

CLUTER INNOVATION CENTRE

# Trust in Waste. Don't Just Throw It Away!

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Semester Long Project

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## **Abstract**

The following project aims at identifying the waste management problems of the Vijay Nagar colony in Delhi and understanding the organization of players in this region. To tackle the specific problems, strategic solutions have been proposed so that waste management is more organized and the players make the best out of waste. The solutions aim to tap the mantras of reduce, reuse and recycle and implement them in such a way that efficient waste management becomes a part of our lives unconsciously.

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## **Acknowledgement**

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## 1 Introduction

Delhi is a densely populated city and is the second most populated city in the world. The city generates around 9,000 tonnes of waste daily. The large amount of waste generated is due to the rapid increase in population, mass migration to Delhi, increase in economic activities and change in lifestyle of people. Therefore, as we move ahead in time the waste generated also differs and hence there has to be amendment in the existing laws of waste management. The other major factor which determines the kind of waste management practices is the type of waste generated. Delhi is packed with residential colonies, industries and manufacturing units, schools and colleges, corporate and government offices, market places and malls and eateries, hospitals and clinics. Therefore the waste is a mixture of municipal waste, construction and demolition waste, E – waste, commercial and industrial waste and hospital waste some of which is even hazardous waste. The kind of waste generated in Delhi is of every kind thinkable. With the said problems there has to be a very efficient garbage collection, segregation and disposal system in Delhi to take care of this large amount and variety of daily waste.

The solid waste generated in Delhi is managed by 3 bodies: Municipal Corporation of Delhi (MCD), New Delhi Municipal Corporation (NDMC) and Delhi Cantonment Board (DCB). These are further assisted by a number of other agencies.

Table 1 Status of Waste in Delhi

Agency	Area (Sq. Km)	Population (Million)	Waste Generation (MT/Day)	Landfill (MT/Day)	Composting (MT/Day)
MCD	1399	13.8	7000	5500-6000	350-400
NDMC	42.8	4.5	250	170	80
Delhi Cantonment Board	43	0.13	60	60	0

Source: <http://dpcc.delhigovt.nic.in>

According to Delhi Pollution Control Committee (DPCC), the MCD has the responsibility of collection of the waste from *dhallons* and has also improved its services and included door to door collection, segregation, privatization of collection for collection & transportation in some zones (Karol Bagh Zone, West Zone, Central Zone, South Zone, City Zone and SP Zone). And NDMC is responsible for segregation and road side collection of sweeping waste mechanization of sweeping at least in VVIP areas Door to Door Collection.

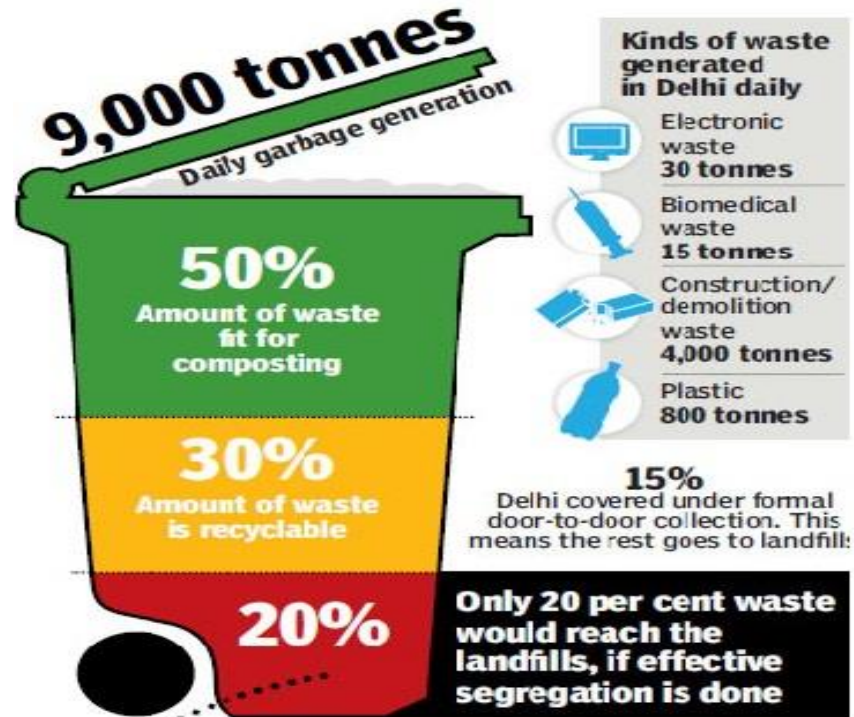


Figure 1 Amount of Waste Generated in Delhi

Source: <http://www.hindustantimes.com/news-feed/chunk-ht-ui-indiasectionpage-htfordelhi/delhi-may-drown-in-its-own-waste/article1-1052381.aspx>

The ordinary sight of waste in a metropolitan city like Delhi motivated us to pick a project on Solid Waste Management. But the problem is not waste. The problem is that its waste everywhere, waste is unmanageable and it might soon engulf the entire city. The amount of waste generated in the city is astronomical. Also 95% of area of Delhi is under MCD and hence the waste management in the city is centralized and hence difficult to manage. Currently there are 3 landfill sites in operation in Delhi. These are located at *Bhalswa* (40 acres), *Okhla* (56 acres) and *Ghazipur* (70 acres). These have exhausted their lifespans but dumping continues. Two landfill sites are proposed in *Jaitwar* (26 acres) and *Bawana* (150 acres). The landfills sites which were once outside the city are now inside the city since the city is expanding. Ideally the biodegradable and non – biodegradable waste should be segregated and treated. But in the current landfill sites everything is dumped to form a huge hillock of waste. During rains a thick black liquid called leachate runs down the landfill making the ground highly toxic and also methane is released to the atmosphere. According to an article in The Hindustan Times, the civic bodies have now confessed in front of the Delhi High Court that since there is no alternative left and hence human life and property are forcibly at risk. A lot of waste generated can be reduced, reused and recycled if and only if proper segregation is done. However, in the present scenario only random picking continues. The civic bodies blame the residents for not segregating properly but the question is what the use is when at the end of the day everything gets mixed up? The

same report by The Hindustan Times also says that only 15 percent of the total funds allocated to the 3 corporations of Delhi to be used for waste disposal and sanitation are used for actual disposal and the rest of the funds are used in collection and transportation. On the other hand plants of Waste to Energy conversion and Waste to Compost, authorized by DPCC, are under operation but they are not a success due to a lot of factors.

Table 2: Status of Solid Waste Management in Delhi

Details	Capacity/ Quantity
<b>Generation of Municipal Solid Waste (MSW)</b>	8500 TPD
<b>MCDs Collection <i>Dhalla</i>s</b>	168 Nos.
<b>Total Quantity of MSW through Sanitary Landfill Sites</b>	5700 TPD
<b>Total Quantity of MSW treated</b>	1000 TPD
<b>Proposed Quantity for treatment of MSW</b>	8800 TPD

Source: <http://delhi.gov.in>

In this project we are focusing on the area of *Vijay Nagar*. *Vijay Nagar* is a colony in *GTB Nagar* ward of the MCD, which lies in the *Civil Lines* zone. This colony has a residential complex and a small market. Most of the waste in the colony is generated from the houses and the market. Hence, the focus of our project is on Municipal Solid Waste. There are a lot of eateries in the area because it is nearby University of Delhi and also serves as the resident for a lot of out station students.



Figure 2: Waste in Media

Therefore, given the kind of economic activities in *Vijay Nagar* we were expecting the following kinds of waste to find in *Vijay Nagar* –

- **Biodegradable waste:** food and kitchen waste, green waste (vegetables, flowers, leaves, fruits), paper.
- **Recyclable material:** paper, glass, bottles, cans, metals, certain plastics, etc.
- **Inert waste:** construction and demolition waste, dirt, rocks, debris.
- **Composite wastes:** waste clothing, Tetra Packs, waste plastics such as toys.

