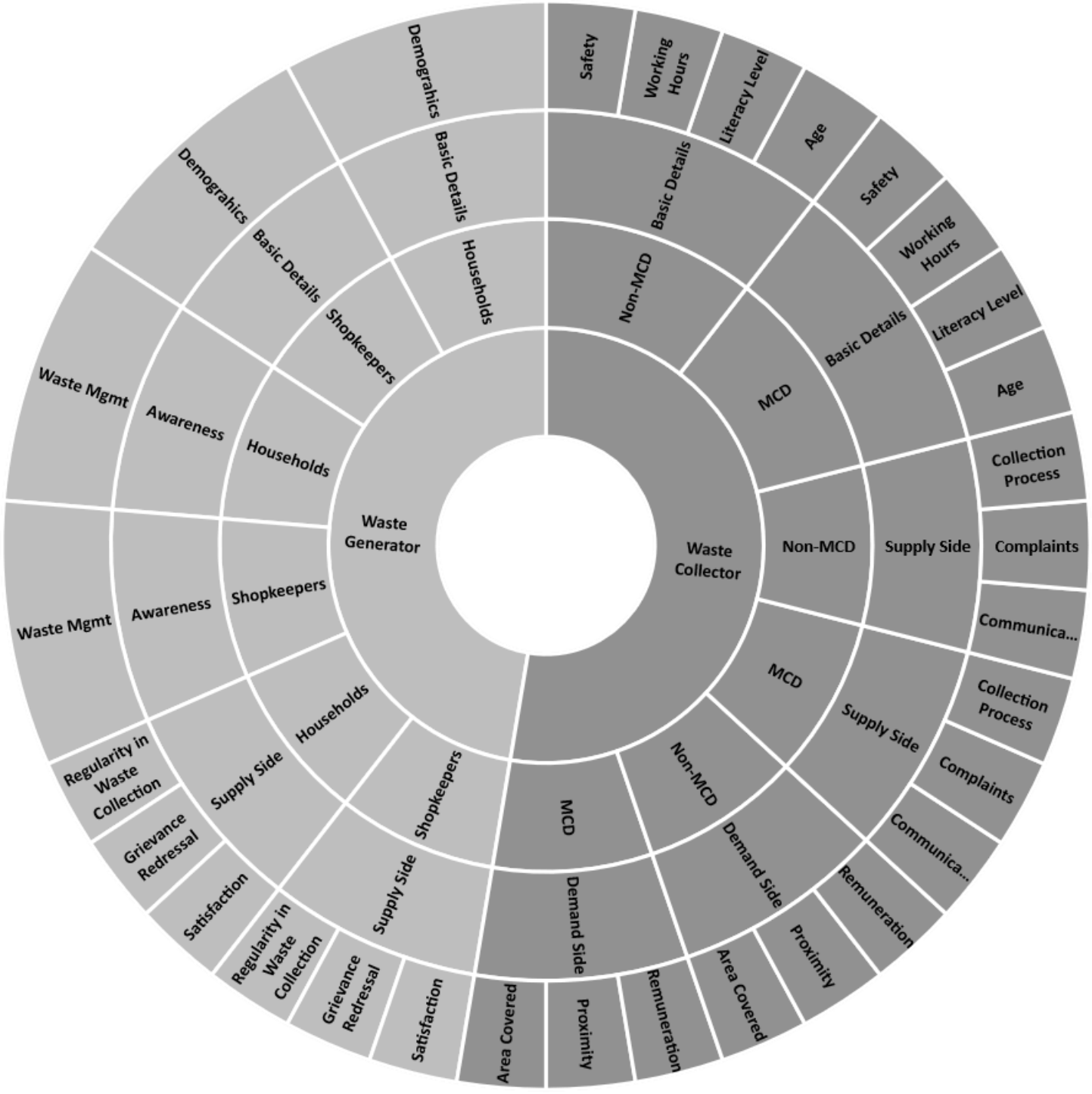
DEMAND SIDE

- Area covered
- Distance Travelled to dispose of waste
- Remuneration (irregularity of work)
  i) Contractual
  ii) Daily Wages
  iii) Part-time jobs

SUPPLY SIDE

- Communication with authorities
- Filing complaints
- Process of Collection
- Dustbins or bags
- Process After collection of waste

The following sun-burst diagram helps represent the broad categories of interviewees and the variables studied under these categories through the questionnaire:



A total of 1072 responses were garnered from 9 zones of Delhi. This included 61 waste collectors and 1011 waste generators. Interviewees' consent was taken for using their answers and pictures in this report.

To better understand the responses of various stakeholders, we proposed a structure to be divided into 4 sub-domains, i.e. Single Variable Analysis, Multivariate Analysis, Zonal Analysis, and Econometric Analysis. All the variables were put under various data analysis techniques to draw out different inferences and conclusions. Additionally, under Zonal Analysis, each zone was given scores and ranked based on their performance in the surveys collected.

Single- Variable Analysis

First, we interpreted individual questions asked to both, waste-generators and waste collectors to get a better understanding of the demographic of the respondents and their views. Under this, we covered questions about the basic details including demography, availability, literacy, age, and remuneration for workers.

Multivariate Analysis

In this segment, we tried to study two or more variables to establish a relationship among them and understand the correlation between them. For example, when we asked about the waste being openly dumped and the availability of dustbins, we found that waste was being openly dumped majorly in areas that had no dustbins.

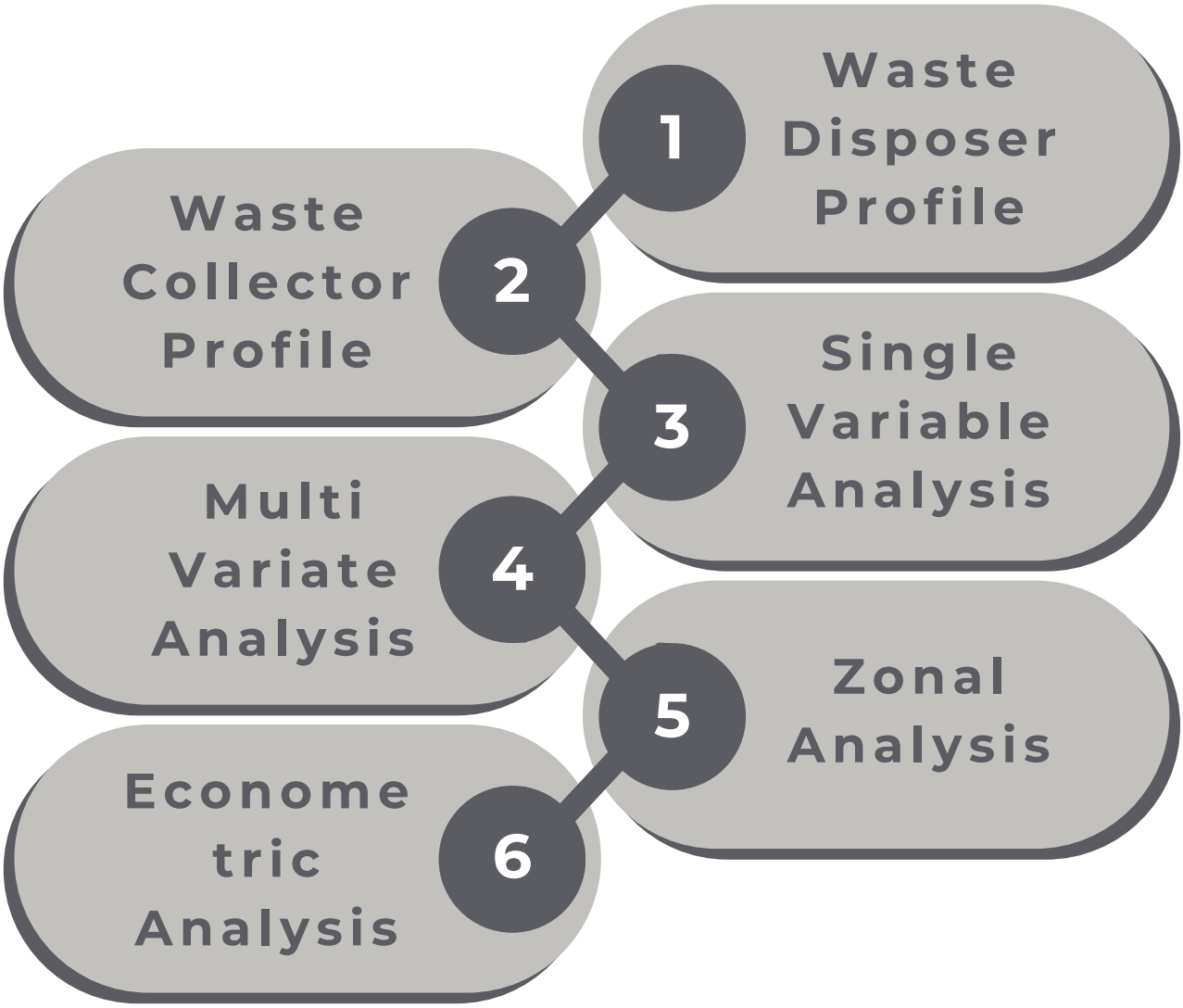
Zonal Analysis

Under Zonal Analysis, we identified nine zones of Delhi, from where the data was collected, and studied how these zones performed based on three broad indicators- awareness & and practice, accessibility, and cleanliness. These zones were given scores and final ranks were calculated using a weighted average.

