# SOLID WASTE MANAGEMENT

# A CASE STUDY OF DELHI

**Submitted by**

Vishruti Gupta

**Delhi School of Economics**

Arjun Kumar

**JNU**

**Supervisor**

Prof. J V Meenakshi

**Delhi School of Economics**

*ABSTRACT*

*The study focuses on the mechanism behind the process of disposal, collection and segregation of the waste in Delhi. It also looks at the role of authorities in the process. We also attempt to answer the questions on the inefficiency in the system and how it can be improved. The study is based on the A to H categorisation of all the areas by MCD. The survey was held in 27 colonies with the households, the dhalao workers, the waste collectors and the segregators .The results show unawareness and ignorance amongst the households in all categories. The analysis show irregular visits of the sweepers and kudawala for door to door collection, increase in the practice of open dumping as we more down the category and more organised structure of segregation as we move up the categories. The colonies in higher categories are found to be cleaner than the lower categories in general.*

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**INTRODUCTION AND MOTIVATION**

How can we define solid waste? In simple microeconomics terms, we can say that it's a "bad" commodity, and no one in the economy would like to consume it. In fact if the assumption of non negative prices is relaxed, we can relate such a commodity to negative prices, which means that the agents in the economy would be willing to pay in order to get rid of it or to dispose it. This is what we generally do; we pay a very nominal amount to the garbage picker to take away the waste generated in our home, created by us. According to the Municipal Solid waste management Rules 2000, **"municipal solid waste"** includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. Why is it a matter of concern? It is a matter of concern because even if we want to dispose it off, it does not vanish immediately. Poor solid waste management affects health and the provision of other amenities of the society.

1. Transmission of disease to residents and waste collecting workers
2. Clogging drains and sewers
3. Visual and smell impacts
4. Creates conditions for disease vectors such as flies, cockroaches, mosquitoes, rodent's insects etc.

According to a study done by Mufeed Sharholy et al. Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. About 90% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment. The study provides a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW practiced in India and hence conclude the major problems. The major findings of this study are need of appropriately designed collection bins, maintenance of the storage facilities and transportation vehicles by the municipal authorities, proper segregation at source and control on open dumping and inadequate disposal practices which leads to severe health losses for both human and animals. A large gap between policy and implementation of the MSWM (municipal solid waste management) Rules 2000 is also highlighted.

Another study done by Papiya Sarkar emphasizes on SWM in Delhi. It brought out some remarkable findings about the impact of SW on various stakeholders and especially the most

vulnerable section: rag pickers, scavengers and waste pickers who are engaged in this occupation. The need for information dissemination and creating awareness on the importance and need to recycle is emphasized. The awareness that would generate changed waste handling habits of households which in turn would reduce the occupational health hazards providing them with better working conditions and also better economic returns.

**OBJECTIVES**

Several studies and contemporary issues motivate us to look at the solid waste management in Delhi under following dimensions:

1. Investigating the prevailing process of collection and disposal of the waste at the household level, the dhalao worker's, waste collector's and the segregator's level.
2. To evaluate the mechanism of the segregation at different stages up to community level
3. To find out if there exist any relation between poor solid waste management and adverse health impact.
4. To examine the role of the authorities.

**SAMPLING STRATEGY AND METHODOLOGY**

In Delhi, SWM is the responsibility of three municipal bodies - the Municipal Corporation of Delhi (MCD), the New Delhi Municipal Council (NDMC) and the Delhi Cantonment Board (DCB). MCD alone manage almost 95 % of the total area of the city. The above authorities are supported by a number of other agencies. Citing and allotment of land to MCD for sanitary land filling is responsibility of the Delhi Development Authority (DDA). Solid waste utilization projects are responsibility of the Department of Non-Conventional Energy Sources (DNES) and Delhi Energy Development Agency (DEDA) under the Ministry of Environment and Forests (MoEF), Government of India. The Department of Flood Control of Delhi Administration looks after the supply of soil to be used as cover for sanitary landfills by the MCD.

Delhi is divided into 12 Zones by MCD

1. City Zone
2. Central Zone
3. South Zone
4. Karol Bagh Zone

5. Sadar pahar Ganj

6. West Zone

7. Civil Lines Zone

8. Shahdra South Zone

9. Shadra North Zone

10. Narela Zone

11. Najafgarh Zone

12. Rohini Zone
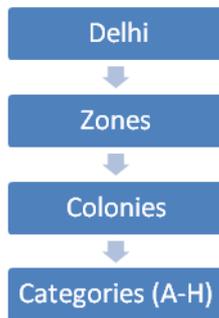


We further categorise them into 4 parts. The division is mentioned below.

1. Part 1 – Karol Bagh , West , Najafgarh

2. Part 2 – City , Central , South

3. Part 3 – Shahdra North , Shadra  South , Sadar Phar Ganj

4. Part 4 -  Rohini , Narela , Civil Line

In each part we choose one colony in each category from A to H. According to MCD, category A has the highest property value as compared to any other category and as we go down, the value of property also goes down implying that the residents of category H have the lowest property value.

Sampling of the households

In each part we choose one colony pertaining to each category. The colonies are chosen with the help of random number generator. In this way we choose $8 \times 2 + 7 \times 2 = 30$ colonies. The household sample size for each colony is 3. Therefore the total household sample size of the

study is $30 \times 3 = 90$. The 3 colonies in part A were found to be industrial areas and not residential, hence survey was not held there. This reduced the total sample size to 81, but the numbers of respondents were 72. Hence the total sample size is 72. Further, in each colony a random house is visited and then every 10th household is visited in order to collect data from three households in each colony. If we did not get a response from a particular household, it is skipped and the 10th household is visited. The details of the colonies visited are mentioned below:

**TABLE: COLONIES**

| Sr No. | COLONY | CATE GORY | WARD | ZONE | PART |
|---|---|---|---|---|---|
| 1 | Indraprasth Estate | A | Minto road | CITY | I |
| 2 | Rouse Avenue, Institution Area | B | Minto road | CITY | I |
| 3 | Vijay Mandal Enclave | C | West gorakh park | SH NORTH | I |
| 4 | Preet Vihar | D | Preet vihar | SH SOUTH | I |
| 5 | Dharam Pura, Chandni Chowk | E | Chandni chowk | CITY | I |
| 6 | Jai Prakash Nagar | F | Ghonda | SH NORTH | I |
| 7 | Valmiki Colony | G | Raghubarpura | SH SOUTH | I |
| 8 | Sabhepur Gujran | H | Yamuna vihar | SH NORTH | I |
| 9 | Ring Road Banglows | A | Bhogal | CENTRAL | II |
| 10 | Safdarjang Enclave | B | Hauz khas | SOUTH | II |
| 11 | Jhandewalan Area | C | Manak pura | SP GANJ | II |
| 12 | Vinoba Puri | D | Jangpura | CENTRAL | II |
| 13 | Nehru Nagar (bhogal) | E | Bhogal | CENTRAL | II |
| 14 | Jangpura – B | F | Jangpura | CENTRAL | II |

| 15 | Sarai Jhuliana | G | Okhla | CENTRAL | II |
|----|----------------|---|-------|---------|-----|
| 16 | Mitha Pur | H | Badarpur | CENTRAL | II |
| 17 | Prema Kunj | B | kashmere gate | CIVIL LINES | III |
| 18 | Arya Bhatt Enclave | C | Bharat nagar | ROHINI | III |
| 19 | Anand Vihar (Rani Bagh) | D | Saraswati vihar | ROHINI | III |
| 20 | Amba Enclave | E | Rohini | ROHINI | III |
| 21 | Anand Nagar | F | Shastri nagar | CIVIL LINES | III |
| 22 | Maniram Park | G | Budh vihar | ROHINI | III |
| 23 | Kadi Pur | H | Burari | CIVIL LINES | III |
| 24 | JNU CAMPUS AREA | B | Mahipalpur | NAZAFGARH | IV |
| 25 | Punjabi Bagh East | C | Moti nagar | WEST | IV |
| 26 | Janakpuri | D | Janakpuri | WEST | IV |
| 27 | Ajay Enclave | E | Tilak nagar | WEST | IV |
| 28 | Raja Puri Colony Uttam Nagar | F | Madhu vihar | NAZAFGARH | IV |
| 29 | Saini Pura, Madhu Vihar | G | Isapur | NAZAFGARH | IV |
| 30 | Mundela Khurd | H | Isapur | NAZAFGARH | IV |