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- **Domestic hazardous waste** (also called "household hazardous waste")
  - **Toxic waste:** medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

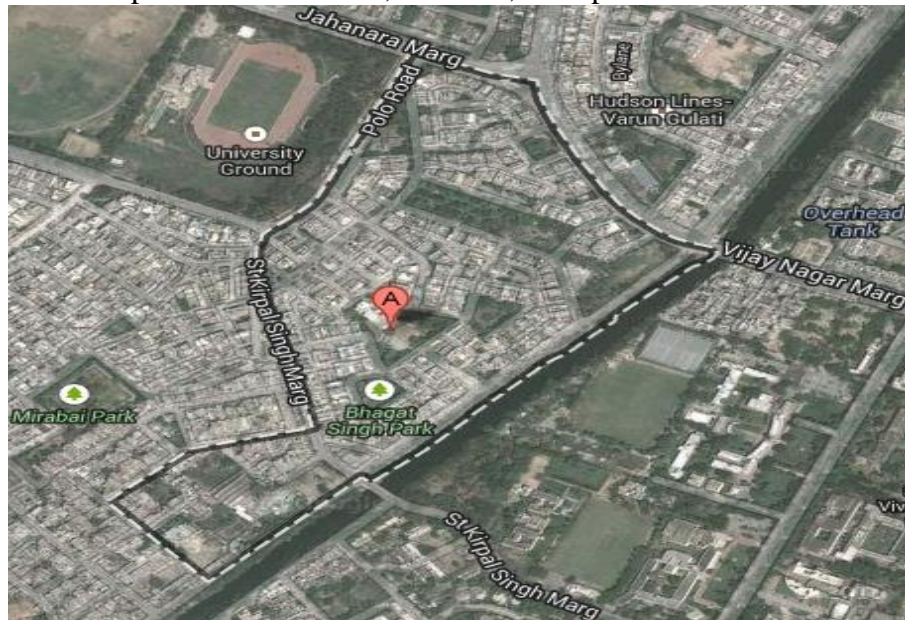


Figure 3: Map of Vijay Nagar

Source: Google Maps

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## 2 Objectives

The ideas and steps conceptualized for the implantation of the project are as follows –

1. To study the challenge of waste management in Delhi with Vijay Nagar as the case study.
2. To explore the journey of waste right from where it leaves the generator till it reaches its destination and the roles played by different players.
3. To understand the economics and environmental impacts of waste management.
4. To propose solutions for efficient waste management in Vijay Nagar for doing away with economic problems, environmental problems and issues of occupational hazards.
5. To develop a social entrepreneurship model for Vijay Nagar and surrounding areas so that waste management is organized and decentralized

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### 3 Methodology

To achieve our objectives the following methodologies were adopted –

1. In the beginning of the project, we explored Vijay Nagar to study the types of waste generated in the colony.
2. We were then convinced that most of the waste in Vijay Nagar is municipal waste. We conducted surveys to understand the roles, working methodology and hence draw a hierarchy the waste takes, we surveyed various households, eateries, daily waste pickers, sweepers, *dhallon* keepers, rag pickers, stationary *kabadiwalas*, mobile *kabadiwalas*, MCD vans and MCD trucks. From these surveys we were able to point out the working conditions, economic status and health conditions of various players. We set out to survey the players in the morning so that we encounter the maximum number of waste pickers and sweepers. (respective survey sheets are in Appendix I)
3. Conducted interviews with all stakeholders to identify shortcomings and loopholes in the waste management sector.
4. Based on the understanding developed from the survey, plans to promote segregation, decentralization, reducibility and recyclability have been theoretically formalized. We have begun to implement the Plans for reusability of goods

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## 4 Observations

### 4.1 The Players

#### 4.1.1 MCD Sweepers



Figure 4: MCD Sweeper in action

*No of Days: 6*

*Working Hours: 8*

*Salary Earn: 20,000 – 25,000*

*Health Issues: Asthma, Acid Burns, Arthritis during their retirement*

*Safety Measures: Nil*

The sweepers are working directly under the MCD and hence have the income structure like that of a regular government employee (includes GPF, home rent etc.) and have holidays on Sundays and other gazette holidays. They have fixed working hours (7 am to 3 pm). Sweepers are working in an organized system where each sweeper is allocated a fixed area which is rotated on regular basis. Their work includes sweeping the assigned area, to collect the swept out waste and to dump it to the nearest dhallons. Our survey with MCD sweepers suggests that there aren't any proper measures taken to ensure that their operations are carried out with ease. *Iqbal* (name changed), a MCD sweeper said, “*We are given two brooms an year, which are not sufficient. We need 2-3 brooms every month*”. Moreover, there aren't any safety measures taken for health of MCD Sweepers. “*There was proper health checkup, when we had joined MCD. But after serving MCD for around forty years, working in dirt, dust, acid while cleaning toilets, we develop problems like asthma, acid burn, and pains in joints and spine, there aren't any steps taken to address our health issues. Even the basic amenities like gloves, shoes, masks are not provided during duty.*”

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#### 4.1.2 *Dhallon* Keeper



Figure 5: *Dhallon* Keeper

There were three *dhallon* keepers that took care of *dhallon*. In a survey to *dhallon thakedar*, we came to know that these were three people who were allowed to scavenge through waste & earn their living. In lieu of that, they have to carry out the job of cleaning and maintaining the *dhallon*. From our observation, we can state that they were scavenging through waste with bare hands and uncovered mouth and hence have a risk of problems like asthma, bronchitis etc.

#### 4.1.3 MCD Van (Driver)



Figure 6: MCD Van (*Chhota Hathi*) for door – to – door collection

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*No of Days: 6*

*Working Hours: 6-7*

*Salary Earn: 8500*

*Health Issues: Swelling of fingers, breathing problems*

*Safety Measures: Nil*

Waste collection van in *Vijay Nagar* area covers single plus double storey buildings. It covers around 700-800 buildings each day. MCD in *Vijay Nagar* area has outsourced its work to a private firm. These vans are operated and maintained by DMSWSL. DMSWSL is successfully running this service in *Vijay Nagar* since past 4.5 years. There are a helper and a driver who daily collect waste from households and dump them into nearby *dhallon*. During non- working hours, these vans are parked in DMSWSL depot. They are cleaned on the weekly basis. With our observation, we can clearly state that, while working, there isn't any fixed path or route that van follows, plus there isn't any segregation of waste in the entire process. While talking to the driver and helpers, we came to know that health issues are not addressed properly; there aren't any gloves or masks provided to workers, which has led to swelling of fingers and breathing problems amongst workers.

#### **4.1.4 MCD Truck (Driver)**

*No of Days: 6*

*Working Hours: 7-8*

*Salary Earn: 7500*

*Health Issues: breathing problems*

*Safety Measures: Nil*

MCD truck involves secondary collection of waste from dhallons, collection of dustbins that are deployed on road sides and dumping the collected waste in landfills (in *Bawana*). There wasn't any segregation of waste from dhallons to landfill site. In *Vijay Nagar* area, this service has been outsourced to *Ramky* (a private firm involved in waste collection process). A single truck is deployed for both *Rohini* and *Civil Lines* area. There was a helper and a driver with the truck. There wasn't any qualification required for this job and they were there since last four years on this job. Even, there was lack of safety equipment for people working in this job.

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#### 4.1.5 Household



Figure 7: A resident of Vijay Nagar using the MCD van waste collection facility

In the entire process, households are the primary source of waste generation. Waste like tea leaves, left out food, old bread, stale vegetables and fruits, milk bags, packaging of food materials are generated on daily basis and are dumped on daily basis by the means of Daily Waste Picker or MCD Vans. While old newspapers, used papers, cardboards, e-waste, and glass, wood, plastic, old bags, shoes, old home decors are generated on periodic basis and are dumped by the means of daily maid or local or stationary Kabadiwalas. People in Vijay Nagar area gave mixed reactions for both Delhi Waste Pickers and MCD Vans. They spend from 50 to 150 rupees for dumping their waste. While many shifted from daily waste pickers to MCD Vans for dumping their waste, many other complained about the uncertainty of time and arrival of MCD Vans. The free of cost service by MCD for collection of waste in a society was appreciated but still there were apprehensions about its operations. *Mrs. Namrata Gandotra* a resident of Vijay Nagar Single storey said, *“People living on the first, second and the third floor aim at the MCD Van and throw their waste directly from their apartments, and there are times when their waste get spill on the road, which leads to fight among neighbors. These MCD Vans are more of a nuisance in their area, are not being managed properly and have added to the problems”*. Although e-waste is much into news. But there aren't any specific practices followed to manage e-waste in Vijay Nagar area. People still sell their old mobile phones, microwave, refrigerators, TV to local or stationary *kabadiwalas* and are neither aware of nor provided with any alternative to manage e-waste in their area. There has been a consensus that these Kabadiwalas do not weigh properly but people are more interested in disposing off their waste rather than price paid for it. *Usha Sapra* said, *“These Kabadiwalas are allowed in our society only on Sundays. Although*