Econometric Analysis

Under econometric analysis, we used a regression tool (ordinary least squares) to better understand the satisfaction scores received by MCD and the overall satisfaction scores. We used to concept of null hypothesis for the model. We also undertook the help of graphs in order to better understand the variability of data.

04 ANALYSIS AND INTERPRETATION



WASTE DISPOSER PROFILE

76.16% of households dispose waste daily

44.51% of households have family members between 3-4

48.66% pay almost null/ negligible charges for waste disposal

81.3% of households knew what waste segregation is.

83.8% have not been charged by waste collectors's extra amount for collecting waste

49.06% of households practice waste segregation

62.61 % of households are aware of the Solid Waste Management (Rules), 2016

62.41% have witnessed some kind of open dumping

WASTE COLLECTOR PROFILE

81.96% workers involved in waste collection are male

56.7% workers are sole breadwinners of their family

83.6% workers work more than 5 days a week

Only **20%** of the workers have achieved matriculation

89.1% of the workers do not receive any commission for segregating waste

52.5% of the workers have atleast 1 family member engaged in waste collection

49.2% of the workers feel they are overworked/ overburdened

65% of workers do not get paid as per the minimum wages specified in the law

SINGLE VARIABLE ANALYSIS

Out of the surveyed population, 4 out of every 5 respondents are aware of waste segregation

Only 3% of respondents have reported being penalized for improper waste disposal

On average, respondents dispose of 0.96 buckets of waste per day, with 0.96 being the average quantity mentioned in terms of the 20L full-size bucket

The majority of respondents (76.16%) dispose of waste 7 times a week, i.e. Daily

On a scale of 1-5, the average satisfaction level with waste collector's services is 3.73

Only 1 out of 5 waste collectors reported receiving training or classes related to waste collection

The average job satisfaction level, measured on a scale of 1-5, is 2.16

MULTI VARIATE ANALYSIS

The adjacent figure illustrates the relationship between open dumping and availability of different coloured dustbins.

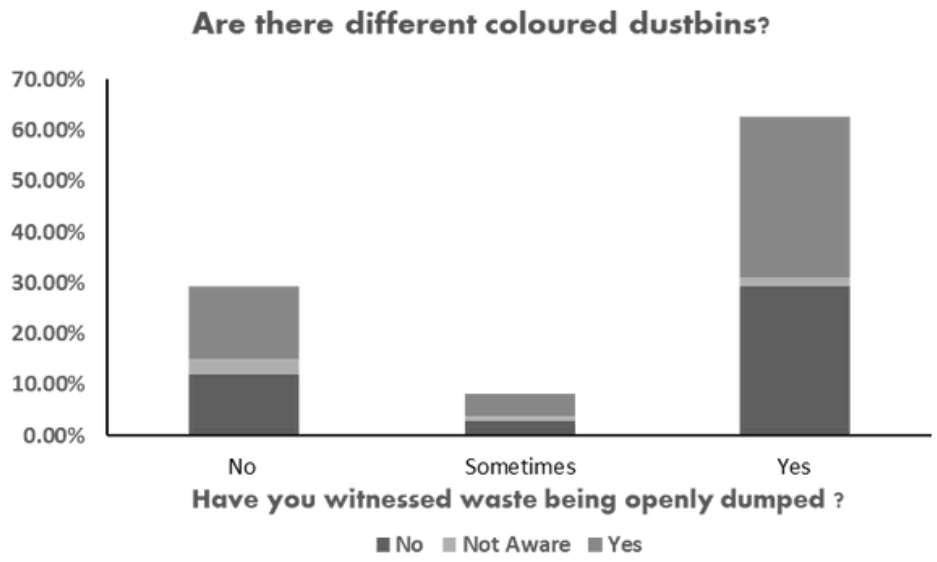
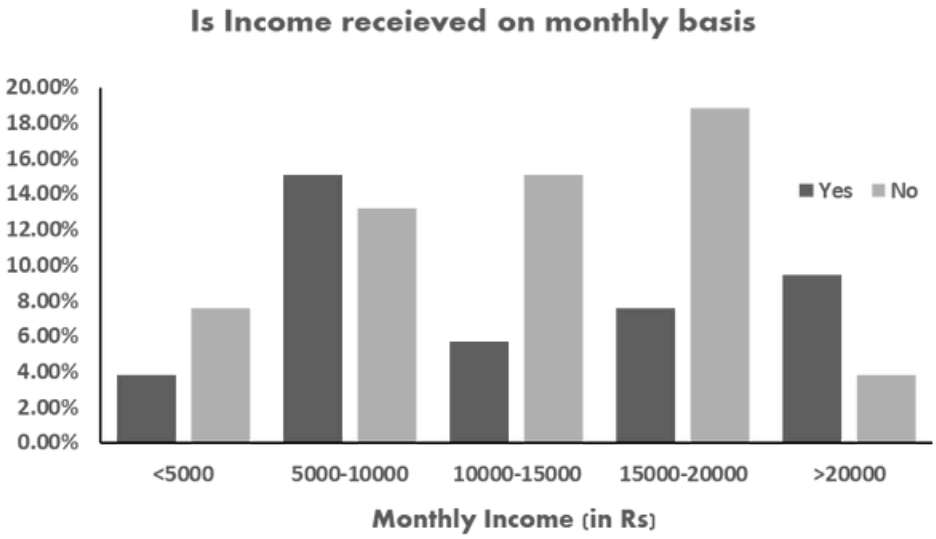


Figure 1 : Dustbins and dumping



The adjacent figure illustrates the relationship between frequency of income along with income level

Figure 2 : Frequency and level of income

The adjacent figure illustrates the relationship between open dumping of waste against % times the incident occur

Figure 3 : Dumping of SWM

The adjacent figure highlights income distribution from waste distribution against family structure

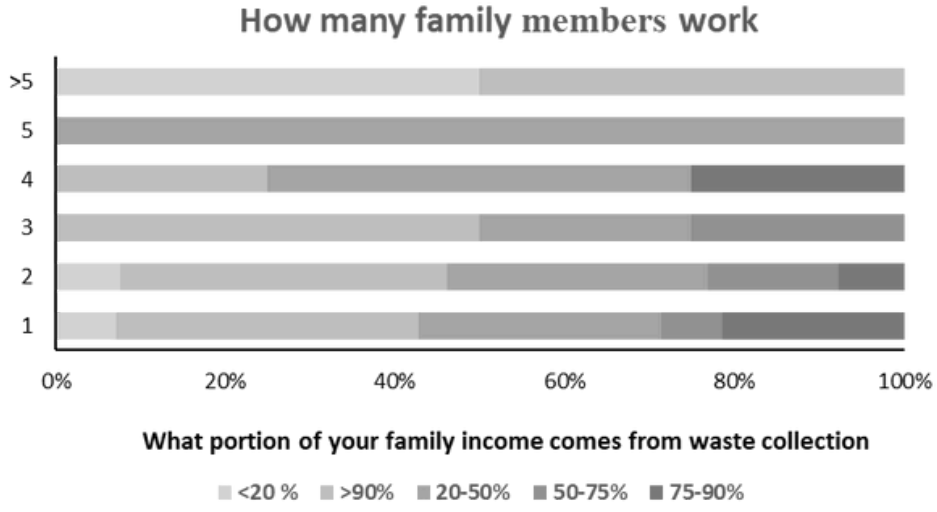
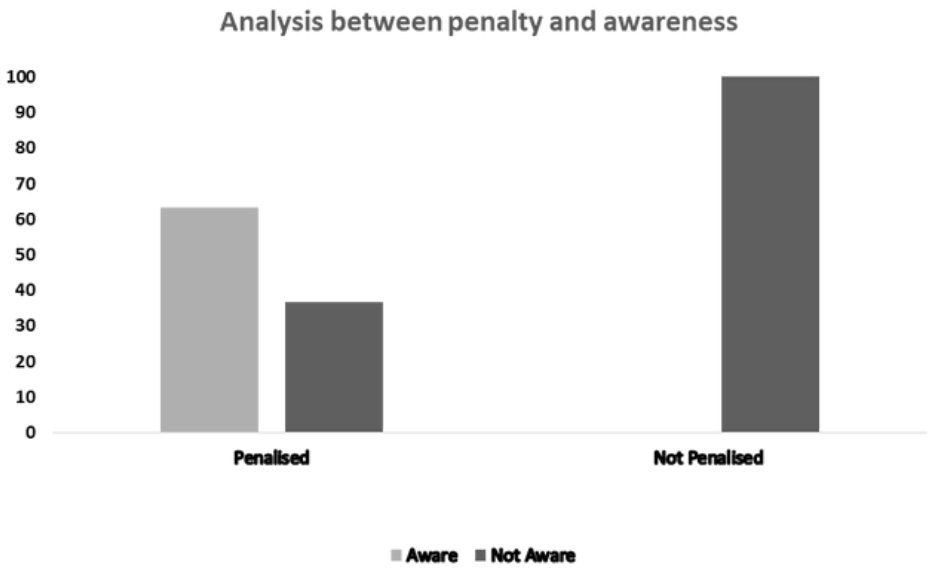