Sampling of Dhalao workers and segregators/waste collectors

In the respective colonies the Dhalao workers and waste collectors/segregators were interviewed who were found at the Dhalo/open dumping site nearest to the colony. No sampling method is used here; the workers are identified at the site only. The total sample size is 27 each for the dhalao workers and the segregators/ waste collectors.

Methodology

The basic source of data for the study and tool for analysis is the survey done in the areas

mentioned. For the information on the collection process we conduct a household survey on a sample of households in category A to H. This would help us to know that how and where they dispose the wastes of their house. We then compare the results across categories and see if there exists a significant difference between them. This is done by clubbing categories A&B, C, D&E and F, G&H together. The significance of the results is testes for the categories C, D&E and F, G&H and not for A&B because of the limitation of small sample size.

The study on the disposal and the collection process is done at three levels, that is; household, Dhalao worker and segregator's/waste collector's. We find the alternatives available and practiced by the households for the disposal of waste. The primary data is collected with the help of survey in households. This leads to the process of collection of waste from the households. Collection is followed by transportation, storage and segregation. In the next stage we look at the segregation process. This is motivated by the increasing importance of the segregation of waste. The most efficient system would be such that emphasizes on the segregation at source, but this does not hold in reality. We look at the various stages at which the waste is segregated; that is; is this is practised by the households, kudawala, dhalao worker, waste collector or segregators. This also explains the various stages of waste before it reaches its end destination, the landfill site. Qualitative nature of questions was asked from the agents in the process of segregation of the waste to get a deeper understanding of the existing problem in the process. We emphasize on the process of collection and segregation because there is a significant difference between the residential areas and the slum areas. The level of segregation in each stage depends on the incentives. The results of these surveys also informs about the role of the authorities as well.

Mismanagement of Solid Waste has severe effects on health. These effects are seen most amongst the waste workers. But the study focuses on the health impact on the households and especially on the children under 5. As we move down the category, the management worsen along with the health indicators of the residents. Simple question on occurrence of fever, cough and cold is asked. There is also a focus on the qualitative aspect of the issue of health regarding the availability of free facilities by the government, the proportion of expenditure on health and the perceptions of the households on the diseases cause by the solid waste. The questionnaires are attached in the appendix.

## EVIDENCE FROM THE HOUSEHOLD SURVEY

The total number of households visited was 170 and the number of respondents was 72. The response rate was 42%.

Category wise details of the response rate are mentioned below

**TABLE: RESPONSE RATE**                                          **Units: No. of Households**

| CATEGORY | A&B | C,D&E | F,G&H | TOTAL |
|---|---|---|---|---|
| **No of households visited** | 38 | 66 | 66 | 170 |
| **No of respondents** | 7 | 31 | 34 | 72 |
| **Response rate** | 18% | 47% | 52% | 42% |
| **Standard error** | 0.06289 | 0.06143 | 0.06152 | 0.037897 |

We cannot conduct a test here because of small sample size as the test for proportions is a large sample test.

Below we mention the t-test results which are found to be significant:

p1 refers to proportion observed in category C, D and E

p2 refers to proportion observed in category F, G and H

| Variable Name | Null Hypothesis | Alternate hypothesis | p-value | 10% | 5% | 1% |
|---|---|---|---|---|---|---|
| **Charges paid to kudawala** | Charges (C, D, E) = Charges (F, G, H) | Charges (C, D, E) $\neq$ Charges (F, G, H) | 0.0061 | * | * | * |
| **Charges paid to kudawala** | Charges (C, D, E) = Charges (F, G, H) | Charges (C, D, E) > Charges (F, G, H) | 0.0030 | * | * | * |
| **Rent of the household** | Rent(C, D, E) = Rent (F, G, H) | Rent(C, D, E) > Rent (F, G, H) | 0.0000 | * | * | * |

| Variable Name | P1 | P2 | Null hypothesis | Alternate hypothesis | p-value | 10% | 5% | 1% |
|---|---|---|---|---|---|---|---|---|
| **Female working** | 12/31 | 6/34 | p1 − p2 = 0 | p1 − p2 $\neq$ 0 | 0.0580 | * | | |
| **Female working** | | | p1 − p2 = 0 | p1 − p2 > 0 | 0.0290 | * | * | * |
| **existence of MCD dustbin/collection point** | 17/31 | 9/34 | p1 − p2 = 0 | p1 − p2 $\neq$ 0 | 0.0197 | * | * | |
| **existence of MCD dustbin/collection** | | | p1 − p2 = 0 | p1 − p2 > 0 | 0.0099 | * | * | * |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **point** | | | | | | | | |
| **open dumping** | 12/31 | 20/34 | p1 − p2 = 0 | p1 − p2 < 0 | 0.0526 | * | | |

The variables for which the t-test was found to be insignificant are

| *Variable Name* | *P1* | *P2* | *Null hypothesis* | *Alternate hypothesis* | *p-value* |
|---|---|---|---|---|---|
| **Waste to kudawala** | 24/31 | 23/34 | p1 − p2 = 0 | p1 − p2 ≠ 0 | 0.3780 |
| **existence of local community bins** | 17/31 | 14/34 | p1 − p2 = 0 | p1 − p2 ≠ 0 | 0.2707 |
| **cleanliness maintained for the storage facilities set up by MCD** | 2/31 | 3/34 | p1 − p2 = 0 | p1 − p2 ≠ 0 | 0.9240 |
| **Households if they segregate the waste** | 10/31 | 8/34 | p1 − p2 = 0 | p1 − p2 ≠ 0 | 0.4322 |
| **Govt. doctor/dispensary is visited in case of illness.** | 7/31 | 5/34 | p1 − p2 = 0 | p1 − p2 ≠ 0 | 0.4138 |
| **Free health facility** | 7/31 | 10/34 | p1 − p2 = 0 | p1 − p2 ≠ 0 | 0.5314 |
| **Efficiency of MCD** | 4/31 | 2/34 | p1 − p2 = 0 | p1 − p2 ≠ 0 | 0.8890 |

The details for the method of disposing the waste are mentioned below. The t-test for this variable is found to be insignificant

**TABLE: Disposal of waste**                    **Units: No. of Households**

| | **A&B** | **C,D&E** | **F,G&H** | **TOTAL** |
|---|---|---|---|---|
| **sample size** | 7 | 31 | 34 | 72 |
| **Kudawala** | 7 | 24 | 23 | 54 |
| **standard error(Kudawala)** | 0 | 0.0750957 | 0.08023111 | |
| **Own** | 0 | 7 | 11 | 18 |

We compare **the charges paid to the kudawala** by the households. 53 households answered this question. The result of the t-test is significant both for one tail and two tail and we can say that the charges paid in higher categories is significantly greater than the charges paid in lower categories.