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*they are the people who are generally responsible for thefts and burglaries, but we do not have any alternative. Government should certainly intervene or device a way to manage this system”.*

#### 4.1.6 Daily Waste Picker



Figure 8: Daily Waste Picker in action

*No of Days: 6/7*

*Working Hours: 5-6*

*Salary Earn: 7000-8000*

*Health Issues: Swelling of fingers, breathing problems*

*Safety Measures: Nil*

Amongst all the players, Daily Waste Pickers form the most unorganized sector in the entire waste collection process. They are the ones who provide door to door service and segregate the collected waste and earn their livelihood by selling left-overs. While talking to these DWP, we get to know that they work under some *Thakedaar*, who has purchased a particular area and has permitted them to collect waste in their area. The hundred rupees per month for collecting waste in that area is pocketed by the *thakedaar*. Tapan Nath, a daily waste picker from Vijay Nagar area said, “Waste is a gold mine for us. We segregate plastic bottles, polythene bags, cardboard, paper from the waste, take the differentiated waste to Jahangirpuri and sell them over there and dump the rest of the waste in dhallons. There are the times when we could earn even thirty thousand a month from waste, the figures which even household giving us the waste could never imagine”. They in a way act as a player who creates value from the waste, and helps in

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increasing the recyclable value of our waste. After surveying a group of daily waste pickers, we could easily suggest that they are the people who have migrated to Delhi and now staying in Delhi in rented apartments generally in areas of *Jahangirpuri* or *Azadpur*. On an average they are able to earn seven thousand per month while working five to six hours a day. But since, they are working in an unorganized sector; they are bullied by policemen and even by local households while collecting waste. They are the ones who are affected directly or indirectly by introduction of new government policies, or any new measure taken to manage waste. *Anwar*, a daily waste picker clearly mentioned that with introduction of green colored vans (while giving reference to MCD Vans or Vans by private players) had sharply affected his source of income.

#### **4.1.7 Stationary *Kabadiwalas***

*No of Days:* 7

*Working Hours:* 8-9

*Salary Earn:* 25000-30000

*Health Issues:* Nil

*Safety Measures:* Nil

Stationary *kabadiwalas* have a fixed area from which they operate. They are the ones who have their self- owned shop, or have small settlement on road side area and are into this business since many years, in some cases from the time of their fathers and fore-fathers. They take stuff like glass, metal, paper, cardboard, thermocol, e-waste and call this stuff to be junk. There isn't any record of their buying and selling, or who sold them what. They further sell this junk in *Mayapuri* market. Price of junk is decided on the basis of the price paid to them from recycling plants and it changes from time to time. Mobile *kabadiwalas* and local residents are their primary customers. They follow a traditional style of working. Operations like segregation and dismantling are done in open with bare hands, comprising the safety of workers in these shops. Activities like burning of wires etc. to extract metals are commonly practiced.

#### **4.1.8 Mobile *Kabadiwalas***

*No of Days:* 7

*Working Hours:* 6

*Salary Earn:* 10000

*Health Issues:* Nil

*Safety Measures:* Nil

They are the ones who can be seen on their bicycles & asking out for our junk in colonies. There aren't any different from stationary *kabadiwalas*, except that they are providing us with door to door service to sell our junk. They take each & every stuff which even stationary *kabadiwalas* could take. They collect junk from households at a slightly lower price than at what they sell to stationary *Kabadiwalas*. Our survey suggested us that there isn't any licensing or any kind of investment required to take up this job. I think this is the main reason that people migrating from other states to Delhi & willing to do a blue collar job, easily take up this job. There isn't any

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record of people serving in this sector. *Harun*, a mobile kabadiwala residing in *Malikpur, Delhi* said, “*I have been residing in Delhi since past five years and earning bread for my family with honesty. But we are continuously harassed by police and watchmen. We are blamed and questioned for thefts and burglaries in society.*”

#### **4.1.9 Rag pickers**

*No of Days:*

*Working Hours: 2-3, takes up other occupation like selling of toys*

*Salary Earn: 1-2*

*Health Issues: Back Pain, Arthritis*

*Safety Measures: Nil*

They are the ones who earn their livelihood by picking up waste material from streets, refuse heaps etc. In this they collect paper, cardboard, glass, wood etc. any stuff which would have a resale value or could be used to their personal use. For example, the wood they collect may not have reusable or recyclable value but can be used as a fuel to the fire, which can be used for cooking their food. They basically reside in rented *jhuggis* or slums of Delhi. Children of very young age could be scavenging through heaps of waste near *dhallons*, industrial areas etc. where there is a high probability of waste being generated/collected. Money they earn through this waste is not enough, so they take up other odd jobs like working as a domestic helper, selling hand-made stuff on red lights and road side area. They do develop diseases like spinal pain, neck pain over time.

#### **4.1.10 Eateries**

Eateries are the commercial eating outlets and *Vijay Nagar* market is flooded with such eateries like *BYD (Big Yellow Door)*, *WoodBox Café*, *Ricos* etc. They generate a huge amount of kitchen waste and hence have a greater responsibility of disposing of their waste in an environment friendly manner. Our survey suggested that almost 95% of our waste generated by these eateries is kitchen waste either it could be because of cooking or because of left out food by its customers. Eateries have a fixed Daily Waste Picker who carries its waste daily and charges from 500 – 800 rupees per month. And the rest of junk that may include glass bottles, tin can are sold to *Kabadiwalas*.

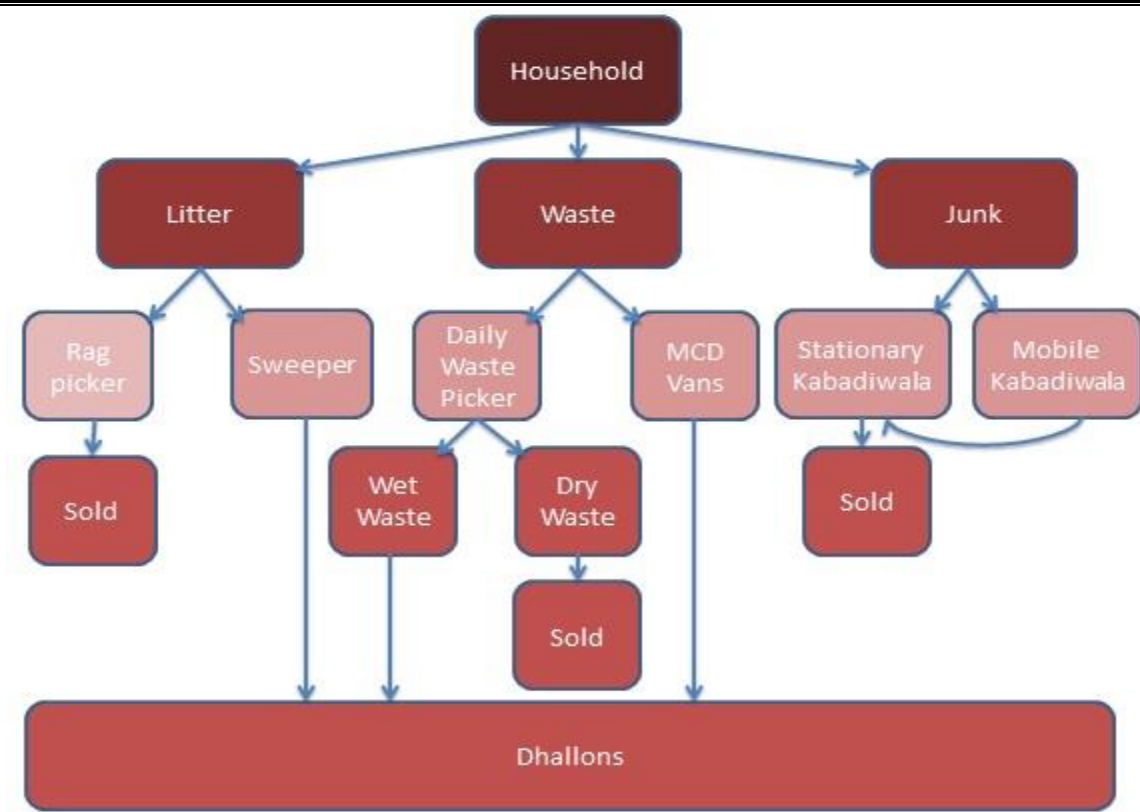


Figure 9: Organization of players

## 4.2 Waste Management in Vijay Nagar

### 4.2.1 The Overview of Roles of Players

Vijay Nagar area comprises of single and double storey residential colonies, eateries, shops and showrooms etc. with huge student fraternity residing in or nearby areas. A huge amount of waste (any substance which is of no use to possessor, it may or may not have a value to the other person) is generated on a daily basis by a large working population. Waste in Vijay Nagar area goes through varied channels and all the said players and organizations like MCD & Ramky play a major role in managing its waste. Household, eateries, shops and showrooms are major waste producer in Vijay Nagar area. In a way, we can easily say that there is a huge hierarchy that exists between these different players. The goods with higher monetary value go by the means of *Kabadiwala*. Whereas, Daily waste Pickers, Rag Pickers, *Dhallon* Keeper makes their money from litter or scavenging through left-outs. MCD Sweepers is elitist group amongst them, who are paid fixed salary and are quite easy on their duty as compared to other players. MCD Sweepers are most organized and formal amongst all the players. They earn 20,000 – 25,000 per month and work 6 -7 hours a day. Their sweep roads and clean toilets as the part of their job.