Figure 4 : Income and family structure



The adjacent figure illustrates the relationship b/w awareness of SWM and penalties

Figure 5 : Awareness and Penalties

The adjacent figure highlights awareness of MCD 2016 SWM (rules) and penalties

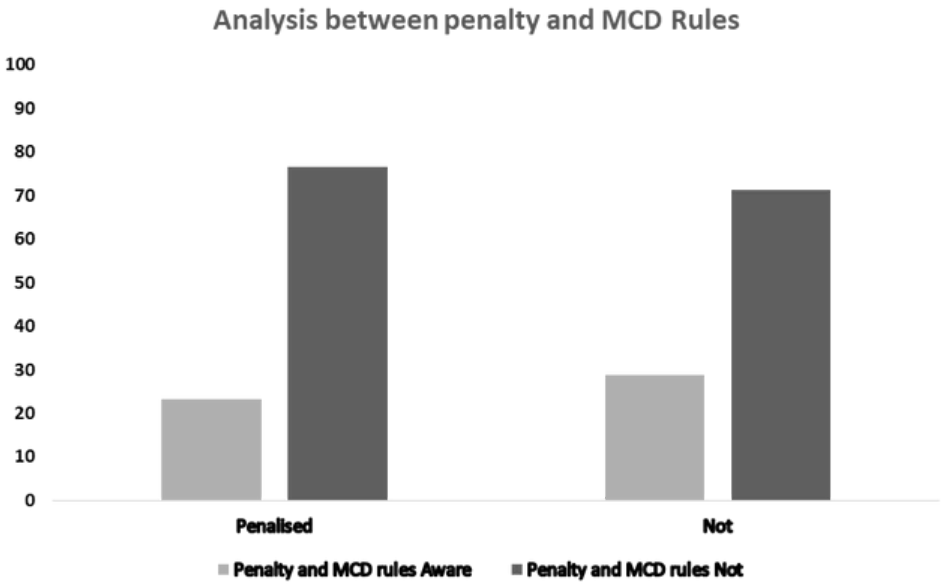


Figure 6 :MCD rules and penalties

ZONAL ANALYSIS

1. AWARENESS AND PRACTICE

Awareness and Practice	North	Centre	East	South	West	North-West	North-East	South-East	South-West	Weights
What Waste Segregation is	2	8	6	5	1	7	3	9	4	0.3
Do you practice waste segregation	1	6	5	9	3	8	2	4	7	0.5
Waste Disposal Systems of MCD	3	9	8	6	1	2	4	5	7	0.1
Knowledge about the Solid Waste Management Act	8	7	5	6	1	3	4	9	2	0.1

The first basis of comparison for the eight zones is Awareness and Practice. The same was judged through four parameters: people's knowledge about waste segregation, whether they practice waste segregation, knowledge about waste disposal systems of MCD and the Waste Management Act, 2016. These were derived from a series of questions centred around the personal experiences of the households concerning their awareness of waste segregation, the magnitude of practice, and other similar factors while disposing of the waste. The said measures were given their respective weights and the zones were accordingly ranked thereafter. Post survey and analysis, it was inferred that while some zones performed exceptionally well in some areas, some were not able to meet the mediocre performance mark. There was mostly a balanced performance by all zones, with the West leading overall and the South Delhi being the last one in the ranking. The overall rankings are indicative of the performance of each zone based on the four indicators and their respective weights.

RANKINGS ON THE BASIS OF AWARENESS AND PRACTICE

West	North	North-East	East	South-West	South-East	North-West	Central	South

2. ACCESSIBILITY

Accessibility	North	Centre	East	South	West	North-West	North-East	South-East	South-West	Weights
Different Dustbins	2	6	7	5	9	8	4	1	3	0.3
Waste Collector's Availibility	4	6	3	8	7	5	2	9	1	0.4
Satsifaction Scores	8	7	5	2	3	9	4	1	6	0.3

The second basis of comparison for the nine zones is accessibility as available to the households. This was judged in three regards: Availability of dustbins, Waste Collector's Availability and Satisfaction scores given by the households to the current system. This measure takes into account variables that impact a lot on the accessibility to practice waste segregation on an individual level. A weighted average of the said measures was calculated and the zones were accordingly ranked thereafter. The supporting table, rankings and insights from the surveys gathered bring a lot of light to the current accessibility structure. The South-West Zone was the forerunner here with the West Zone ranking ninth. The rankings below are indicative of the performance of each zone based on the three indicators and their respective weights.

RANKINGS ON THE BASIS OF ACCESSIBILITY

South-West	North	North-East	East	South-East	Central	North-West	South	West

3. CLEANLINESS

Cleanliness	North	Centre	East	South	West	North-West	North-East	South-East	South-West	Weights
Witnessing Dump in Open	3	8	2	1	6	9	4	7	5	0.5
Health Consequences	8	3	9	7	5	1	4	2	6	0.5

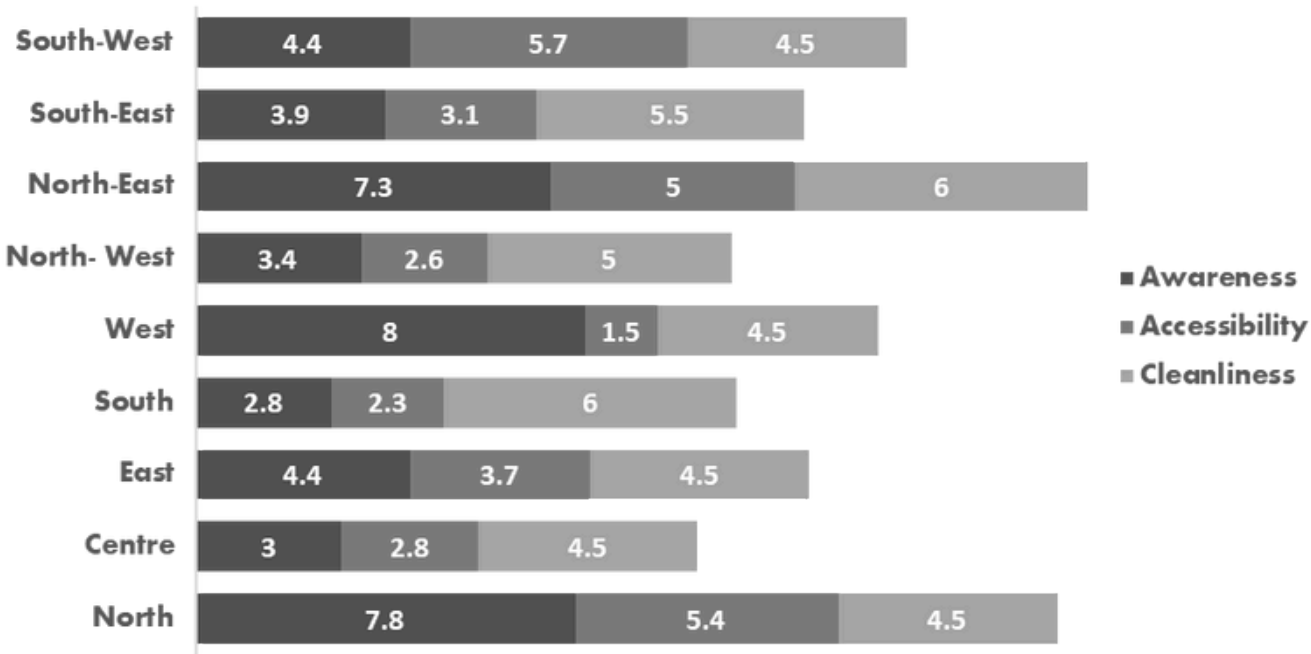
The third basis of inter-zonal comparison is the Cleanliness maintained in and around the waste disposal system. This was judged in two regards, namely witnessing dumping in the open and hygiene as perceived by the commuters. The measure is to account for the hygiene around waste disposal systems and to check on the cleanliness maintained in the surroundings. The measures

were given their respective weights, and a weighted arithmetic mean was calculated thereafter. It was inferred that the cleanliness and hygiene maintained were not satisfactory and that there was a need for tangible changes to be brought in this regard. The South leads here with the West Zone ranking last. The rankings below are indicative of the performance of each zone based on the two indicators and their respective weights.