**TABLE: Charges paid to kudawala**          **Units: In Rs**

| | **A&B** | **C,D&E** | **F,G&H** |
|---|---|---|---|
| | | | |

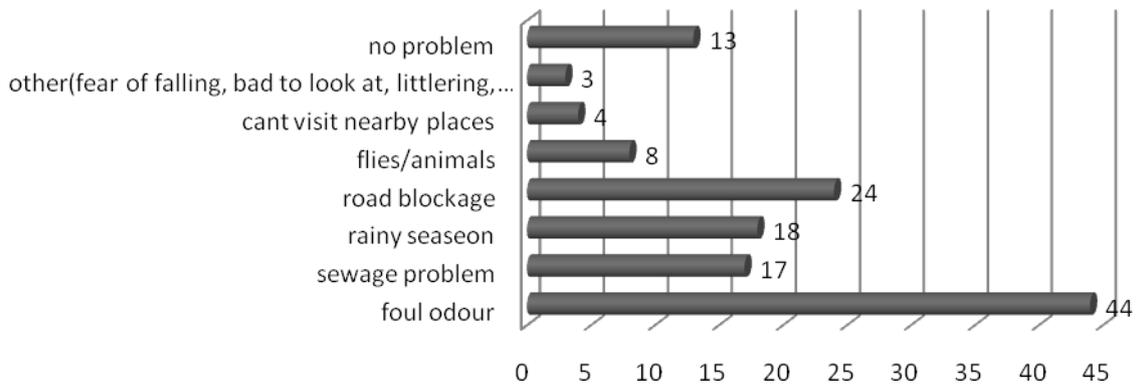| | | | |
|---|---|---|---|
| **N** | 6 | 24 | 23 |
| **Min** | 50 | 30 | 0 |
| **Max** | 100 | 100 | 70 |
| **Mean (in Rs.)** | 78.3333 | 50.8333 | 37.3913 |
| **SD** | 24.8327 | 15.7884 | 16.2277 |
| **SE** | 10.1379 | 3.22280 | 3.38372 |

29 agreed on the presence of MCD dustbin, 19 households are found to be unaware and 24 refused the presence of any collection point. Both one tail and two tail tests are significant.

Overall 33 households reported practice of open dumping in their colony. The maximum practice of open dumping was reported in category H (10 households)

The **problems which are faced** in day to day life due to mismanagement of SW. More than one problem was reported by many households and all households answered to this question. The overall result is shown below. Maximum case was found for that for foul odour

## Problems faced due to SW

| Problem | Count |
|---|---|
| no problem | 13 |
| other(fear of falling, bad to look at, littlering,…) | 3 |
| cant visit nearby places | 4 |
| flies/animals | 8 |
| road blockage | 24 |
| rainy seaseon | 18 |
| sewage problem | 17 |
| foul odour | 44 |

The absence of **different collared bins** was reported by 59 households. Moreover it was found that there were no bins at all in lower categories, being of different colours are out of questions. It is also found that the practice of open dumping is practiced most where there are no bins at all.

We asked what is done to the **dry leaves** in each area. The motivation behind the question is that the dry leaves can be a good and cheap source of manure. In more than 8 areas the leaves are burnt, in 5 areas the leaves are either left on the roads only or the households are not

aware about it. 3 areas have no plants at all in their surroundings because of too many buildings and no place for parks. Only few utilize dry leaves as a source of manure otherwise it's swept away or mixed with the other waste.

The **composition of the household waste;** maximum waste found was that of kitchen waste and paper waste. The household could not tell the exact proportion.

We asked the **households** if they **segregate** the waste or not.

The personl attribute in the process of segregation by the households can be directly linked with the category and hence the parameters such as level of income, education etc.

21 households told us what all they segregate. Each househlod told more than one item which they segregate. Maximum number of households told that they segregate paper because of the possibility of selling it further in second goods market. Also kitchen waste was is found to be segregated, the reason being the stink which is generated when it gets mixed with the other household waste and another reason being that it is the wet waste. Some households practice segregation of dry and wet waste. The culture of segregation needs to be encouraged as the conventional segregation process is based on incentive and need which should be changed to a responsibility.

## what is segregated?

| Category | Value |
|---|---|
| polythene | 1 |
| plastic | 1 |
| metal | 1 |
| paper | 14 |
| kitchen | 11 |
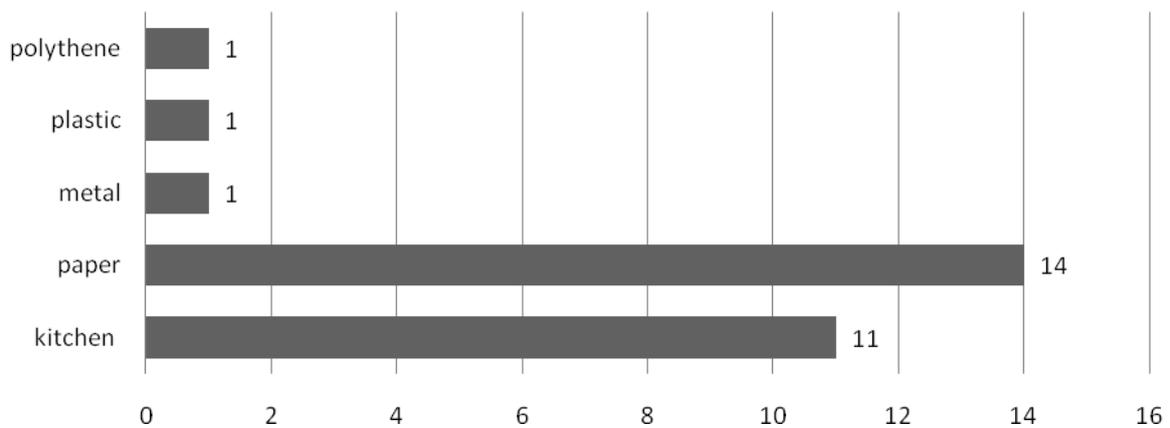
The households which do not segregate the waste were asked the reason for not doing so. 51 households answered this question and a variety of answers were found which are shown below. The maximum households reported their ignorance towards the importance and benefits of segregation. The reasons for not segregating were found to be ignorance, no time, and no incentive, do not like, not possible etc.

We asked about the prices at which the households sell old paper and plastic in the second goods market. In category A, no one answered this question. In category B the per kg rate for paper was Rs 7. In category C the per kg rate varied between Rs 6 – Rs9. In category D the

per kg rate varied between Rs 4 – Rs 8. In category E the per kg rate Rs 6 – Rs 8. In category F the per kg rate Rs 5 – Rs 8. In category H the per kg rate varied between Rs 4 – Rs 7.We could not get a response for plastic in per kg terms because the price varies according to the shape and size of the bottles or containers sold.

Where is **construction malba dumped?**

 We received various answers to this question like given to builder/constructer only, left there only, taken in trucks to fill plots, thrown in garden, pay Rs 100/cart to pick, keep outside only, kept at the site only, manual labour employed to dispose, no one takes away, MCD takes away, thrown on roads, used to fill vacant plots, done nothing etc.