The waste pickers deal directly with the households. They charge Rs.75 to Rs.100 from households. From our observation, we can state that Daily waste Pickers visit the area early in the morning, picks up the dustbin from their door-step and segregates the waste on his rickshaw.

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He segregates plastic bottles, milk bags, sweets boxes from the waste and sells them in Jahangirpuri market. In the case of the daily waste pickers the waste is collected and segregated. Papers, cardboards, plastic, metals etc. are sold to the stationary *kabadiwala* and this is the source of income of the daily waste pickers. The junk (newspapers, plastic, glass, cardboards, and electronic waste) from the households is sold to a stationary or mobile *kabadiwala*. Generally each colony has its particular mobile *kabadiwalas*. They further sell the waste collected to stationary *kabadiwalas* at a higher price. From the stationary *kabadiwalas* the waste is sent to different places according to the type of waste. We were told that these items are recycled at plants across North India. Added to these, rag pickers play an important role in segregation. They use the waste they segregate for their household use and sell the rest which forms their meagre income. We saw some daily waste pickers indulged in segregation at the *dhallaon* as the MCD van that dumps the waste at the *dhallaon* do not segregate waste. Therefore, we see the role of daily waste pickers and rag pickers as almost the same.

#### 4.2.2 The Service Providers: MCD and Ramky

The management of waste in *Vijay Nagar* is the responsibility of the Municipal Corporation of Delhi. The MCD has outsourced the job to *Ramky Enviro Engineers* who take care of the collection, transportation and disposal of waste in the *Rohini* zone and *Civil Lines* zone. (*Vijay Nagar* is in *Civil Lines* zone.) In other words Ramky takes care of both primary waste collection services (door to door waste collection) and Secondary Waste Collection services (*Dhallaon* to landfill waste collection) to *Ramky* (private firm to manage waste). *Ramky* charge MCD around Rs.500 per ton for Primary waste collection and Rs.1500 per ton for Secondary Waste Collection<sup>1</sup>. It is seen that people in *Vijay Nagar* are dependent on both MCD Van and Daily Waste Picker for their daily waste disposal though MCD provides its service free of cost. These MCD Vans are by *Ramky*. The same van covers single and double storeys buildings. It is running in the area since past 4 to 5 years. It visits each and every *Vijay Nagar* block blowing a siren on their arrival, so that people can get out from their houses and dispose their waste in the van. Once this van is filled up to its brim or is expected to fill, they take it to *dhallaon* and empty it there and start their second or third round in the similar manner.

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<sup>1</sup> Data through informal communication with *Ramky* official

No record of number of people employed as daily waste pickers, or local or mobile *Kabadiwalas*.

No proper segregation by MCD Vans

Results of doubts between MCD sweepers and MCD Officer

Waste from *Kabadiwalas* has more resale, recyclable value than those from DWP

Table 3: Differences between Ramky and MCD

Ramky	DWP
No segregation	Segregation, segregated waste is a source of income
Free service	Charge for service
Defaults in service common	No defaults in services
Do not have a fixed time	Fixed time of arrival
Roam about in the colony and do not go door to door, not very convenient for residents other than ground floor residents	Door to door collection
Poor segregation	Better segregation than Ramky

#### 4.2.3 Interaction with Ramky

As already discussed, Ramky takes care of primary and secondary collection in Civil Lines and Rohini zone and in the NDMC region, Ramky has installed bins which are its responsibility. The bins are emptied at regular intervals and the waste is treated in the same way as in the case of *Rohini* and *Civil Lines*. Ramky officials told us that the waste is not segregated at the source, though according to the contract with the MCD segregation at the source was one of the clauses and had to be ensured by Ramky. A good amount of funds is therefore, invested in raising public awareness through street plays, campaigns and so on. However, all these efforts have been failures as segregation at source remains a dream. This door – to – door collection is implemented using the *Chhota Haathi*(Figure 3) This is a kind of small truck. But an important point to note is that all the waste collected is dumped together. So, even if some of the residents are segregating the waste at the source at the end of the day what we get is a huge heap of all kinds of waste. Ramky officials claim that in the *dhallon* the keepers ensure that there is no random throwing of waste (especially by the juice vendors etc.). They say the keepers also click pictures of the *dhallon* after regular time intervals and the send them to the office.

Ramky ensures that the waste collected in the *dhallons* is removed every 24 hours. From the *dhallon* the waste is picked by a bigger MCD truck. A special vehicle is used to load the truck with the waste. (Figure 4) The MCD trucks collect waste from a number of *dhallons* and take them to the landfill site. The waste is segregated according to the particle size using machines and chemicals. The Ramky landfill is at *Bawana* where the only 10% of the waste is thrown. *Bawana* is a new landfill site and there is an upcoming waste – to – energy plant in the landfill which will be in operation shortly.



Figure 10: Vehicle to load the MCD truck with waste

#### 4.2.4 Occupational Hazard Risk

But on the part of waste management players, it can be concluded that there have not been any proper safety measures for the health of these Daily Waste Pickers, MCD Truck (drivers), MCD Van (drivers), MCD Sweepers, Dhallon Keepers and Kabadiwalas. Segregation of waste by bare hands results in swelling of fingers of Daily Waste Pickers and MCD Truck people. The cleanliness and maintenance of MCD trucks and vans is not a priority. In addition to that, there isn't any mask while they work. It leads to various respiratory problems. Even MCD sweepers are devoid of basic safety equipment like mask, gloves and shoes. Their job is to sweep the roads. There have been the cases that when they quit the job, they end up having problems like arthritis, spinal problems due to their working pattern.

#### 4.2.5 Ambiguity in Organization

We were told by some daily waste pickers that they are work under *thakedaars* who in a way 'own' a particular part of Vijay Nagar. Under this system, the Daily Waste Pickers are exploited. Money collected from waste collection from local household goes to these *thakedaars* and DWP earns their livelihood by merely selling the segregated waste. Waste collection being an unorganized process in Vijay Nagar Area, carries no record of number of people employed in this sector. It is very easy to enter and exit from this sector. Further, people in this sector do not carry any recognition and are constantly bullied by Police. *Kabadiwalas*, generally engaged in buying and selling of old and used stuff, end up in dealing with stolen stuff and are sometimes held responsible for the crime that may have been committed by that stuff. Hence, there isn't any record of buying and selling by *kabadiwalas*.

We met some *dhallon* keepers during our visit to a *dhallon* at *Vijay Nagar*. There were three people working as care takers who were not being paid anything and depended on the waste for

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their livelihood. We then talked to the person under whom they work and he said that there was some particular number of *dhallons* under him. However, Ramky says that this sort of system doesn't exist and they haven't leased out the *dhallon* to any private contractors.

Another important question that struck us after learning all this is that how is such segregation of this level achieved without proper segregation at the source? The waste, even if segregated later on, loses its value after going through all the levels without proper segregation. However, segregation on the basis of just particle size and magnetic properties cannot help us achieve 100% segregation.

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## 5 Conclusions and Recommendations

From our findings in the *Vijay Nagar* area we would like to propose some solutions that would help manage municipal solid waste in a better way. There are some key ideas that we would like to focus on. These are the points that all waste management organizations are focusing on.