RANKINGS ON THE BASIS OF CLEANLINESS

South	North-East	South-East	North-West	North	Central	East	South-West	West

OVERALL RANKING



North-East	North	South-West	West	East	South-East	South	North-West	Central

ECONOMETRIC ANALYSIS

To further study the relation between the satisfaction scores of the MCD grievance redressal system and the overall satisfaction scores, we chose to build a model with the help of a regression tool. This led to the building of a linear regression model which has been developed using the ordinary least square method. In the model, we took overall satisfaction scores as the dependent variable while MCD grievance redressal scores as the independent variable.

$$O = \beta_1 + \beta_2 X_2 + \mu \text{ where,}$$

- O: Overall Satisfaction scores *(on a scale of 1 to 5)*
- B_1: Intercept
- X_2: Scores given to MCD Grievance Redressal cell *(on a scale of 1 to 5)*
- B_2: Coefficient of X_2

OLS Regression Results

Dep. Variable:	Overall	R-squared:	0.478
Model:	OLS	Adj. R-squared:	0.473
Method:	Least Squares	F-statistic:	98.74
Date:	Wed, 17 Jan 2024	Prob (F-statistic):	6.50e-17
Time:	11:38:55	Log-Likelihood:	-133.58
No. Observations:	110	AIC:	271.2
Df Residuals:	108	BIC:	276.6
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	1.4897	0.200	7.447	0.000	1.093	1.886
MCD	0.5813	0.059	9.937	0.000	0.465	0.697

Omnibus:	0.073	Durbin-Watson:	1.357
Prob(Omnibus):	0.964	Jarque-Bera (JB):	0.055
Skew:	0.046	Prob(JB):	0.973
Kurtosis:	2.941	Cond. No.	9.36

Figure 1: *Regression Results summary table*

On running the regression, we observe that the adjusted R square is 0.473 which is moderately significant. This implies that the satisfaction scores given to the MCD portal explain about 47% of overall satisfaction scores. This means for an average user, the kind and quality of service of MCD received by citizens plays a great role in the overall satisfaction of the entire waste disposal infrastructure. Upon running regression, we can see that the estimated B coefficient is 0.5813 which is greater than 0 signifying there's a positive relation between both the variables. Moreover, the corresponding P-value associated with X is limiting to 0, rejecting the null hypothesis that, there's no relation between both the variables.

Upon qualitatively analysing data, it also makes sense for MCD's grievance score to contribute a lot to the overall satisfaction scores since most of the people in Delhi hold MCD responsible for administrating the entire waste disposal infrastructure. Therefore, a positive and quick response from MCD helps to create a better image of Delhi's waste management infrastructure. Hence, the concerned stakeholders should try to increase the transparency of these processes and response time among the citizens. Moreover upon further analysing the data we saw that the averages of both scores were more or less equal, however, there was a lot of variation present in the MCD grievance redressal satisfaction scores rather than the overall satisfaction scores. From Fig 2, we can see that the mean of both the variables are very close but the Variance of MCD scores is 1.81 while it is just 1.28 for the overall scores. Hence, we can conclude that the scores received in the overall section are more uniform than the scores given to the MCD portal.

Parameter	*MCD*	*Overall*
Mean	3.145454545	3.318181818
Variance	1.813511259	1.283152627
Observations	110	110
df	109	109
F	1.413324667	
P(F<=f) one-tail	0.036144322	
F Critical one-tail	1.372282589	

Figure 2: *F-Test summary table*

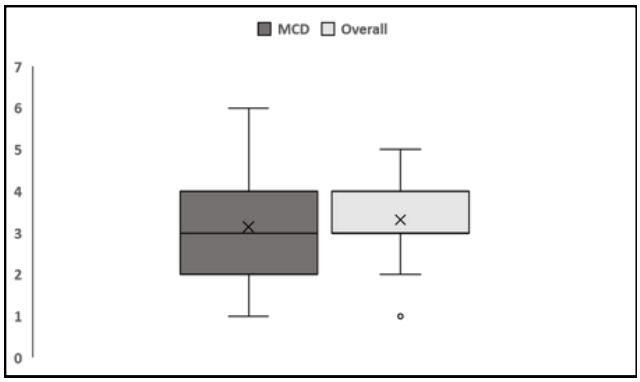


Figure 3: *Box-plot charts*

05 RECOMMENDATIONS

01. Promoting Behavioural Change

02. Littering in Public Spaces

03. Increasing Efficiency of the System

04. Exploitation of Workers

05. Compliance of SWM Rules

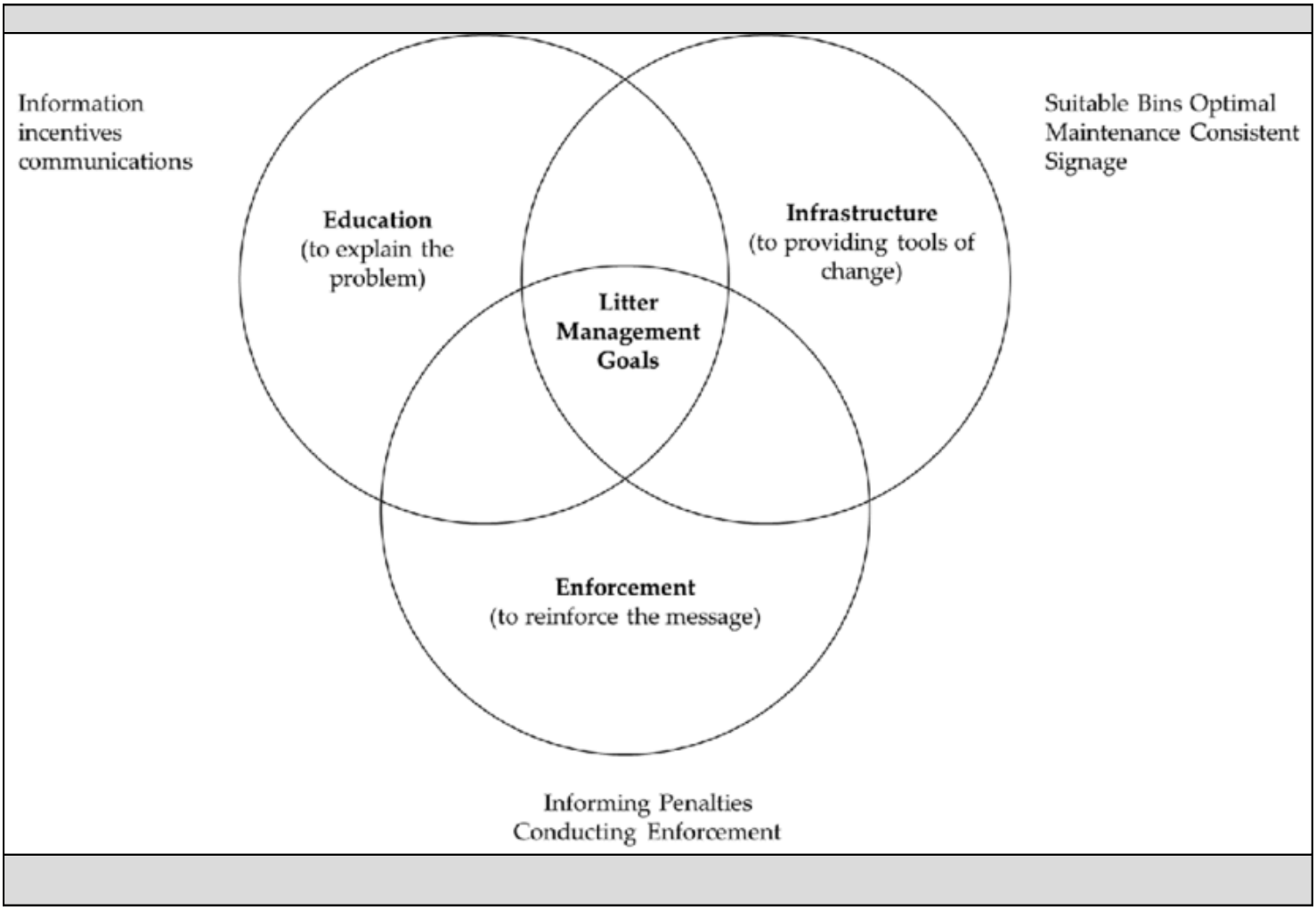
06. Waste Management Model

PROBLEM

Delhi is one of the fastest-growing cities in the world, and with its rapid urbanisation, comes a significant problem of waste management. The waste management system in Delhi has been struggling for years with inefficient waste collection, improper segregation, and waste disposal. Due to a lack of proper infrastructure, awareness, and inadequate education, people often dispose of waste in an unorganised and haphazard manner, which leads to increased pollution and a negative impact on the overall environment. Therefore, there is a dire need to promote behavioural change to strengthen waste segregation at the source in Delhi. One of the prevailing issues in waste segregation in Delhi is the lack of awareness and education about proper waste management practices. About 40% of the people in Delhi are unaware of the MCD Laws. The need of the hour is to spread the knowledge about these laws among the people, especially the poor people.

Approximately, 50% of the population in Delhi generally does not practice proper segregation techniques, resulting in a considerable amount of mixed waste being generated. Despite the municipality's effort to promote segregated waste collection through a door-to-door collection system, people tend to dispose of all waste in one bin, making segregation very difficult.

Even 49% of the people in Delhi do not have separate green and blue dustbins in their area to segregate waste. This is a serious issue as all the waste then compiles and it becomes really difficult for the workers to segregate these wastes. Additionally, waste dumps also serve as breeding grounds for insects and rodents, increasing the risk of diseases like dengue, malaria, and other vector-borne diseases.