On Health

We initiated to meet this objective by conducting a survey with the doctors at the government dispensary located in each colony respectively. The survey was actually conducted in 2 areas, Janakpuri and Arya Bhatt Enclave and no useful information were extracted because of the reluctant behaviour of the doctors towards answering the questions. The reasons for not visiting a private doctor in a particular colony ware that the study focuses on the health facilities provided by the government and the problem of sampling. We also visited the Directorate of Health, MCD, Delhi for information on all zones of Delhi. Later, since no useful information could be obtained, it was decided to drop the survey from the study. So the results on health impacts are as told by the households and the limitations of these results are the small sample size of the households and even smaller sample size of the households who responded to this section in the questionnaire.

We asked which **doctor/dispensary is visited in case of illness**. 55 households reported that they visited private doctor/hospital. Only 12 visited a government dispensary. 4 households which reported "can't afford" was due to the reason that the income is too low to afford the commutation expenses to the dispensary because they are located very far from the household. 2 households that report "self" were either doctor by profession or did not want to visit a doctor. We conduct a two tail tests for proportions, which is insignificant.

We further asked if **free health facility** was provided to the households by the government. 55 households said "no". We conduct a two tail tests for proportions, which is insignificant.

The question on the diseases to children under 5, only 16 out of 72 households answered the question and the limitation which we faced are mentioned below

- The few households with children under 5 did not respond properly
- Households did not know the name of diseases
- Did not remember the frequency of recurrence

We could find any concrete result hence the findings are not mentioned

The diseases which are perceived by the households which are caused by mismanagement of solid waste are fever, dengue, diarrhoea, respiratory problem, infection, viral, stomach problems and eye irritation.

On MCD

Maximum number of households informed irregular visits and no supervision by the MCD in their area. More awareness programmes should be undertaken. Cleaning of roads should be done on a regular basis and more frequently. Implementation of the rules and policies in some areas is very important. According to some households the officials of MCD should be honest, because any amount sanctioned for a public utility in their area is not utilised. MCD should also take steps to encourage participation at the community level. Installation of more dustbins in many areas is required. Cleaning of market areas, open dumping grounds and the service lanes requires immediate attention. In few areas, households did not give any suggestions because private agencies operate there and MCD plays no/little role. In the last 2 categories people feel that regular door to door visits by the doctors should be done in order to check for diseases as people are ignorant, reluctant and illiterate. More awareness programme regarding health should be held in these particular areas.

57 out of 72 respondents said that the MCD is not efficient in their respective area. We conduct a two tail tests for proportions. The test is insignificant hence we conclude that there is no difference in the efficiency of MCD across categories.

Overall 40 households believed that the rag pickers are useful in improving SWM.
Reasons:
- Helps to keep roads outside home clean
- Do household tasks in exchange of things which are a no more useful for households
- Saves time

But only 27 said that they should be allowed in their locality. Reasons being the following
- It is not safe; the rag pickers could be thieves.
- Small children do this, which is a social evil

The condition of SWM after privatisation is:

| Better | 18 |
|---|---|
| No change | 18 |
| Worse | 3 |
| Dnk | 27 |
| Can't say | 6 |
| n/a | 3 |

**DHALAO WORKERS**

The response rate in the dhalao workers survey is 100%

The employment structure was analysed for the dhalao workers, the result is as follows:

**TABLE: Employment structure**                    **Units: No. of Workers**

| Employed by | Dhalao worker |
|---|---|
| **RWA** | 2 |
| **private agency** | 13 |
| **Ngo** | |
| **self employed** | |
| **MCD** | 12 |

We asked **dhalao workers** if the **open dumping** is practiced in the area where they work. 20 out of 27 workers said yes. Except in category A, B and C it is found in all other categories. The answer match with the segregator's survey. The reasons reported were no bins, no concern, no mechanism, drainage problem, insufficient space and distance. The suggested solutions were awareness programmes, more bins, rules and fines and covered and small bins.

Dhalao workers were asked if they **kept the Dhalao clean**. Out of 27 workers 13 said yes and 14 said no. The reasons told were less manpower, no concern and disposal of waste outside the dhalao by the people. The suggested solutions were more manpower, regular inspection, maintenance, support and timely check..

The dhalo workers told that **dry leaves** are taken away with the other waste in all the areas; this result does not match with the response of the households. According to the households the leaves are either burnt or left on the roads

The **tools** which are used by the dhalo workers for the collection of waste are broom, belcha, board and tokri. The number of workers who answered this is 27 which is our total sample size for this survey.14 reported the **condition of the tools** provided to them is bad and non satisfactory, the tools are more than 10 years old. 10 said that the tools are in ok condition but they are not very good.

The **carts are not covered** while transportation of the waste as reported by 26 out of 27 **dhalo workers**.

We asked if the **bins** in the locality are clean or not 17 out of 27 **dhalao workers** said no. The reasons told were no concern, no bins, and no support by RWAs. The solutions suggested were strict rules, more manpower, installation of more bins, more tools to be provided and support.

**Problems faced** in this work as told by the dhalao workers are that the present number of carts is less than the requirement, the supply of tools and equipments is irregular, less salary and no increments are given, the manpower is constrained, more bins must be installed, the area of the Dhalao is small relative to the volume of waste and it also requires repairing. The workers also seek support from the RWAs.

We asked the **dhalao workers** if they **segregate** the waste or not. 4 out of 27 workers said yes.

We asked the Dhalao workers how MCD can help to solve these problems. The suggestions were that MCD should more carts for the collection of waste, more bins and more equipments and tools should be provided without delays. Hike in the alary of waste workers and timely payment is essential. More manpower and support by the authorities is needed.

The actions which MCD should take to improve the conditions of the Dhalao Workers are to give them incentives by increase in salary along with timely payments, help in solving the distance problem because many workers travel long distance from their home to their workplace. Modern facilities should be provided to the workers

14 dhalao workers answered the question on the design of the dhalao and all agreed for a need for the improvement in the design. All 27 workers agreed with a need for the presence of a gate at the dhalao. The reason being its usefulness in security, cleanliness, odour and keeping the animals like pigs, dogs and cows away. The only disadvantage of a gate at dhalao as told by the workers is that it encourages the people of the surrounding area to litter and throw the waste outside the dhalo at any point of time in the day.
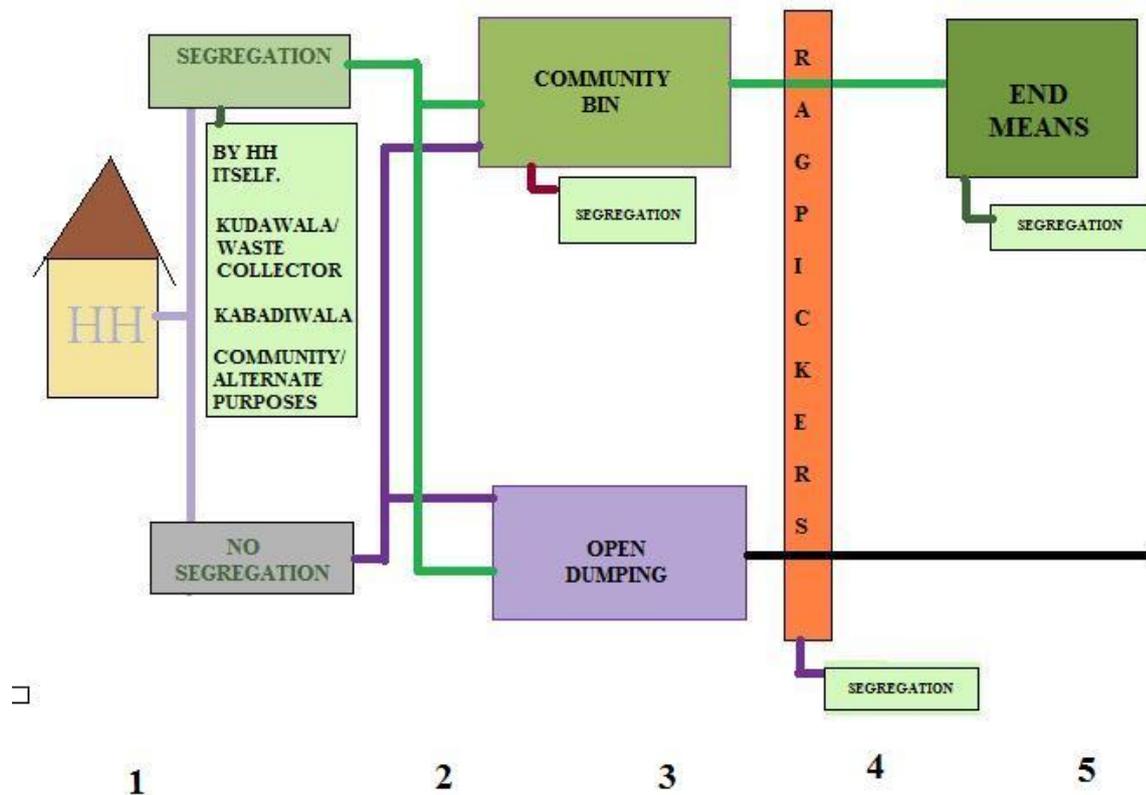
### SEGREGATORS/COLLECTORS