### 5.1 The Economics: Current system and proposed system

There are various paths for waste to take from households to landfills. However, we know that in the current system, waste is not used to its maximum capacity. So we thought of analyzing the value the waste has when it goes through a path in which segregation is involved and a path of the current system. The composition of the waste is 82% organic waste, 8% is plastic, 9% is paper and 1% is glass (refer figure 5). 0.6 kg waste is generated per capita per day in Delhi. The daily waste pickers sell the waste to *Kabadiwalas* at Rs.5 per kg for plastic, Rs.2 per kg for paper and Re.1 per kg for glass. If all of these wastes are not segregated then it is sold for Rs.1.5 per kg.<sup>2</sup>

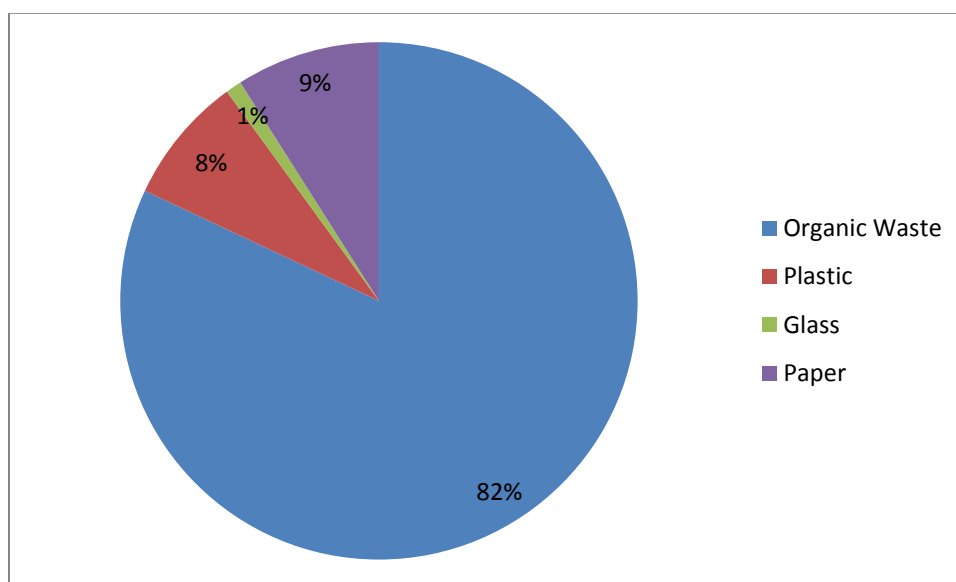


Figure 11: Composition of Daily Municipal Solid Waste

Source: Sustainable Solid Waste Management: Issues, Policies, and Structures By Urvashi Dhamija

For calculating the change in the economics of the system when we consider the present system and a system in which segregation is done, there are certain assumptions.

1. We are doing the calculations for a sample of 1000 individuals.
2. There are 5 members in the family
3. 50% of the residents give dispose their waste using MCD vans (comply only in current scenario) and 50% dispose their waste using daily waste pickers.

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<sup>2</sup> The values were found during the survey conducted.

4. The waste dumped at the *dhallons* is segregated and resold by the daily waste pickers. The efficiency of segregation by the daily waste pickers at the dhallons is 100%.
5. The role of the rag pickers is considered to be done by the daily waste pickers because during our surveys at the dhallon in Vijay Nagar we found that the daily waste pickers are also involved in segregation at the dhallons.
6. We are calculating the amount earned by daily waste pickers.
7. Prices of waste per kg

Table 4: Prices of Waste per kg

Type of Waste	Price per kg(Rs.)
Organic Waste (after composting)	4
Plastic	5
Paper	2
Glass	1
Unsegregated dry waste	1.5

**Case I** - Let's consider the current system first. (Without any segregation)

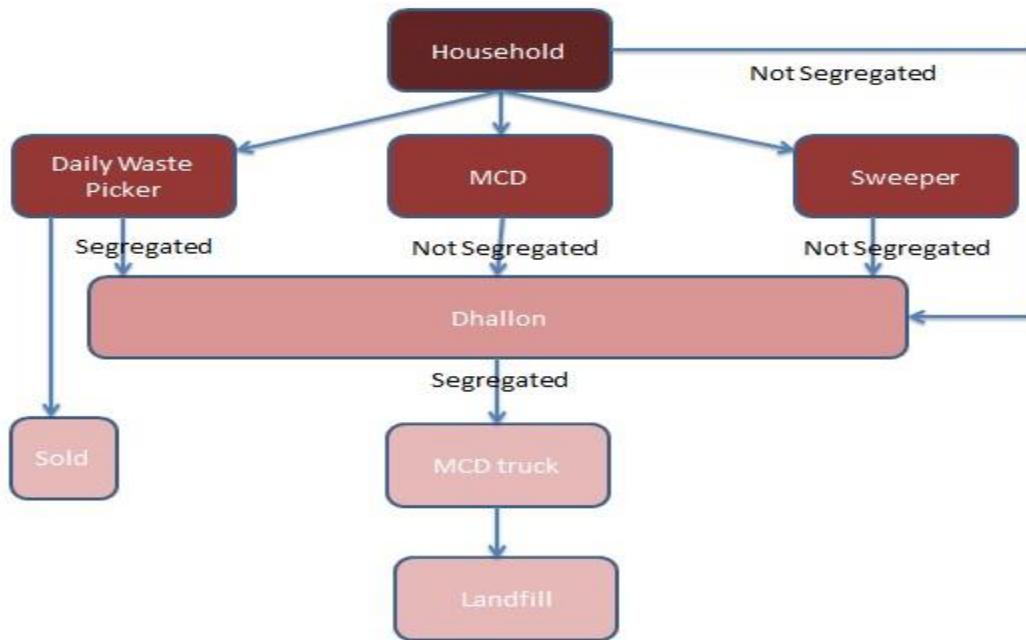


Figure 12: Current Scenario of Waste Management

Table 5: Value of waste on the basis of Economics in the current system

Number of people	1000		
Number of people disposing their waste using MCD vans	500		
Number of people disposing their waste via daily waste pickers:	500		
<b>Daily Waste Picking</b>		<b>MCD vans</b>	
Quantity of organic waste (kg)	246	Quantity of organic waste (kg)	246
Quantity of plastic in the waste (kg)	24	Quantity of plastic in the waste (kg)	24
Quantity of paper in the waste (kg)	27	Quantity of paper in the waste (kg)	27
Quantity of glass in the waste (kg)	3	Quantity of glass in the waste (kg)	3
Cost of organic waste	0	Cost of organic waste	0
Cost of plastic	$24 * 5 = 120$	Cost of plastic	0
Cost of paper	$27 * 2 = 54$	Cost of paper	0
Cost of glass	$3 * 1 = 3$	Cost of glass	0
Combined dry waste	0	Combined dry waste	81
Total Cost	177	Total Cost	81
<b>Total amount earned by the waste picker per day from 1000 individuals</b>		<b>258</b>	

**Case II** – Segregated waste (no need of MCD vans)

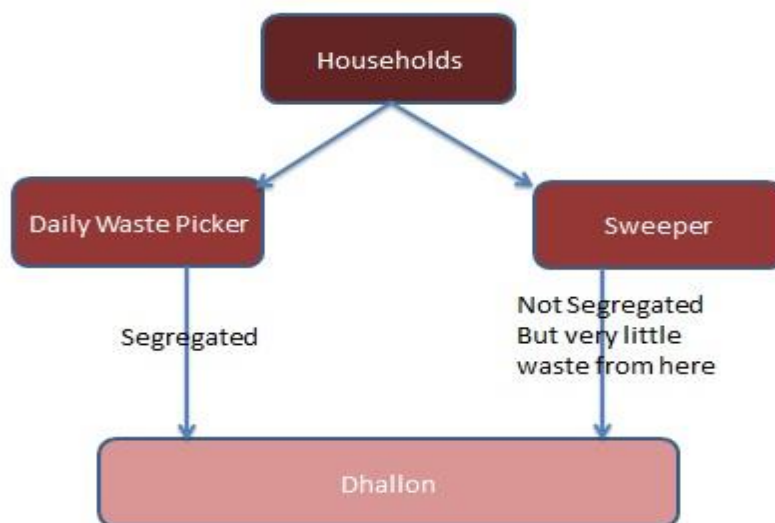


Figure 13: Proposed System of Waste Management

**Table 6: Value of waste on the basis of Economics in the proposed system**

Number of people	1000
Number of people disposing their waste using Daily waste pickers	1000
Quantity of organic waste (kg)	592
Quantity of plastic in the waste (kg)	48
Quantity of paper in the waste (kg)	54
Quantity of glass in the waste (kg)	6
Cost of organic waste <sup>3</sup>	160
Cost of plastic	240
Cost of paper	108
Cost of glass	6
Combined dry waste	0
Total Cost	514
<b>Total amount earned by the waste picker per day from 1000 individuals</b>	<b>514</b>

The tables clearly show that there is almost double wealth generation if waste is segregated properly and at source. The current monthly income of the daily waste is picker is **Rs.7,740** whereas in the proposed system the monthly can be **Rs.15,420**. The strategic solutions to execute the proposal are highlighted in the next part of the section. We plan to use the following strategies and come up with a proposal to manage waste more efficiently in the Vijay Nagar area.