Source - *Research Gate (Factors influencing waste disposal behaviour)*

SOLUTION

Improper disposal of waste also poses a significant threat to public health and the environment. Due to the uncontrolled disposal of waste, significant amounts of toxic and hazardous substances get released into the air, water, and soil, causing severe health hazards to the surrounding communities.

- The scheme promoting behavioural change to strengthen waste segregation at source could be used to address these problems. The scheme's primary objective is to promote awareness and education about proper waste management practices and encourage people to segregate waste at the source. By creating awareness and educating the public about the significance of proper waste segregation, it will become easier to change the behaviour.

- The scheme can be implemented in several ways, such as conducting seminars and workshops, distributing informative pamphlets and brochures, and disseminating information through social and print media. The municipality could also introduce an incentive program to encourage people to segregate their waste properly. For example, households can be monitored for proper waste segregation, and those who comply can be awarded reduced waste collection charges, while those who do not comply can be penalised.

- Furthermore, community engagement and participation are also critical to the success of the scheme. The municipality should involve the community in the planning, implementation, and monitoring process as this will encourage ownership and ensure sustainability. By engaging the community, people can explore different waste management solutions and they can collaborate on implementing measures that aim to address their specific waste management concerns.

FEASIBILITY

The scheme promoting behavioural change to strengthen waste segregation at source holds promising potential for reducing the volume of waste being generated and effectively managing solid waste. The feasibility of the scheme is primarily dependent on its effectiveness in driving behaviour change among the targeted communities.

Another critical factor that may influence the feasibility of the scheme is the level of awareness and education among the targeted communities. Waste segregation at source requires a high level of knowledge and understanding about the benefits of proper waste management and the appropriate methods for segregating waste.

One of the key factors that need to be considered is the availability of the necessary infrastructure, such as waste collection systems, community bins, and recycling facilities. Without these essential components, the scheme may not be effective in encouraging waste segregation at the source. It is, therefore, crucial to ensure that the necessary infrastructure is in place before implementing the scheme.

Without adequate awareness and education, communities may not buy into the scheme, and it may fail to achieve its desired objectives.

In addition, incentives and disincentives can be used to encourage the participation of communities. For instance, communities may be offered incentives such as reduced waste disposal fees or access to recycling facilities. Disincentives can be put in place for non-compliance, such as imposing fines

Finally, the feasibility of the scheme is dependent on the availability of funding and resources. The implementation of the scheme requires significant resources to develop and enforce the necessary infrastructure, education and communication strategies, and incentives and disincentives.

In conclusion, the scheme promoting behavioural change to strengthen waste segregation at source is feasible if implemented effectively. It requires the availability of the necessary infrastructure, education, and awareness, effective communication strategies, incentives and disincentives, community engagement, and sufficient funding and resources. By implementing the scheme, communities can reduce the volume of waste generated, minimise the impact on the environment, and promote sustainable waste management practices.

LITTERING IN PUBLIC SPACES

PROBLEM

Landfill sites in Delhi had exceeded their capacity way back in 2008 and most of these sites have contaminated groundwater in and around their neighbourhood. This has led to unattended garbage piling up in many localities of Delhi Littering is a major problem here. Despite numerous efforts to tackle the issue, the city's streets, parks, and other public spaces are often littered with trash, including plastic bags, food wrappers, and cigarette butts.

Littering makes the city look filthy and polluted and poses serious health and environmental hazards as understood from the survey.
Almost 70% of the people surveyed have witnessed waste being dumped in open public spots. On the contrary, only a mere fraction of 3% of the surveyed population have been fined for littering (taking into mind the fact that it is one of the most populated cities in the world).

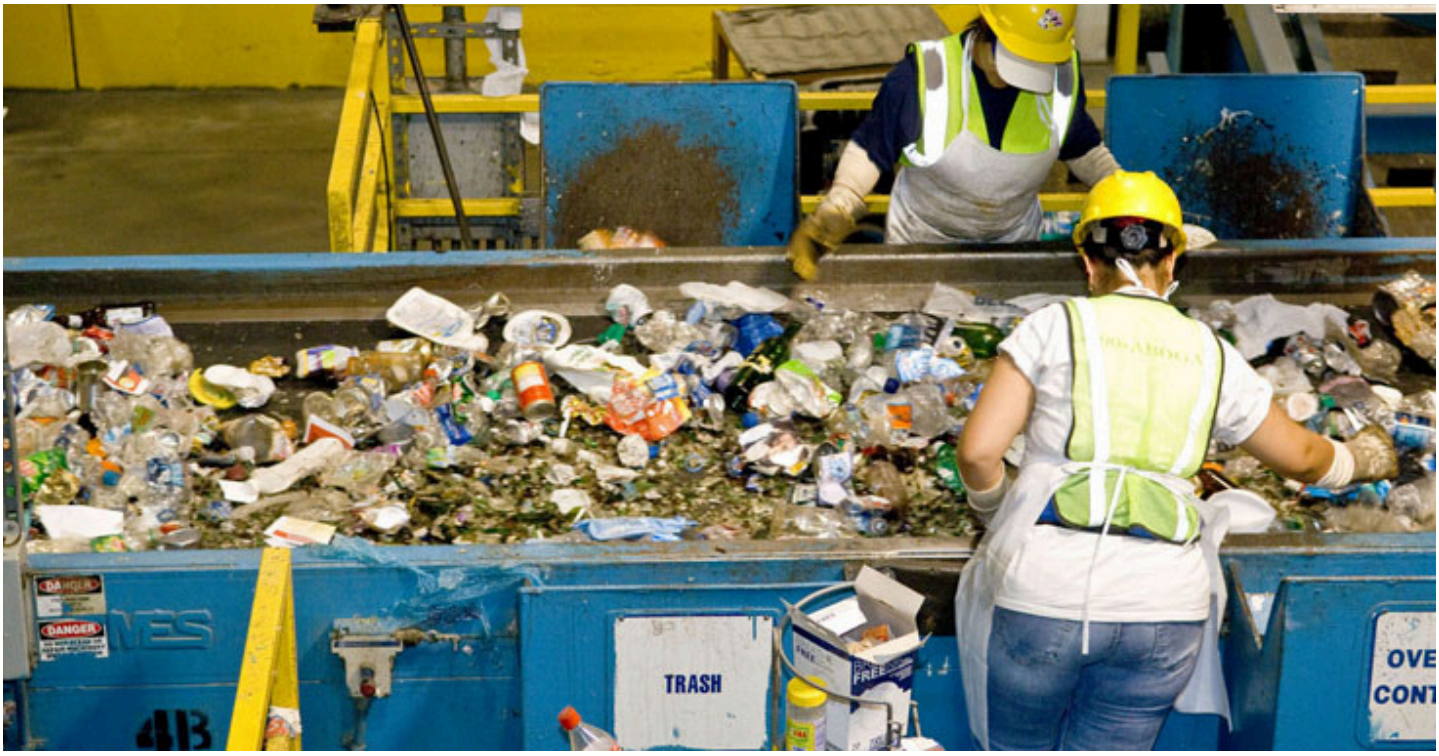
SOLUTION

The threat and enforcement of penalties, which make individuals comply with personal responsibility for their garbage, might discourage littering. In Singapore (known for having among the world's most spotless public spaces) litterers face fines starting at S$300, accompanied by punishments such as community cleaning. Under the new Solid Waste Management Laws passed by the Delhi Government, any person found littering will attract a fine of Rs. 500. But as the survey indicated this penalty is lacking proper implementation. Revamping these laws by enforcing a strict surveillance system can be a step in the direction of enforcing the penalty and discouraging littering.

Another scheme that could be implemented might be to provide an incentive to people who are willing to collect and deposit waste in the primary garbage receptacle points (Delhi has over 1209 such points spread over North, South, and East Municipal Corporations). This can take the form of helping people from lower-class communities when they are willing to take waste to the centres and receive tokens which can then be exchanged for public transport or food (PDS). From the survey, it was clear of the irregularity in the arrival of MCD vans and that two-thirds of waste collection in most localities is already undertaken either by private contractors or self-employed waste collectors. This scheme is practised in Brazil for recycling purposes and could have an impact on Delhi as well.

Deposit Refund This scheme is already in practice in several North American states, south Australia, and 10 European countries. It is mainly focused on recycling bottles but can be extended to other single-use plastics and packaging. When purchasing certain bottles, consumers pay a nominal deposit, which is reimbursed once the empty bottle is returned to a retail outlet (here a primary garbage receptacle point).

Plastic items will carry a higher deposit amount compared to reusable glass or cardboard articles. A non-profit group called CITAG (Citizen Involved & Technology Assisted Governance) is taking form in Bengaluru which is a community-driven effort that uses an app to regulate waste management. People may file complaints on the app when waste collection is inefficient, for instance when rubbish is never picked up or when "black spots" (public areas where trash accumulates) form. Any officer who removes the black spot, will take a picture and timestamp and then upload it on the app. Such an initiative could also be undertaken by the Delhi government to prevent unattended garbage from piling up in public spots.



FEASIBILITY

Strict imposition of penalties can be enforced with the help of proper and efficient surveillance. This can be achieved with the help of either local police surveillance or by deploying patrolling plain-clothes officers in and around hot spots where garbage is usually dumped in the open.