The response rate in segregators/collectors survey is 100%

**TABLE : Employment structure**                    **Units: No. of Workers**

| Employed by | Segregator/waste collector |
|---|---|
| **RWA** | 3 |
| **private agency** | 13 |
| **Ngo** | |
| **self employed** | 3 |
| **MCD** | 8 |

As told by segregators, the various means of transportation of waste found are carts, rickshaw, bullock cart, truck and tractor. Maximum use is that of carts and rickshaw

We asked **segregators** if the **open dumping** is practiced in the area where they work. 20 out of 27 workers said yes. Except in category A and B it is found in all other categories. The reasons reported were conventional, awareness problem among people, no bins. The suggested solutions were inspection, increase in manpower, awareness programmes and strict action.

The **carts are not covered** while transportation of the waste as reported by 22 out of 27 **waste collector/segregators.** The reasons being no incentive to cover, no use and no facilities like plastic sheet is provided to cover the waste.

We asked if the **bins** in the locality are cleaned by **the segregators** or not. 20 out of 27 segregators said no. The reasons told were no concern, no bins, waste being spread outside the bins, lack of manpower and poor planning. The solutions suggested were regular inspection and proper check.

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We asked the **waste collector/segregator** if they **segregate** the waste or not. 20 out of 27 said yes. The segregator also told that the waste is segregated near the **bin & local community. Segregators/waste collectors** segregate paper, plastic, metal which is for the sole objective of sale in the second goods market and other material is also segregated.

The **segregators/waste collectors** also answered this question. The following prices per unit were reported

|  | Min (in Rs/kg) | Max (in Rs/kg) |
|---|---|---|
| Paper | 1 | 6 |
| Plastic | 1 | 5 |
| metal | 8 | 20 |

The following information about the segregation process is concluded for the segregator's/waste collector's survey:

There is no exclusive protection provided to the works who work at the segregation site like masks, gloves, boots and any special training to perform the job more efficiently and safely.

The opinion of the segregators about the process is that it requires hark work, cooperation amongst the co-workers, encouragement by the authorities and a huge amount of manpower.
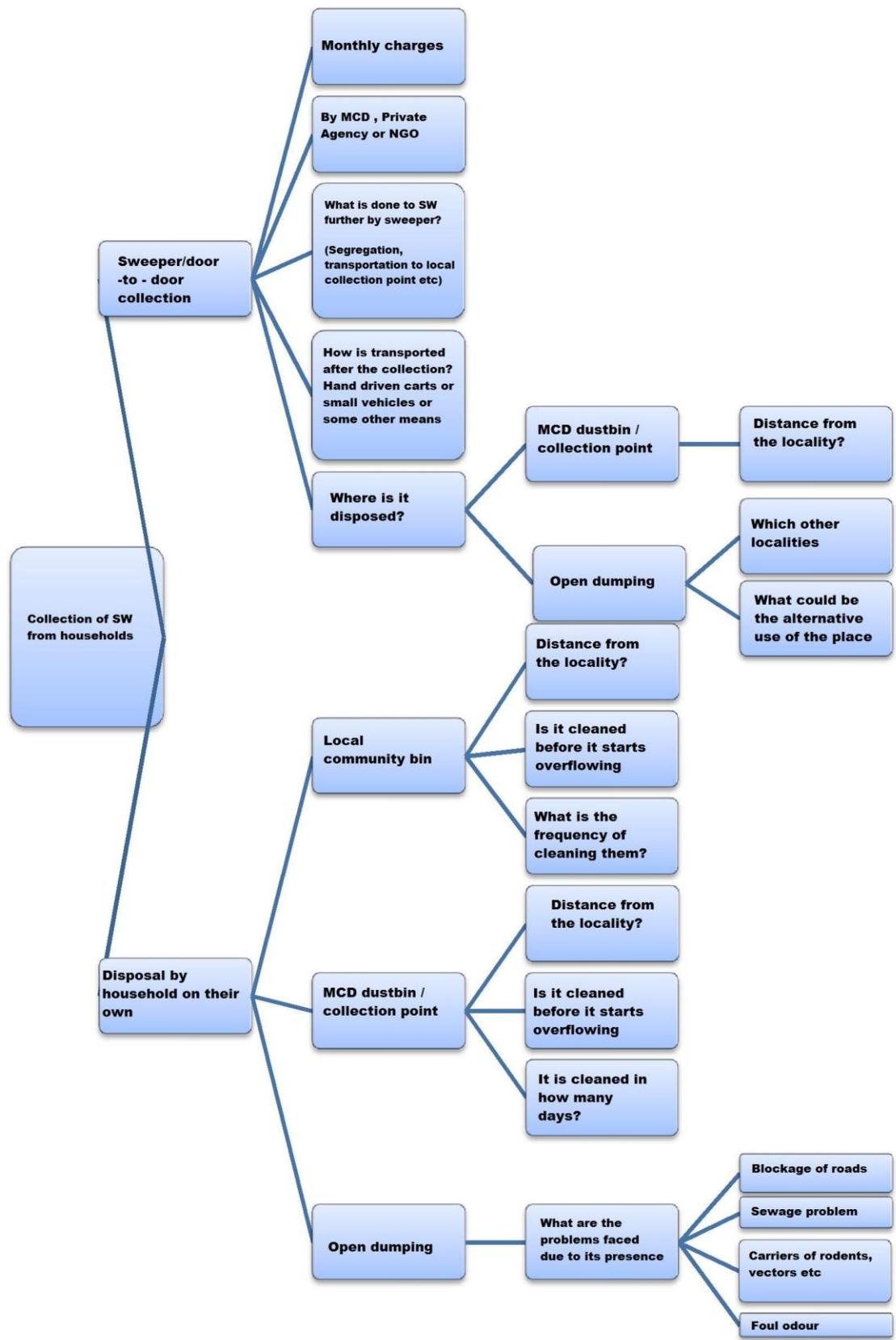
On the other hand the reported limitations of the system were fewer facilities and support, no proper place for allotted for segregation, no cooperation and long distances. The suggestions to overcome these limitations were, hike in salary, encouragement for worker, awareness amongst the citizens, cooperation and support from the authorities, effective rules instead of rigid rule and installation of more bins in the colonies. According to the 12 segregators the MCD should provide more facilities, encourage practice of segregation at household level, keep a proper check and control over the system.