- Reduce and reuse waste
- Segregation at source
- Recycle
- Reuse

<sup>3</sup> The cost of manure is Rs.4 per kg. Since there are 200 families and every family can produce 6kgs manure per month. Therefore, the families produce 40 kg of manure per day.



Figure 14: Pyramid of Waste Management

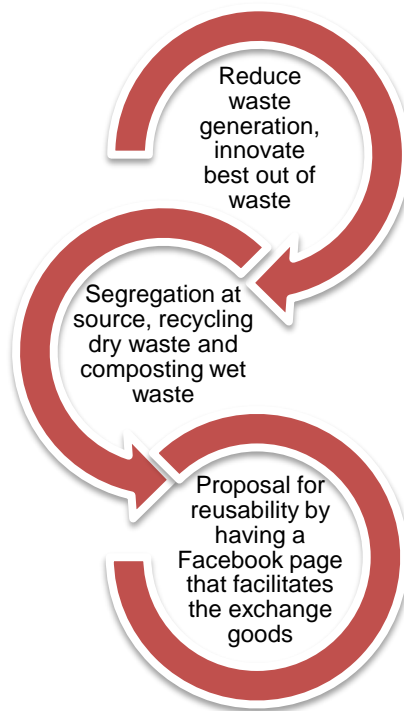


Figure 15: Reduce, Reuse and Recycle

## 5.2 Reduction of Waste

In the first case, waste reduction is the key factor to tackle the problem of waste management. For instance, cardboard waste can be reduced if the packaging material after delivery is taken back by the company. The cardboard can be used for packaging again. The waste straws, cloth

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pieces, broken bottles and bangles can be used in a variety of ways to do the interiors. These tasks might seem a little tedious but we should respect the fact that we are just guests on the earth.



Figure 16: Lamp Shade at Wood Box Café in Vijay Nagar made with a wooden frame and straws

### 5.3 Segregation at Source and Recycling of Waste

Another important point is the segregation at source. If there is segregation at the source, the same trend can be continued at the later stages also. Waste loses its value if everything's mixed up. Also the authorities will find managing things easier and the problem of waste management can be solved to a great extent. To promote segregation at source we plan to do something that compels the households to segregate wet and dry waste. For this we designed a dustbin with 2 compartments – one for the wet waste and the other for the dry waste. The container for wet waste will be made of cane and that for dry waste will be made of cloth. The cloth bin will compel a person to throw only dry waste into it and this will lead to segregation at the source. The containers will be resizable according to the amount of waste.



Figure 17: A schematic of the dustbin design having different compartments for dry and wet waste

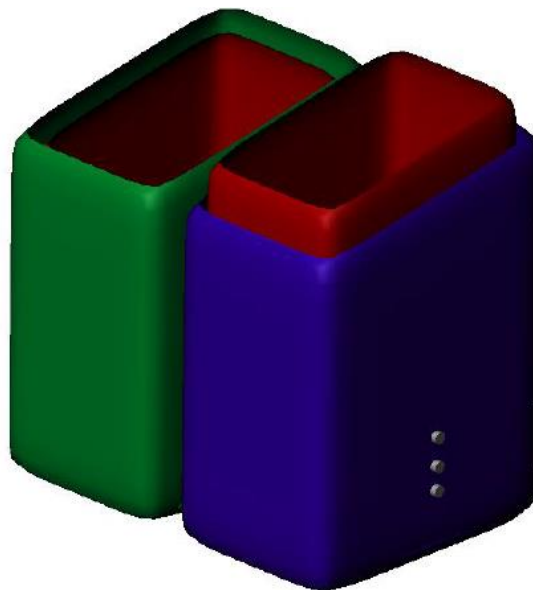


Figure 18: Dustbin design showing the resizing facility

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As talked about in the flow charts, we wish to decentralize waste management and restrict it to a colony. This means almost all the waste generated should be either used in the colony itself or sent for recycling. Therefore, only a very small amount of waste from a colony will reach the landfill. For this reason we propose to get rid of MCD vans. According the proposed model, the daily waste pickers will collect the segregated waste, sell the dry waste and the biodegradable wet wastes sent for composting. This includes the recycling and replenishment part of the plan. The dry waste is recycled and the product of composting can be used for the gardens of the locality or can be sold. Composting can be achieved by installing a product of Daily Dump called *Manthan*. *Manthan* is used for community composting.



Figure 19: Composting for a community of 15 families.

Source: <http://dailydump.org>

During composting the moisture content of the mixture should be correct. Too wet and the mixture will attract various organisms and too dry and the process of composting will be slower. Hence, there is a need for a few housekeepers to take care of the composting as well. Therefore, daily waste pickers of a colony can also work on the composting site.

## 5.4 Proposal for Reusability

### 5.4.1 Further Proposal

We believe that we do carry a lot of good stuff that loses its value sooner or later but it may still have the potential to be reused. But due to lack of proper disposal path or methods, we dispose it of in an irresponsible manner and hence they are not utilized up to their fullest. So, we want to take up a social initiative to promote reusability of goods in Delhi University campus. Since, Vijay Nagar is close to Vijay Nagar we wish to implement our plan in this colony first.

We believe you may have books/novels that can be exchanged with your fellow mates or notes and books of your previous semester or you may be leaving your PG this year – then your tables,

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mattresses, coolers, that can be given to newbies and hence by this you can prevent a huge amount of waste from landfills. Anything or everything that may not be valuable to you may carry a value for the other. So, we hereby want to promote culture of social responsible citizens that are ready to give away their goods either Free or in cash and want to take part in waste management drive in or nearby DU areas. This drive can instill a sense of responsibility and generosity among DU students and can create wealth out of waste.

#### **5.4.2 Implementation of the proposal**

Internet is the greatest asset of the time and helping people to connect, exchange their ideas through social networking sites like Facebook, Twitter etc. We want to utilize the same source for building up a network of social responsible citizens and students of Delhi University, who aims at reusing the good stuff and can keep them out of landfills. By the means of our Facebook page, you can contact us and inform about your old used stuff and can get possible customers for your product and can either give it free or for cash.

Students from all courses and colleges can join our page, post about the goods that they want to give away either in cash or in free. And the ones desiring to help may interact

DISCLAIMER: People are advised to take care of their privacy and safety while taking part in any of the exchange process. Preferably the exchange process should take place at a public place. Page admins are only facilitating the exchange of information and do not hold any responsibility for any of the exchange process or communication between the parties.

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## 6 References

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- <http://delhi.gov.in> (Accessed on: November 13, 2013), for accessing *Statistical Handbook of Delhi 2010, Economic Survey of Delhi*
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- Sustainable Solid Waste Management: Issues, Policies, and Structures by Urvashi Dhamija
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## Annexure I – Survey Forms

### 1. Sweepers

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics and Information Technology**  
**Survey Form: Sweepers**

Name:

Address:

Phone No:

Age:

Place of Residence:

Residing since:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	Which areas do you cover? No of streets do you cover in a day?		
<b>2</b>	How much do you charge per house? How do you earn your livelihood?		
<b>3</b>	Do you segregate the waste swept by you?		If yes, then what is the basis of your segregation?
<b>4</b>	Where do you dispose of the waste swept you?		
<b>5</b>	Number of days you work in a week?		Specify, any holidays if you have
<b>6</b>	Number of hours in a day you work? What time do you sweep the streets?		
<b>7</b>	Are there any other persons working with you?		If yes, how many? How much do they earn?
<b>8</b>	What is the method of your working?		
<b>9</b>	Who do you work for and when do you get paid?		

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10	Are there any safety equipment provided to you? What all measures do you take for your safety?		
11	Have you suffered from/ suffering from any disease or ailment in past 5 years?		
12	Number of years you have been in this job?		
13	Do you burn any of the waste swept by you?		
14	Any other job that you are doing along with this job?		
15	Are there any problems being faced by you?		

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## 2. Stationary *Kabadiwala*

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics and Information Technology**  
**Survey Form: Stationary Kabadiwala**

Name:

Address:

Phone No:

Age:

Place of Residence:

Residing since:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Are you: ☐ Owner ☐ Worker of the shop?