Surveillance technology like CCTV cameras can also be installed to identify defaulters. It can also be employed to prevent urination/spitting in public places. The deposit fee in the Deposit Refund Scheme is added to the purchase price at the point of sale. Consumers can then return the used articles to the designated collection points (for example, any packaging used by Amazon could be returned to the nearest Amazon facility).

A similar technology used by CITAG could be implemented in Delhi with minimal effort. Or maybe, after taking into consideration the situation in Delhi, a new app could be developed exclusively for Delhi (app development can be outsourced). Officials from MCD can then periodically check the app for updates on specific black spots and take necessary action whenever required.

PROBLEM

Non-compliance with Waste Segregation Practices:

Despite the existence of a segregated waste disposal system, it has been observed that a significant percentage of the population disregards the segregation guidelines. Approximately 82% of respondents are aware of the segregation policy; however, only 48% actively practice it. This inconsistent behaviour hampers the proper disposal and management of biodegradable and non-biodegradable waste.

Municipal Corporation of Delhi (MCD) workers responsible for waste collection often fail to enforce the segregation policy due to ignorance or negligence. Consequently, people dispose of their waste in any section without regard for segregation. This results in mixed waste, making it challenging to process and recycle efficiently.

Open Dumping and Irregular Waste Disposal:

A concerning 62.41% of respondents have reported witnessing instances of open dumping in their localities. This practice not only degrades the environment but also poses health hazards. Furthermore, the irregularity in waste disposal, including delayed pickups and inconsistent collection schedules, exacerbates the problem, leading to unhygienic conditions.

Underutilized Back-End Tracking System:

Although a vehicle tracking system exists for consumers to monitor MCD vans' movement, its potential remains largely untapped in the back-end administration. The current tracking system fails to streamline the waste collection process effectively, from households to landfills. By integrating this tracking system into the administrative backend, the overall efficiency of waste collection and disposal can be significantly improved.

SOLUTION

Stricter Implementation of Waste Segregation Policies:
Enforce stricter penalties for non-compliance with waste segregation practices to discourage mixed waste disposal and promote proper waste sorting at the source.

Enhanced Training and Accountability for MCD Workers:
a) Provide comprehensive training programs to waste collection workers to ensure they understand the importance of waste segregation and are equipped with the necessary knowledge and skills.

b) Implement a monitoring and evaluation system to assess the performance of MCD workers in enforcing waste segregation policies, with appropriate incentives and consequences for adherence or non-compliance.

Preventing Open Dumping and Irregular Waste Disposal:
a) Increase the frequency of waste collection to minimize the accumulation of waste, reducing the likelihood of open dumping.

b) Improve coordination between waste collection teams and ensure consistent and reliable collection schedules to avoid irregular waste disposal practices.

Optimization of Back-End Tracking System:
a) Upgrade the existing vehicle tracking system to enable real-time monitoring of waste collection vehicles, ensuring efficient route planning, and optimizing collection operations.

b) Integrate the tracking system with the administrative backend to streamline the entire waste collection process, from households to landfills, improving coordination and reducing delays.

c) Implement fixed timings for the arrival of MCD vans in localities to collect waste from households. This will ensure regularity and enable residents to prepare and segregate their waste accordingly.

d) Establish fixed timings for MCD trucks to transport the collected waste from local waste collection centres to designated landfills. This will streamline the waste disposal process and minimize delays.

e) Utilize data from the tracking system to generate reports and analytics that can identify areas of improvement by identifying inefficient areas, optimising routes, and allocating resources more effectively.

FEASIBILITY

1. Stricter Implementation of Waste Segregation Policies:
Enforcing stricter penalties for non-compliance with waste segregation practices requires implementing effective monitoring and reporting mechanisms. This can be achieved by leveraging existing waste management infrastructure and integrating it with digital tools such as mobile apps or online reporting systems.

2. Enhanced Training and Accountability for MCD Workers:
Adequate training programs can be developed and delivered to waste collection workers, leveraging existing training facilities or outsourcing to specialized training providers.

The feasibility of this solution depends on the availability of appropriate trainers and training materials and the willingness of MCD workers to participate in training programs. Training sessions can be scheduled during non-peak operational hours to minimize disruption.
Implementing a monitoring and evaluation system can be achieved by leveraging technology such as time-stamped reporting tools. This data can be analyzed periodically to assess worker performance, identify areas of improvement, and provide appropriate incentives or consequences. The feasibility of this solution depends on the level of technological adoption and data management capabilities in the waste management sector.

3. Preventing Open Dumping and Irregular Waste Disposal:

Increasing the frequency of waste collection requires careful planning and resource allocation. This can involve deploying additional waste collection vehicles or optimizing existing routes to ensure timely collection. The feasibility of this solution depends on the availability of resources for additional waste collection vehicles or route optimization. Improving coordination between waste collection teams can be achieved through effective communication channels, such as dedicated communication devices or centralized command centres. Clear guidelines and protocols can be established for consistent and reliable collection schedules, minimizing irregular waste disposal practices. The feasibility of this solution depends on the willingness of different stakeholders to cooperate and collaborate in implementing coordinated waste collection practices.

4. Optimization of Back-End Tracking System:

Upgrading the existing vehicle tracking system can involve leveraging advancements in GPS technology, vehicle telematics, and data analytics. This can enable real-time monitoring of waste collection vehicles, efficient route planning, and optimization of collection operations. The feasibility of this solution depends on the availability of appropriate technological infrastructure and data management capabilities.

Integrating the tracking system with the administrative backend can involve developing or upgrading existing software systems to enable seamless data exchange and communication between different stakeholders. This can streamline the waste collection process, enhance coordination, and reduce delays. The feasibility of this solution depends on the availability of appropriate technological infrastructure and data management capabilities.

PROBLEM

Delhi In the pursuit of a healthier society, it's crucial to confront the stark healthcare disparities that continue to persist. A disconcerting example of this inequity lies in the absence of health coverage benefits for municipality workers, particularly those affiliated with the Municipal Corporation of Delhi (MCD). This oversight not only jeopardizes the health of these workers but also underscores the broader gap in healthcare accessibility between the general public and low-income labourers. As per our research, Municipality workers are not provided with any health coverage benefits from MCD. There is a need for a comprehensive health roundup scheme.

1. Providing masks and gloves to workers registered under MCD

Reason- Collection and segregation of waste can invite multiple health issues originating from a lack of sanitation and cleanliness. Also, the fact that coronavirus keeps paving its way back, masks and gloves at all times become necessary.

2. On-site damage claims

If any sweeper/ ragpicker/ MCD worker faces any kind of physical or health damage then that individual has to be reimbursed by MCD.

Reason- As of now, ragpickers and sweepers use rickshaws, hand-pulled crates, trucks and big dustbins and can be injured on the street. To ensure their well-being, this step should be taken forward.

SOLUTION

Providing masks and gloves to workers registered under MCD.
Implementation-

- Monthly provision of masks and gloves to waste workers registered under the MCD portal.
- Providing rubber gloves that could work well for one whole month. They just require a wash and are ready to be in use for the next day.
- Providing cloth masks that could be reused and function well for a considerable period. Cloth masks are also skin-friendly.
- The workers could go to the nearby MCD office to collect the same or they could also be distributed with the help of MCD trucks.

On-site damage claims.
Implementation-

- Another tab should be made on the MCD grievance portal with the name 'On-site damage'
- Some of the following elements should be included in the same Reimbursement details (Bank Account details etc.)
- If the claim is accepted, then the amount will be transferred to the Beneficiary A/c in 3-4 working days. If the claim is not accepted, (in case of fraudulent bills, incomplete information etc) then the person should be communicated about the same (can be done through an SMS)
- Apart from that, physical forms should be provided to the workers as well. MCD Supervisors should be encouraged to inform workers about the forms. They should also be liable to submit forms every week to the MCD Chancellor. Photocopies of the medical bills and records should be provided with physical copies.

FEASIBILITY

To encourage the use of masks and gloves, four key strategies, namely awareness generation, guidelines on the use and reuse of masks and gloves, support from the public and private sector organisations for their free availability, and compliance monitoring can be adopted.

- Awareness generation - Workers should be made fully aware of the benefits of using masks and gloves about how they are a good safety cover and would shield the workers from health hazards.

- Use and re-use of masks and gloves- Sensitization to waste workers registered under the MCD portal on the use and re-use of masks and gloves should be given. This becomes necessary so that the workers can make judicious use of the same throughout the month without facing issues. This can be done in the form of a workshop.

- Support from the public and private sector- Both the public and the private sector organisations should extend financial support for making face masks available to the people free of cost. The cost incurred for the free distribution of masks would be less compared to the huge benefits generated from their use. The rate of return on such investment would be extremely high in terms of the good health of workers and a healthy workforce. Funds available under corporate social responsibility may also be used for the purpose.

- Monitoring - The functioning of the same should be monitored occasionally. Every area supervisor could do monitoring for their respective area.