No severe health impacts were faced as told by 23 out of 27 waste workers. Others reported problems like breathing, cough and fever.

The efficiency and the efficacy of the system can be improved with the help of following action if taken by MCD

- proper check
- more facilities provided regularly
- cooperation and RWA support
- inspection and strict rule
- strong management and administration

# RESULTS

```
                                    ┌──────────────────┐
                                    │  Monthly charges │
                                    └──────────────────┘

                                    ┌──────────────────┐
                                    │  By MCD , Private│
                                    │  Agency or NGO   │
                                    └──────────────────┘

                                    ┌──────────────────────────┐
                                    │ What is done to SW        │
                                    │ further by sweeper?       │
      ┌──────────────┐              │ (Segregation,             │
      │ Sweeper/door │              │ transportation to local   │
      │ -to - door   │──────────────│ collection point etc)     │
      │ collection   │              └──────────────────────────┘
      └──────────────┘
                                    ┌──────────────────────────┐
                                    │ How is transported        │
                                    │ after the collection?     │
                                    │ Hand driven carts or      │
                                    │ small vehicles or         │
                                    │ some other means          │
                                    └──────────────────────────┘
```

**Sweeper/door -to - door collection**

- Monthly charges
- By MCD , Private Agency or NGO
- What is done to SW further by sweeper? (Segregation, transportation to local collection point etc)
- How is transported after the collection? Hand driven carts or small vehicles or some other means
- Where is it disposed?
  - MCD dustbin / collection point
    - Distance from the locality?
  - Open dumping
    - Which other localities
    - What could be the alternative use of the place

**Collection of SW from households**

**Disposal by household on their own**

- Local community bin
  - Distance from the locality?
  - Is it cleaned before it starts overflowing
  - What is the frequency of cleaning them?
- MCD dustbin / collection point
  - Distance from the locality?
  - Is it cleaned before it starts overflowing
  - It is cleaned in how many days?
- Open dumping
  - What are the problems faced due to its presence
    - Blockage of roads
    - Sewage problem
    - Carriers of rodents, vectors etc
    - Foul odour

Collection at source and other attributes

1. The female empowerment can be seen as having a direct relationship with the rent/income as a proxy for the standard of living which means that the level of income is having a direct impact on the socio economic scenario among the females of Delhi.

2. The **number of bins** in a household reflects the personal habits of disposing waste. It was found that most of the households have either one or two dins in their house. The case for 3 or more than 3 bins is rare. We cannot relate this result to the category because the information obtained is varied across categories.

3. A disaggregation is done to know if the waste is disposed on their own then where it disposed is. This question was answered by 18 out of 72 households and it was found that 8 households practised open dumping and 7 use local community bin. We cannot conduct a test here due to the limitation of small sample size.

4. The test for proportion of households who give the waste kudawala is found to be insignificant between category C, D & E and category F, G & H. Hence, we can say that there is no significant difference in the disposing habit of the households across categories.

5. A disaggregation is done for the collection done at door step. We find out which organisation/agency do the task of door to door collection. This question was answered by 54 households. The two major observations made are that 72% (39) households believe that the collection is done by private agency and none of the households reported that the waste was collected by an NGO in their colony. The remaining 11% (6) said that it is done by MCD and 17% (9) households were unaware.

6. Overall the average was found to be Rs 47 per month; the minimum and the maximum amount paid are found to be Rs 0 and Rs 100 respectively. This answer to this question was not known in category A&B. It is observed that there is a significant different and higher in the charges paid to kudawala in category C, D&E and category F, G&H. This can be related to better service of the workers in the higher categories. In the lower categories, since the pay is relatively low, the workers do not have sufficient incentives to work.

Transportation and community level

1. The **waste is transported** by hand driven carts or small vehicles in most of the areas as told by 54 households.

2. The existences of MCD collection point, the result are found to be significant. Moreover, its significantly greater in category C, D & E than category F, G & H as

reported by the households. On the other hand the results on the existence of local community bins in insignificant.

3. The test for comparing the difference between the cleanliness maintained for the storage facilities set up by MCD is found to be insignificant and hence we concluded that there is no significant difference in the cleanliness in category C, D & E and category E, F & G. Another observation made here is that lack of awareness amongst the households, they do not even know about if there even exists a storage facility for waste in their area.

4. The absence of **different collared bins** was reported by 59 households. Moreover it was found that there were no bins at all in lower categories, being of different colours are out of questions. It is also found that the practice of open dumping is practiced most where there are no bins at all.

5. We do not observe a decreasing or an increasing trend along the categories in the prices of paper in the second goods market across categories and there was no/improper response for the prices of plastic. We also see there is a discrepancy in the prices told by the households and the segregators. The maximum price told by the segregators is also lower than the minimum price told by the household. The reason being that there no perfect market mechanism and the workers do cannot negotiate for higher prices.

6. Due to absence of proper mechanism to dispose, construction malba leads to various problems like blockage of roads and drains. Especially during rainy season, the roads are blocked by water because the water does not pass through as the drains are blocked because of malba. This observation was made in north Delhi. Due the construction taking place all over Delhi due to commonwealth games, the presence of malba has become a routine in almost all areas.

7. Unawareness about the privatization.

**CONCLUSIONS**

1. The role of civil society and institutions (RWAs, NGOs etc.) can be instrumental to make SWM efficient and effective by encouraging reduction in waste generation and segregation at source. The utilization of waste in a manner to create alternate energy source instead of making it a burden. It can also empower market mechanism by enforcing formal employment scheme as mismanagement leads to various other problems.

2. The informal structure of rag pickers and segregators engage many children which is one of the worst forms of child labour. It also leads to problem of maintaining law and order as per Delhi police as these children are found to be involved in illegal activities

3. Segregation can be promoted if the segregator is well known in the community by the households. The segregator should have an identification given by the authorities (MCD, RWA, NGO etc)

4. Encouraging segregation during collection, proper mechanism and incentives are required which will lead to less burden on the landfills and more alternate sources of energy. This mechanism was observed in Chandigarh. A similar mechanism can be replicated in Delhi.

**SUGESSTIONS AND POLICY RECOMMENDATIONS**

1. Steps should be taken to install different coloured dustbins category where required to accomplish this task, the government should join hands with NGO's. The bins should be located at a central point to make it accessible to maximum number of people.

2. Collection facilities should be improved, open dumping should be discouraged.

3. Public awareness should be created about the importance of hygiene and cleanliness. For example, practice of covering the bins can help to reduce the possibilities of many diseases.

4. Special attention should be paid to the health factor in the slum areas. This can be done by regular visits by the doctors in the nearest government hospital.

5. A market mechanism should be created where the people have an incentive for proper disposal of the waste.

6. Compulsory education at all level may be adopted in order to protect environment for the waste pollution.

7. Segregation should be promoted at all levels. Avoid, Reduce, Reuse & recycle should be followed as a culture.

In order to have a satisfactory, efficient, and a sustainable system of solid waste management, the following aspects need consideration:

1. Door to door collection of the waste may be adopted and the job may be assigned to the ragpickers. Aided by proper awareness building mechanism, good results may be obtained in terms of waste segregation and improvement in the state of the ragpickers. The financial sustainability of the setup may be achieved by asking for a nominal fee from the generators or/and handing over the recyclable waste to the ragpickers.