Is this place ☐ Owned ☐ Rented?

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	From what all sources do you get your junk? / Who are your potential customers?		
<b>2</b>	How do you decide rates for your junk?		
<b>3</b>	How many hours do you work in a day?		
<b>4</b>	Where/Who do you resell your junk to?		
<b>5</b>	How frequently do you resell your junk?		
<b>6</b>	How do you transport your junk to its destination and what is the transportation cost incurred?		
<b>7</b>	When was the last time you bought junk?		Please specify what all you had received. How much did you pay to the customer? How much are you expecting to earn from it?

8	What is the approximate quantity of junk you receive on a monthly basis?	<input type="checkbox"/> .....Newspapers <input type="checkbox"/> .....Cardboard <input type="checkbox"/> .....Glass <input type="checkbox"/> .....Thermocol <input type="checkbox"/> .....Plastic <input type="checkbox"/> .....Electronic	If there are any other materials that you get occasionally, please specify.
9	How many people are working in your shop? How much do they earn?		
10	What all are the equipment you are using for measuring/ weighing?		
11	Number of years you have been in this business?		
12	Have you suffered from/ suffering from any disease or ailment in previous 5 years?		
13	What all are the items generated as waste from your shop?		
14	Do you burn any of your waste/ junk?		
15	How do you check for authenticity of junk? Do you maintain the record of items sold to you, and by whom?		
16	Do you have any license or recognition for your work?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
17	Are you being threatened/ bullied by government bodies/ Police?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, how do you handle the situation?
18	What kind of competition (if any) do you face from mobile <i>kabadiwalas</i> ?		

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19	What is the approximate % of items bought by you which are reusable?		
20	Are there any other problems you face?		

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### 3. RagPickers

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics and Information Technology**  
**Survey Form: Rag pickers**

Name:

Address:

Phone No:

Age:

Place of Residence:

Residing since:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	Which areas do you cover? No of streets do you cover in a day?		
<b>2</b>	How do you earn your livelihood?		
<b>3</b>	What items do you pick/collect and where do you sell what you collect?		
<b>4</b>	What do you do with the waste collected? If you sell, what rates do you get for the collected items?		
<b>5</b>	Number of days you work in a week?		
<b>6</b>	Number of hours in a day you work? What time in the day do you go to collect/ pick the waste?		
<b>7</b>	Are there any other persons working with you?		If yes, how many? How much do they earn?
<b>8</b>	What is the method of your working?		
<b>9</b>	What is your family size and do other members of your family earn?		

10	Do you work in liaison with other individuals working in the waste sector e.g. sweepers/ MCD vans etc.		
11	Are you being threatened/ bullied by government bodies/ <i>chowkidar</i> / Police?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, how do you handle the situation? What do you do for ensuring your safety?
12	Have you suffered from/ suffering from any disease or ailment in past 5 years?		
13	Number of years you have been doing the job of ragpicking?		
14	Do you burn any of the waste collected by you?		
15	Any other job that you are doing along with this job?		
16	Are there any problems being faced by you?		

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## 4. Mobile *Kabadiwala*

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics and Information Technology**  
**Survey Form: Mobile *Kabadiwala***

Name:

Address:

Age:

Place of Residence:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Monthly Income:

Phone No:

Residing Since:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	From what all sources do you get your junk? Who all are your potential customers?		
<b>2</b>	Which areas do you cover? No. of streets do you cover on daily basis?		
<b>3</b>	How do you decide rates for your junk?		
<b>4</b>	How many hours do you work in a day?		
<b>5</b>	How frequently do you go for collecting the junk?		
<b>6</b>	Who do you sell you junk to?		
<b>7</b>	When was the last time you had gone for collecting junk?		Please specify what all you had collected How much you had paid to household? How much did you get by selling junk?
<b>8</b>	What is the approximate quantity of junk you get on monthly basis?	<input type="checkbox"/> .....Newspapers <input type="checkbox"/> .....Cardboards <input type="checkbox"/> .....Glass <input type="checkbox"/> .....Thermocol <input type="checkbox"/> .....Plastic <input type="checkbox"/> .....Electronic	If there is any other material that you get occasionally, then please specify.

9	Are there any other person working with you? Do your family members help you in your job?		If yes? Then how many? How much do they earn?
10	What all are the equipment you are using for measuring/weighing?		
11	Number of years you have been in this business?		
12	Have you suffered from/ suffering from any disease or ailment in previous 5 years?		
13	Are you able to resell 100% of the junk that you buy?		
14	How do you check for authenticity of junk? Do you keep record of your bought and sold stuff?		
15	Do you have any license or recognition for your work?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
16	Are you being threatened / bullied by government bodies/ <i>chowkidars</i> / police?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
17	What kind of competition do you face from stationary <i>kabadiwala</i> ?		
18	Are there any other problems that you face?		

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## 5. MCD Vans

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics and Information Technology**  
**Survey Form: MCD Vans**

Name:

Address:

Phone No:

Age:

Place of Residence:

Residing since:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	Which areas do you cover?		
<b>2</b>	What is the total number of households you cover daily?		
<b>3</b>	How much do you charge per house? How much do you earn in this process?		
<b>4</b>	Is the waste collected by you in the Van segregated at any level?		If yes, then what is the basis of your segregation?
<b>5</b>	Where do you dispose of the waste collected by you? How frequently do you dispose it?		
<b>6</b>	Number of days you work?		
<b>7</b>	Who do you work for? Are you hired temporarily or on permanent basis?		
<b>8</b>	Where did you work before this?		
<b>9</b>	Apart from this, are you doing some other job?		

<b>10</b>	Are there any other persons working with you?		If yes, how many? How much do they earn?
<b>11</b>	Are there any safety equipment provided to you? What measures do you take to ensure your safety?		
<b>12</b>	Have you suffered from/ suffering from any disease or ailment in last 5 years?		
<b>13</b>	Number of years you have been in this business?		
<b>14</b>	What all are the waste items that you collect?		
<b>15</b>	What is the number of MCD Vans allocated for Vijay Nagar?		
<b>16</b>	Who take care of these MCD Vans? Where are they parked?		
<b>17</b>	Are the MCD Vans cleaned? How frequently? Who is responsible for this?		
<b>18</b>	Are there any problems that you face?		

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## 6. MCD Truck People

Cluster Innovation Centre, University of Delhi

B. Tech. in Innovation with Mathematics and Information Technology

Survey Form: MCD Truck People

Name:

Address:

Phone No:

Age:

Place of Residence:

Residing Since:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Monthly Income (Salary/ any other):

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	Which areas do you cover? Number of <i>dhallaons</i> you cover?		
<b>2</b>	Does the waste in your Truck get segregated?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, then what is the basis of your segregation?
<b>3</b>	What are the sources of the waste carried in your Truck?		
<b>4</b>	Where do you dispose of the waste collected in the Truck?		
<b>5</b>	Number of days you work?		Specify, any holidays if you have
<b>6</b>	Number of hours in a day you work?		
<b>7</b>	Are there any other person working with you?		If yes? Then how many? How much do they earn?
<b>8</b>	Who do you work for? Are you hired temporarily or on permanent basis?		
<b>9</b>	Where were you working before doing this job?		

<b>10</b>	In addition to working on this Truck, is there any other job (gainful employment) that you do?		
<b>11</b>	Are there any safety equipment provided to you? What are the measures you are taking for your safety?		
<b>12</b>	Number of years you have been in this business?		
<b>13</b>	Have you suffered from/ are suffering from any disease or ailment in the past 5 years?		
<b>14</b>	What all areas do you cover on a daily basis for collecting the waste? What is the time interval between waste collection and its disposal?		
<b>15</b>	How often are the trucks cleaned?		
<b>16</b>	Number of MCD trucks visiting Vijay Nagar locality?		
<b>17</b>	Who maintains these trucks? Where are they parked every day?		
<b>18</b>	Specify any other problem that you are facing?		