The grievance portal is already being maintained and regulated by MCD. However, the entire portal focuses mainly on residents. The idea of the same should be extended to the baseline workers as well. There is a need to inform workers about these provisions. The same should be taken up by the supervisors.

Apart from that, physical forms need to be provided to all MCD Supervisors every month.

To access and evaluate the claims, a separate division is needed. This division would go through claims and divide them into legitimate and illegitimate claims.

A legitimate claim should include

- All necessary details about the incident
- Hospital and medical records
- Reasonable claim (a person can at a maximum ask for 10% more than what they have spent on the medical bills).

- Support from the public and private sector- Both the public and the private sector organisations should extend financial support for making face masks available to the people free of cost. The cost incurred for the free distribution of masks would be less compared to the huge benefits generated from their use. The rate of return on such investment would be extremely high in terms of the good health of workers and a healthy workforce. Funds available under corporate social responsibility may also be used for the purpose.
- Monitoring - The functioning of the same should be monitored occasionally. Every area supervisor could do monitoring for their respective area.

The grievance portal is already being maintained and regulated by MCD. However, the entire portal focuses mainly on residents. The idea of the same should be extended to the baseline workers as well. There is a need to inform workers about these provisions. The same should be taken up by the supervisors.

Apart from that, physical forms need to be provided to all MCD Supervisors every month.

In order to access and evaluate the claims, a separate division is needed. This division would go through claims and divide them into legitimate and illegitimate claims.

A legitimate claim should include

- All necessary details about the incident
- Hospital and medical records
- Reasonable claim (a person can at a maximum ask for 10% more than what they have spent on the medical bills)

NOTE- On-site damages are not an insurance policy. Hence any damage incurred by the individual outside the strata of work, shall not be accounted for.

PROBLEM

The absence of adequate infrastructure, as well as limitations in enforcement for managing hazardous waste, has resulted in ineffective waste management. Waste contractors collecting hazardous waste are mostly ill-equipped, untrained, and poorly paid, and the high-temperature treatment infrastructure in India is inadequate. The existing structure does not support complete doorstep segregation of waste. Domestic hazardous waste has not been the priority of urban local bodies because it is generated in relatively lesser quantities. As a result, segregation is not being practised by households. Devising changes in the existing framework would ensure the segregation of domestic waste into dry, wet, and hazardous.

EPR: Brands have lagged on the very first one – that is, registration. Under the new rules, producers, importers, brand owners, and plastic waste processors are not allowed to carry on any business without registration on the pollution control board's Extended Producer Responsibility portal. Despite the notification coming in as far back as 2018, why have all producers, importers, and brand owners not registered for Extended Producer Responsibility, especially when the rules prohibit them from doing any business without this mandatory registration? The Break Free From Plastic-India report noted that "there is a real danger that EPR will channel materials away from the informal sector and into a new, private sector, destroying the livelihoods of millions."

SOLUTION

Hazardous waste segregation centres

- Along with the blue and green dustbins, the law also mandates the use of red-coloured dustbins for hazardous domestic waste. However, these are hardly found in any locality. For domestic hazardous waste segregation, red dustbins should be set up in every colony of Delhi.

- Also, there is a lack of awareness regarding hazardous waste segregation and what exactly comes under the ambit of hazardous waste. The government must undertake information dissemination programs to spread awareness of the need and importance of segregating hazardous waste and how it can be done.

- Households should segregate the waste into three categories- wet waste, dry waste and hazardous waste. They should hand over the wet and dry waste to the door-to-door waste collectors and dispose of the hazardous waste in the red dustbins set up in the colony. Those who use MCD trucks for disposing of waste, should also segregate the waste into three categories, dispose of wet and dry waste in trucks, and the hazardous waste in separate red dustbins set up in the colony.

- A separate class of waste collectors should be employed who collect this waste from the colonies, and transport it to the local dumps. Since the amount of hazardous waste is considerably less, the waste collection can be done twice a week.

- The waste that cannot be recycled should be treated properly instead of being disposed of in landfills or oceans.

Waste Disposal App

The Swachh Delhi App can be improved to:

- Have an option for uploading pictures in your phone's gallery.
- Respond to the complaint within a stipulated period and post a 'before-after' picture of that particular place.
- The app can be used to book a van for the collection of hazardous waste from homes.
- The app should have an improvised GPS so users can mention the accurate location of the garbage.
- The app can be used to convey important guidelines to the citizens to ensure maximum compliance with the Solid Waste Management Rules, 2016. This can be done through notices and short videos to garner the attention of the users.

Additionally, the app can be used to list down information about the waste collection system in Delhi. Say, for instance, it can list down the major waste collection centres around their area, the timings of the waste collection van, and whatnot

Improvement in the existing legislation:

The definition of domestic hazardous waste under the Solid Waste Management Rules 2016, which contains a list of items classified as "domestic hazardous waste," is not exhaustive. There are many other items, like cigarette butts, that are hazardous in nature as they contain traces of metal and other chemicals, and must be discarded separately. Thus, the definition must be revised to include cigarette butts within its ambit.

.

FEASIBILITY

Hazardous waste segregation centres

- To ensure proper segregation and collection of hazardous waste, we recommend setting up Red Dustbins in every house across Delhi and employing a separate class of workers for twice-a-week collection of the same. As per the census conducted in 2011-12, there are approximately 34.36 lakh households in Delhi, with waste collection salary per house per month ranging between 200-300. The salary can be set at Rs. 100 per house for hazardous waste collection and can be initially provided by the government to incentivise the people. It can be later regulated as the salaries of other waste collectors are done. Therefore, the total cost of employing hazardous waste collectors would be approximately 34.36 Crore. As per the Delhi Statistical Handbook, around 10% of Delhi's population was below the poverty line.

- To incentivise people to segregate waste, the government can provide them with red dustbins, which cost around Rs. 100. The total estimated cost would be approximately 3.436 Crore. Along with this, five separate hazardous waste disposal centres are to be set up to facilitate the segregation of waste. Each such plant would cost around 50 lahks. Therefore, the total cost of setting up waste segregation centres would be approximately 2.5 Crore.

Improving the Swachh Delhi App

- Option for Uploading Pictures from Gallery: This is a relatively straightforward feature to implement, as many apps already allow users to upload photos from their phone's gallery.

- Respond to Complaints with Before-After Pictures: Feasible, but it would require coordination with the responsible authorities to ensure they have the resources to take before and after pictures.

- Booking Hazardous Waste Collection: Feasible, but this would require setting up a system for hazardous waste collection and the availability of vans.

- Improved GPS for Accurate Location: Feasible, as it involves updating the GPS functionality in the app.

- Conveying Guidelines Through Notices and Videos: Feasible, but it requires content creation and regular updates. Developing and maintaining a library of guidelines, notices, and videos would be needed.

- Listing Waste Collection Information: Feasible, as it involves creating a database of waste collection centres and schedules. This would require collaboration with waste management authorities to provide accurate and up-to-date information.

In addition to feasibility, it's crucial to consider the following:

- Budget: Developing and maintaining these features would require financial resources. Funding should be secured.

- Government Support: Coordination with local authorities and government agencies is essential for many of these improvements. Ensuring their buy-in and support is crucial.

- User Adoption: Promoting the app and ensuring that citizens are aware of its new features is vital for its success.

- Data Privacy and Security: Uploading pictures and location data raises privacy and security concerns. Adequate safeguards must be in place to protect user data.

- Technical Resources: The development team should have the technical expertise and resources to implement and maintain these features.

DECENTRALISING WASTE SEGREGATION

There is a pressing problem of inefficient waste management, particularly in the sorting and processing of recyclable materials. Currently, a significant portion of recyclable materials ends up in landfills. Therefore, this calls for an intricate model to resolve the same

Decentralised Waste Processing Units: Limiting Waste going to landfills

Shift towards decentralized waste treatment, inspired by the Alleppey model, using bio-bins in parks managed by MCD workers to reduce delays, storage costs, and pressure on centralized units. This approach promotes public awareness, supports efficient waste treatment, and aims to make each household a waste treatment unit

In summary, decentralized waste treatment with bio-bins not only ensures efficient local disposal butalso promotes public awareness, envisioning every individual household as a self-sufficient waste treatment unit.

THREE PHASE MECHANISM

Phase 1

Parks: The initiative begins with pilot parks, assessing bin needs, and aims to efficiently utilize all park areas in Delhi.

Phase 2

Colonies/ Residential Buildings: RWAs and CGHS-managed colonies will implement the bio bin system in parks, overseen by waste collectors, enhancing efficiency and distributing by-products among members to dispel misconceptions.

Phase 3

Households: After Phases 1 and 2, households can adopt subsidized mini bio-bins, facilitating decentralized waste processing, reducing volume and complexity at each stage without extra space.

Why are we doing this?

With around **50%** of the waste going to landfills being biodegradable, **30%** being recyclable and **20%** being non-biodegradable, non-recyclable and non-combustible waste, we can potentially **reduce the amount of waste going to landfills by more than 80%**.