2. Targeting waste reduction at source: Waste reduction at source can be accomplished in three ways:

   (1) Fees and tax incentives to promote market-mechanisms to effect source reduction,
   (2) mandatory standards and regulations,
   (3) education and voluntary compliance with policies by business and consumers.

3. Market actions for waste reduction- By charging for the environmental and economic costs of production and disposal of waste upfront, market forces can be employed to improve the efficiency of waste management. By incorporating the cost of disposal also in the production cost, tendency to use less packaging or adoption of the recyclable/reusable packaging material would be promoted. At the consumer end also the tendency to reuse the material would be promoted.

4. Collection of waste - The preferred option would be to revamp the existing collection service structure to provide community with waste bins, conveniently placed for the people to deposit domestic waste, and door to door collection of waste. This along with separation of waste, at source, into biodegradable and non-biodegradable components would not only reduce the cost of transportation for final disposal but also provide segregated organic waste stock for waste to energy activities.

5. Treatment and disposal - Proper segregation of waste would lead to better options and opportunities for its scientific disposal. Recyclables for example, could be straightaway transported to recycling units, which, in turn,would pay the corporations for it, thereby increasing their income. Finally, the inert material that will be required to be sent to landfill would be of much lower quantity compared to unsegregatedwaste, consequently increasing the life of our existing disposal facilities.

6. To contain and control the problem, there must be `*awareness program*' & public participation to reduce solid waste.

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**APPENDIX**


MUNICIPAL SOLID WASTE (MANAGEMENT & HANDLING) RULES, 2000

There has been a formulation of rules and regulations for the same. The MSW Rules are applicable to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solids. The Rules essentially contain four Schedules and the study primarily emphasizes on the second who provides specifications relating to collection, segregation, storage, transportation, processing and disposal of municipal solid waste (MSW).

Some definitions as mentioned in the rules which pertain to our study area are as follows:
**"Generator of wastes"** means persons or establishments generating municipal solid wastes
"**Disposal"** means final disposal of municipal solid wastes in terms of the specified measures to prevent contamination of ground-water, surface water and ambient air quality.
**"Operator of a facility"** means a person who owns or operates a facility for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes and also includes any other agency appointed as such by the municipal authority for the management and handling of municipal solid wastes in the respective areas
**"Segregation"** means to separate the municipal solid wastes into the groups of organic, inorganic, recyclables and hazardous wastes
**"Storage"** means the temporary containment of municipal solid wastes in a manner so as to prevent littering, attraction to vectors, stray animals and excessive foul odour
**"Transportation"** means conveyance of municipal solid wastes from place to place hygienically through specially designed transport system so as to prevent foul odour, littering, unsightly conditions and accessibility to vectors.

According to the management and handling rules, 2000, **collection of Solid Waste** is defined as lifting and removal of solid wastes from collection points or any other location. Steps for the collection are mentioned below:
• Organising house-to-house collection through methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle;

• Devising collection of waste from slums and squatter areas or localities

• Management of biodegradable wastes collected from slaughter houses, meat and fish markets, fruits and vegetable markets

• Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose;

• Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerised carts or other small vehicles;

• Horticlutural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms.

• Waste (garbage, dry leaves) shall not be burnt;

• Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws.

The rules for segregation of municipal solid waste are
• In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials.

• The municipal authority shall undertake phased programme to ensure community participation in waste segregation by holding regular meetings at quarterly intervals with representatives of local resident welfare associations and non-governmental organizations.

The rules for storage of municipal solid waste are:
Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely:-


i. Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities

ii. Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly;

iii. Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste

iv. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.

The rules for transportation of municipal solid waste are:

Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:-
i. The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing;
ii. Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.


STATISTICAL METHODS USED

We use the following statistical tools to analyse and conduct the tests:

• t –test for comparing the difference in the means

• z-test for comparing differences in the proportions

• binomial exact confidence intervals to know the exact probabilities in case of small sample size

• standard error to know the variation in data across categories

Further results

HOUSEHOLDS

The **rent** of the household was told by only 38 out of 72 households.

The rent of the household is asked for two purposes:

1. It is taken as a proxy for the income and the standard of living of the households.
2. The categorisation of the MCD is based on the property value in each are. This helps us to confirm with this fact.

Category wise details are mentioned below along with the average rent in each category. The rent is found to be in line with the MCD categorization based on the property value. The rent falls as we move from A to H except for the categories G and H.

**TABLE 8: Rent of the household**                    **Units: In Rs.**

| CATEGORY | A&B | C,D&E | F,G&H |
|---|---|---|---|
| No. of respondents | 7 | 31 | 34 |
| Rent told by | 3 | 16 | 19 |
| Average rent(in Rs) | 26000 | 11656 | 5394 |
| Standard deviation | 15099.67 | 4982.365 | 2669.68 |
| Standard error | 8717.799 | 1245.591 | 612.4666 |

The standard deviation and standard error of category B, D and F comes out to be very high, it may be seen as the outcome of small sample size and various discrepancies in zonal areas of Delhi and inappropriate level of growth in all pockets. The test is found to be statistically significant.

The proportion of total income spent on health expenditure in a month, 62 out of 72 households answered the question, details are mentioned below

**TABLE 7: % of income spent on health**                    **Units: No. of Households**

| (In %) | A&B | C,D&E | F,G&H |
|---|---|---|---|
| 0 to 5 | | 7 | 5 |
| 5 to 10 | 1 | 2 | 4 |

| | | | |
|---|---|---|---|
| **10 to 15** | 1 | 6 | 6 |
| **15 to 20** | 1 | 3 | 4 |
| **20 to 25** | 2 | 7 | 5 |
| **25 to 30** | 1 | 1 | 3 |
| **30 to 35** | | 2 | 1 |
| **35 to 40** | | | |
| **40 to 45** | | | 2 |

38 out of 62 households sped < 20 % of their income on the health expenditure in a month

The **highest education of a female member** in the household

**TABLE 3: female education**                    **Units: No. of females**

| | A&B | C,D&E | F,G&H | O |
|---|---|---|---|---|
| PG | 2 | 9 | 4 | 15 |
| Graduate | 4 | 12 | 10 | 26 |
| 12$^{th}$ | 1 | 6 | 10 | 17 |
| < 12$^{th}$ | | 4 | 10 | 14 |

The sample size and the distribution is not be appropriate to interpret the general female literacy scenario in Delhi, although our observations suggests that the standard of living and rent of the house has a direct link with the literacy rate in Delhi as shown above. As we move down the category the no of years of education of a female falls.