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## 7. Household

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics & Information Technology**  
**Survey Form: Household**

Name:

Address:

Email ID:

Phone No:

Age:

Residing since:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Profession:

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	What type of daily waste gets generated in your house?	<input type="checkbox"/> Kitchen waste <input type="checkbox"/> Newspapers <input type="checkbox"/> Dry waste (explain) <input type="checkbox"/> Other (please specify)	
<b>2</b>	How do you dispose of your waste?	<input type="checkbox"/> Daily Waste Picker <input type="checkbox"/> <i>Dhallaons</i> <input type="checkbox"/> MCD Van <input type="checkbox"/> Don't Do	If any other method, then please specify?
<b>3</b>	Who is responsible for disposing waste in your house?		
<b>4</b>	How much do you spend to dispose of your waste on a monthly basis?		
<b>5</b>	Does MCD Van visit your locality? If Yes, then at what time? How many days a week?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>6</b>	If answer to question no 5 is yes, what do you prefer: MCD Van or DWP and why?		
<b>7</b>	What items do you sell in your junk/ <i>kabaad</i> ?	<input type="checkbox"/> Newspapers <input type="checkbox"/> Cardboards <input type="checkbox"/> Glass <input type="checkbox"/> Thermocol <input type="checkbox"/> Plastic waste <input type="checkbox"/> Electronic Waste	Any other, please specify? _____

8	Who do you sell your junk to? Why?	<input type="checkbox"/> Mobile <i>Kabadiwala</i> <input type="checkbox"/> Stationary <i>Kabadiwala</i>	If any other method, then please specify?
9	What is the approximate monthly generation of the following junk in your house?	<input type="checkbox"/> ..... Newspaper <input type="checkbox"/> ..... Cardboard <input type="checkbox"/> ..... Glass <input type="checkbox"/> ..... Thermocol <input type="checkbox"/> ..... Plastic <input type="checkbox"/> ..... Electronic	
10	Mention the items in junk that are occasionally generated?		
11	When was the last time you sold your junk?	<input type="checkbox"/> .....days <input type="checkbox"/> .....weeks <input type="checkbox"/> .....months	
12	How frequently do you sell your junk?	<input type="checkbox"/> .....days <input type="checkbox"/> .....weeks <input type="checkbox"/> .....months	
13	How much did you earn by selling your junk the last time you sold it?		
14	Are you satisfied with the prices/rates of waste set by <i>kabadiwalas</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If No, give reasons
15	Are you satisfied with the measurements/weighing balance used by <i>kabadiwalas</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If No, give reasons
16	How do you dump your used clothes?	<input type="checkbox"/> Bartanwali <input type="checkbox"/> Other	If other, please specify.
17	How frequently do you dump your clothes?		
18	Have you ever donated clothes/ books or any other stuff?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, then please specify.

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## 8. Eateries

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics & Information Technology**  
**Survey Form: Eateries**

Name:

Address:

Email ID:

Phone No:

Operating since:

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	What type of daily waste gets generated? And /how much?	<input type="checkbox"/> Kitchen waste <input type="checkbox"/> Newspapers <input type="checkbox"/> Dry waste (explain) <input type="checkbox"/> Other (please specify)	
<b>2</b>	How do you dispose of your waste?	<input type="checkbox"/> Daily Waste Picker <input type="checkbox"/> <i>Dhallaons</i> <input type="checkbox"/> MCD Van <input type="checkbox"/> Don't Do	If any other method, then please specify?
<b>3</b>	How do you segregate your waste?		
<b>4</b>	Who is responsible for disposing waste?		
<b>5</b>	How much do you spend to dispose of your waste on a monthly basis?		
<b>6</b>	Does MCD Van visit your locality? If Yes, then at what time? How many days a week?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>7</b>	If answer to question no 5 is yes, what do you prefer: MCD Van or DWP and why?		

8	What items do you sell in your junk/ <i>kabaad</i> ?	<input type="checkbox"/> Newspapers <input type="checkbox"/> Cardboards <input type="checkbox"/> Glass <input type="checkbox"/> Thermocol <input type="checkbox"/> Plastic waste <input type="checkbox"/> Electronic Waste	Any other, please specify? _____
9	Who do you sell your junk to? Why?	<input type="checkbox"/> Mobile <i>Kabadiwala</i> <input type="checkbox"/> Stationary <i>Kabadiwala</i>	If any other method, then please specify?
10	What is the approximate monthly generation of the following junk ?	<input type="checkbox"/> ..... Newspaper <input type="checkbox"/> ..... Cardboard <input type="checkbox"/> ..... Glass <input type="checkbox"/> ..... Thermocol <input type="checkbox"/> ..... Plastic <input type="checkbox"/> ..... Electronic	
11	Mention the items in junk that are occasionally generated?		
12	When was the last time you sold your junk?	<input type="checkbox"/> .....days <input type="checkbox"/> .....weeks <input type="checkbox"/> .....months	
13	How frequently do you sell your junk?	<input type="checkbox"/> .....days <input type="checkbox"/> .....weeks <input type="checkbox"/> .....months	
14	How much did you earn by selling your junk the last time you sold it?		
15	Are you satisfied with the prices/rates of waste set by <i>kabadiwalas</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If No, give reasons
16	Are you satisfied with the measurements/weighing balance used by <i>kabadiwalas</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If No, give reasons

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## 9. Daily Waste Picker

**Cluster Innovation Centre, University of Delhi**  
**B. Tech in Innovation with Mathematics & Information Technology**  
**Survey Form: Daily Waste Picker**

Name:

Address:

Age:

Residing since:

Phone No:

Place of Residence

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Selection</b>	<b>Comment</b>
<b>1</b>	Which areas do you cover for daily waste collection?		
<b>2</b>	What is the total number of households that you cover daily?		
<b>3</b>	How much do you charge per house for daily waste collection?		
<b>4</b>	How do you segregate the waste that you collect? What is the basis of segregation?		
<b>5</b>	What do you do with the waste that you collect?		
<b>6</b>	How much do you earn by selling the waste and how much from households on monthly basis?		
<b>7</b>	Are you burning any kind of waste?	<input type="checkbox"/> .....Yes <input type="checkbox"/> .....No	
<b>8</b>	Number of hours you work in a day?		

9	Do you have any off days? / Number of days you work in a week? How many holidays?	<input type="checkbox"/> .....Yes <input type="checkbox"/> .....No	
10	Are there any other persons working with you? If yes, then how many? How much do they earn? Are your family members assisting you in the job?		
11	For how long have you been doing this job?	<input type="checkbox"/> .....days <input type="checkbox"/> .....months <input type="checkbox"/> .....years	
12	Any disease or ailment that you have suffered/are suffering from since last 5 years?		
13	Do you think you are facing competition from MCD Vans? If Yes, then please specify how it has affected your business.	<input type="checkbox"/> .....Yes <input type="checkbox"/> .....No	
14	If not this present job, what will you be doing?		
15	Any other problems that you are facing while collecting daily waste?		

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## 10. *Dhallon Keeper*

**Cluster Innovation Centre, University of Delhi**  
**B. Tech. in Innovation with Mathematics & Information Technology**  
**Survey Form: *Dhallon Keeper***

Name:

Address:

Phone No:

Age:

Place of Residence:

Residing Since:

Type of Accommodation: ☐ Rent ☐ Owner ☐ Individual ☐ Family

Monthly Income:

<b>Id</b>	<b>Question</b>	<b>Comment</b>
<b>1</b>	The area to which this <i>dhallon</i> belongs? Who organizes this <i>dhallon</i> ? Since how many years it is in operation? Who constructed it?	
<b>2</b>	Do you charge people/DWP for disposing their waste? (historical record)	
<b>3</b>	Do you segregate the waste that gets dumped in the <i>dhallon</i> ? If yes, then what is the basis of your segregation? What is the % of each category of waste?	
<b>4</b>	How do you dispose of the waste that gets dumped in the <i>dhallon</i> ? Where does the waste go from here?	
<b>6</b>	The frequency or the interval in which waste is carried away from the <i>dhallon</i> ?	
<b>7</b>	Do you burn any of the waste which is dumped in the <i>dhallon</i> ?	
<b>8</b>	What are your sources of income? Do you have any other source of income generation?	
<b>9</b>	Number of days you work at the <i>dhallon</i> ? Specify if there are any holidays that you have.	

10	Number of hours in a day you work at the <i>dhallon</i> ?	
11	Who do you work for? Are you permanently or temporarily employed? Do your family members help you at <i>dhallon</i> ?	
12	What were you doing before this? How did you get to work at <i>dhallon</i> ?	
13	Are there any other persons working with you? If yes, then how many? How much do they earn?	
14	Are there any safety equipment provided to you? By whom?	
15	Have you suffered from/ suffering from any disease or ailment in the past 5 years? Specify.	
16	Number of years you have been in this business?	
17	If not this present job, what will you be doing?	
18	What all are the problems you face while working in the <i>dhallon</i> ?	