Other Recommendations

- **WasteTech Hub:** Parks Transformed into Attractive Mini Waste Treatment Plants
- **Strategic Alliance** with 3rd Party Recyclers: Streamlining Household & waste recycling
- Establishment of well-equipped **Material Recovery Facilities** (MRFs)
- **Educating residents** about the importance of waste segregation and recycling is vital.
- **Digital Waste Audit System**: Enhancing Waste Management through Data-driven Segregation

Timeline for Waste Disposal

1-4 months	5-8 months	9-12 months	13-16 months	17-20 months	21-24 months
Reach out for funding & investment	Building organised parklevel bins	Testing with a small group	Applying it on a larger scale	Sustaining the program and maintaining it	

Feasibility Check

- Cost-effective- this model relies on public participation and proves efficient in resource management despite initial setup costs.
- In cities like Mysore, zero-waste colonies like Navjiwan in New Delhi, this community-based waste disposal system iis thus, sound.

Maintainence of Bio Bins

Optimizing Compost Odor

To check the smell of the compost, an adequate mix of both green and brown biodegradable substance should be maintained to balance the carbon and nitrogen components.

Regular Inspection and Uniform Mixing

There should be a regular inspection of these bins and the contents within should be turned regularly to make the compost mix uniform. To make this easier, a tumbler style Composter can be used.

WASTE MANAGEMENT MODEL

06
CONCLUSION

This research project has been an attempt to study the infrastructure committed to solid waste management in Delhi. This also dealt with collecting and understanding the behavioural patterns of the waste generators and how we can further inculcate them to reduce the burden of waste management on the central authority. All the data analysis and recommendations proposed in this project have been strictly based on and inspired by what was gathered during the primary survey process. This project also attempted to study the conditions of waste collectors/pickers in the status quo and how they can be further improved.

The first part of this project included an extremely comprehensive and deep dive into the already existing policies and infrastructure in Delhi to combat the waste management problem in Delhi. To achieve this, a well-sought preliminary literature review was conducted. This was followed by an overall policy review to get a better understanding of schemes that govern waste management infrastructure. Under this schemes like the Solid Waste Management Act and Swatch Sainik Initiative were thoroughly analysed and insights drawn from them were used to make a detailed questionnaire. After jotting down all the responses, they were critically scrutinised.

For Data analysis, we took various variables and adopted diverse techniques to conclude. These techniques included single variable analysis, multivariate analysis, econometric analysis and finally, zonal analysis. Some striking conclusions we were able to draw were that most of the people practised proper waste disposal daily (76%) but many were not aware of the process of waste segregation due to which there is an increasing burden on the already existing landfills and waste management infrastructure. On the waste picker's side, we saw there is a dearth of training and safety measures being provided to them, this is also contributing to inefficient waste segregation in the current scenario. Moreover, the remuneration received by more than 60% of the people falls below the minimum wage prescribed by the government which throws a light on the unfair and inhumane conditions under which they are working.

Also, upon conducting an econometric analysis, we were able to conclude that there is still a lack of transparency among people whenever they are not satisfied with a given service or infrastructure. Upon surveys, we were able to see that most people were not aware of the grievance redressal system of MCD and they never used it. Even people who used those services had an unsatisfactory experience. Hence, this is something that was flagged and requires immediate response and attention of the central authority.

One of the main issues that we were able to identify through our analysis was the centralisation of the waste segregation problem. Waste segregation is a very complicated process and can be only efficient when it is being done from the root level. Decentralised waste processing methods can help to reduce the burden of landfills in Delhi and decrease the amount of biodegradable waste accumulation. This has been our main theme of recommendations in auxiliary to improving conditions for the sanitary workers. Further, these recommendations have been subdivided into two domains, one focussing on inculcating behavioural practices to segregate waste at grass root level through the use of penalties, spreading awareness etc. Another sub-domain of recommendations has been focussing towards building an ecosystem to promote these behavioural changes.

For the infrastructure part, we have also tried to propose a detailed proposal subdivided into three phases to gradually bring the changes required to support the waste management infrastructure. These phases try to build an innovative plan to help and encourage people to segregate waste at grassroots levels and treat the biodegradable waste. In the first phase, we would target parks that can serve as waste collection and treatment hubs followed by community and individual bio bins in the second and third phases respectively. This model along with some creative suggestions like digital waste audit can reduce a huge chunk of burden on landfills and streamline the process of solid waste management.

In the end, this project was eye-opening and provided various insights into the status quo of the waste management system in Delhi. We were able to observe some striking patterns and behavioural trends which we have tried to put to best use and improve the efficiency of the current system.

07
REFERENCES

Solid waste management as an acute problem, especially with the handling of plastic waste
https://www.nationalheraldindia.com/environment/solid-waste-management-remains-a-giant-problem-in-delhi

Delhi's new waste management technology park as a new government initiative
https://www.hindustantimes.com/cities/delhi-to-get-new-waste-management-technology-park-tomorrow-101648472916880.html

Delhi's trash towers: Why India's capital is drowning in its garbage
https://www.indiatoday.in/news-analysis/story/delhi-trash-towers-why-india-capital-is-drowning-in-its-own-garbage-2293864-2022-11-06

Alappuzha's model waste management system
https://www.thenewsminute.com/article/why-states-are-lining-study-alappuzha-s-model-waste-management-system-105341

Odour of compost and its ramficiations
https://helpmecompost.com/compost/basics/does-compost-smell/#:~:text=A%20healthy%20compost%20bin%20shouldn,ecosystem%20that%20has%20particular%20needs.

Aerobic treatment of municipal solid waste
https://www.researchgate.net/profile/Dhanalakshmi-Dr/publication/281747678_Impact_Factor_3029/links/55f7169208aeba1d9ef08a08/Impact-Factor-3029.pdf

State policy SWM strategy
https://www.dpcc.delhigovt.nic.in//uploads/pdf/StatePolicySWMStrategypdf-6c76442a187a2b1c5b072f25a76c60ea.pdf

Delhi Master Plan 2041- DDA
https://online.dda.org.in/mpd2041dda/_layouts/Public_Suggestion_2041/MPDHomeNew.aspx

SDMC joining hands with United Residents Joint Action to cover maharani Bagh Area
https://timesofindia.indiatimes.com/city/delhi/sdmc-joins-hands-with-rwa-body-for-waste-mgmt/articleshow/90062047.cms

Guidelines of 2016 Plastic Waste Management Rules
http://web.delhi.gov.in/wps/wcm/connect/environment/Environment/Home/Environmental+Issues/Waste+Management

Delhi Municipal Corporation(amendment) bill, 2022
https://prsindia.org/billtrack/the-delhi-municipal-corporation-amendment-bill-2022

Survey on e-waste and waste management awareness
https://www.emerald.com/insight/content/doi/10.1108/MEQ-12-2013-0139/full/html

DPCC quality report 2022
https://www.dpcc.delhigovt.nic.in//uploads/pdf/Quarterly-Report-on-SWM-Delhi-Jan-March-2022pdf-c8cdbb491cd0123cd29c76da71650f66.pdf

MCD portal for contacting workers
https://mcdonline.nic.in/portal/

Mission Sahbhagita 2022
https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1907683

RAGHAV KANT
Datalab Director

RUCHI GUPTA
Datalab Director

Keshav Khemka
President
+91-62893-69919

Yuvraj Sehrawat
Secretary
+91-88001-45508

ON-GROUND SURVEY

Aaryan Sojiya
Aastha Jha
Angad Syal
Arin Verma
Arshiya Chaudhary
Ayush Gupta
Ayushi
Bhavya Nayak
Dhwani Arun
Divyansh Gupta
Divyansh Nagpuri
Divyanshu Singh
Giridhar S
Girisha Chitkara
Gopal Saraf
Harsh Thakker
Harshini Agarwal
Harshit Gaur
Harshita Yadav
Ishita Gambhir
Khushi Sharma
Krrish Kohli
Mahalaxmi
Manjari Bagri
Megha Goenka
Mithraeye E
Mitul Kaul
Mukund Gupta
Paridhi Gupta
Poonam
Priyanshi Bansal
Pulkit Bansal
Raghav Singhal
Rajavi Agarwal
Rallapalli Jaya Mokshith
Rishi Chandak
Satakshi Akanksha
Sneha Mishra
Swadha Gupta
Ujjwal Goel
Zaina Sharma

LITERATURE REVIEW AND QUESTIONNAIRE

Aastha Jha
Ayush Gupta
Ishita Gambhir
Krrish Kohli
Mithraeye E
Paridhi Gupta
Rishi Chandak
Satakshi Akanksha
Zaina Sharma

DATA ANALYSIS

Ayush Gupta
Divyansh Nagpuri
Mitul Kaul

REPORT FORMULATION

Ayush Gupta
Mitul Kaul

DESIGN

Arshiya Chaudhary
Divyansh Gupta
Ishita Gambhir

RECOMMENDATIONS

Aastha Jha
Brinda Issar
Deepanshi Yadav
Divyansh Gupta
Divyanshu Singh
Giridhar
Girisha Chitkara
Harshit Gaur
Ishita Gambhir
Krrish Kohli
Swadha Gupta
Zaina Sharma

THE ECONOMICS SOCIETY

SHRI RAM COLLEGE OF COMMERCE

ecosocsrcc.com
contact@ecosocsrcc.com