In our sample the highest proportion of the females working is found to be in category B, C,D and then it falls. Its lowest in the last four categories. The trend in our sample is matching with the outcomes of the no of years of education of females.

| *Variable Name* | *P1* | *P2* | *Null hypothesis* | *Alternate hypothesis* | *p-value* | *10%* | *5%* | *1%* |
|---|---|---|---|---|---|---|---|---|
| **Female** | 12/31 | 6/34 | p1 − p2 = | p1 − p2 ≠ | 0.0580 | * | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **working** | | | 0 | 0 | | | | |
| **Female working** | | | $p1 - p2 = 0$ | $p1 - p2 > 0$ | 0.0290 | * | * | * |

**Binomial exact intervals at 95% level**

Dhalao Workers

The interpretation of the result is that if the true probability of covering the carts (*) were 0.0009373, the chances of observing a result as extreme or more extreme than the result observed i.e. 1 is 2.5% and if the true probability of covering the waste were 0.1897056, the chances of observing a result as extreme or more extreme that the result observed i.e. 1 is 2.5%. The standard error is .0363447

| *Variable* | *Lower limit* | *Upper limit* | *Standard error* |
|---|---|---|---|
| open dumping | .5371513 | .8888554 | .084337 |
| Dhalao clean | .2866725 | .6805035 | .096159 |
| carts are covered(*) | 0.0009373 | 0.1897056 | .0363447 |
| bins in the locality are cleaned | .1940072 | 5763204 | .0929349 |
| segregate the waste | .0418874 | .3373109 | .3373109 |

Segregators

| *Variable* | *Lower limit* | *Upper limit* | *Standard error* |
|---|---|---|---|
| open dumping | .5371513 | .8888554 | .084337 |
| carts are covered | .6191701 | .937 | .0747568 |
| bins in the locality are cleaned | .1111446 | .4628487 | .084337 |
| segregate the waste | .5371513 | .8888554 | .084337 |

QUESTIONNAIRES

**Household's questionnaire**

Basic information

1.Name-_____

2. Rent of the house-_____

3. Highest education of female member in the household-_____

4. If the female members of the family are working- y___ n___

Information on collection of SW

1. How is the waste disposed-

collection by kuda wala-_____     disposed on your own-___

2. If you dispose it on your own then where?

local community bin-__   MCD dustbin / collection center-___

open dumping-___        others-___

3. If collection is done from the doorstep then whether its done by

Municipality-__           Private Agency -           NGO-____

4. If collection by kuda wala then,monthly charges paid-____

5. How is the collected waste transferred to community bin?

 hand driven carts-__   small vehicles-__   other(specify)_____

6. If there exists a local community bin-  y_____ n__

7. If yes then , its distance from the locality-

8. If there exit MCD dustbin/collection center in the locality? Y__ n__

9. If yes then , its distance from the locality :

10. If there exist open dumping near the locality? Y___ n___

11. If yes then , its distance from the locality :

12. How many times does the waste is taken away from the locality in a month-

     MCD-____       others-_____

13. Are the storage facilities set up by municipal authorities daily attended for clearing of wastes?- y_____  n_____

14. Are the bins or containers wherever placed cleaned before they start overflowing? -

15. Problem if any faced due to presence of waste in the locality?

foul odour-___    sewage problem-___ rainy season-___ road blockage-____

others(specify) -_____

16.Are the bins for storage different for bio-degradable wastes:painted green , recyclable wastes:painted white and other wastes:painted black :   y_____   n_____


Information on personal habits of disposing and hygiene

1. Number of dustbins in the house-_____

2. Composition of waste of the household(approximate proportion)

Kitchen-_____ paper-_____  plastic-_____ other-_____

3. Is the waste segregated? Y _____ N _____

4. If yes then what all:

Kitchen-_____  paper-_____  plastic-_____  metals-_____  other-_____

5. Is there availability of the scrap vendor? Y _____ N _____

6. If yes what all?

Paper -Rate/Kg ___                    Plastic-Rate/Kg___


Information on Health

1. Which doctor/hospital/dispensary is visited in case of illness-_____

2.  Are free govt health facilities available?-  y___ n___

3. What proportion of total income is spent on health expenditure? _____

4. If the children under 5 have been diagnosed with the following diseases in the past 2 months and in each season:

|  | 2 months | Winter | summer | Monsoon | Autumn |
|---|---|---|---|---|---|
| fever(no of times) |  |  |  |  |  |
| cough(no of times) |  |  |  |  |  |
| cold(no of times) |  |  |  |  |  |

5. Presence of which diseases do you think can be attributed to the mismanagement of SW?

6. What can be done for better SWM?

_____

7. Is the MCD efficient? _____

8. What should be done for better results? _____


Information about the community:

1. Do you know who cleans the community? Y_____N_____
2. What is the frequency of cleaning in a week?

3. Do you know the ASI/SI of you area? Y_____N_____

4. When is the Dhalao cleaned? Time_____ Frequency in a week_____

5. After privatization is the cleaning of Dhalao better or worse?

6. Are the rag pickers useful? Y_____ N_____

7. Should they be permitted? Y_____ N_____

8. What happens to the dry leaves around the locality?

Left_____ Burnt_____

**Waste collectors' and segregators' survey**

1. Name: _____

2. Area: _____

3. Where do you come from?

4. Employed by : RWA____Private agency_____NGO_____Self employed_____

5. Organisation Structure_____

6. How many segregators' work in the locality?

7. Are they unionized?

8. Waste is taken to which place?

9. How is it transported?

10. What is the distance of the local community bin from the locality?

11. How many times is the waste carried to the segregation point in a day?

12. What is the volume of the waste carried per day?

    In kgs_____ in tons_____ in quintals_____

13. The vehicle used for transportation is covered? Y _____ N _____

        Reasons:

        Solutions:

14. Are the bins clean in the locality? Y_____ N_____
    Reasons:

    Solutions:

15. Is the waste segregated? Y_____ N_____

16. Where is it segregated?

17. What is the distance of the local segregation point from the locality?

18. What is the percentage of the waste that is segregated out of the total waste in each cart?

19. In the segregated waste what is the proportion of the following

    Paper _____Plastic _____Metals_____Other Material_____

20. What is done with the segregated waste?

    Sold_____ Disposed _____ Compost _____

21. If Disposed, then where? _____

22. If sent for Compost then where? _____

23. If sold then at what price per unit:

    Paper _____Plastic _____Metals_____Other Material_____

24. What is your income per month from segregation?

25. What is your opinion about the process of segregation?

26. What are the limitations of the system?
_____

27. What are the suggestions to improve the system?
_____

28. What is the health impacts faced?
_____

29. What do you do to protect yourself? Eg : use of gloves , boots , masks etc
_____

30. Market Dynamics:
_____

31. What can be the role of MCD?
_____

32. What are the other sources of income :
_____

33. Open Dumping:
Reasons:

Solutions:

34. What measures would bring efficiency and effectiveness in the SWM:
_____

**Dhalao workers questionnaire**
1. Name _____
2. Area_____
3. Work for _____
4. Income per month_____
5. Tools used _____
6. Waste is carried to _____
7. What is the distance from the locality to the place where waste is taken_____
8. Are the carts covered : Y_____ N _____
   Reasons

   Solutions:

9. Are the bins clean? Y_____N_____
   Reasons:

   Solutions

10. Condition of the tools (how many years old, broken etc.)
_____

11. What are the problems faced in this work?
_____

12. How can MCD solve these problems?
_____

13. What are your suggestions to improve the functioning?

_____

14. What          is          done          with          dry          leaves?
_____

15. Is the Dhalao kept clean? Y_____ N_____

    Problem faced _____

    Remedy

16. Is segregation done? Y _____ N _____
17. Is there open dumping? Y _____ N _____

    Reasons:

    Solutions:

18. What can the MCD do for Dhalao Workers?

19.  Is the design of the Dhalao appropriate or should it be improved?

20. Should there be gate on Dhalao or not? Y_____ N_____

21. How          does          the          presence          of          gate          help?
    _____

22. Does the presence of gate leads to any difficulty?