


Spring 2011

The Solid Waste Management System of Jaipur: An Overview and Analysis

Laura Olivier
SIT Study Abroad

Follow this and additional works at: https://digitalcollections.sit.edu/isp_collection

 Part of the [Asian Studies Commons](#), [Environmental Health and Protection Commons](#), [Environmental Policy Commons](#), [Public Administration Commons](#), and the [Urban Studies and Planning Commons](#)

Recommended Citation

Olivier, Laura, "The Solid Waste Management System of Jaipur: An Overview and Analysis" (2011). *Independent Study Project (ISP) Collection*. 1073.
https://digitalcollections.sit.edu/isp_collection/1073

This Unpublished Paper is brought to you for free and open access by the SIT Study Abroad at SIT Digital Collections. It has been accepted for inclusion in Independent Study Project (ISP) Collection by an authorized administrator of SIT Digital Collections. For more information, please contact digitalcollections@sit.edu.

THE SOLID WASTE MANAGEMENT SYSTEM OF JAIPUR

AN OVERVIEW AND ANALYSIS

Laura Olivier

Tara Dhakal, Academic Director

Dr. Dinesh Bhandari, former Chief Health Officer, Jaipur Municipal Corporation, Project Advisor

School for International Training India: Sustainable Development and Social Change
Spring 2011

Table of Contents

I. Abstract.....	1
II. Introduction	1
III. System Implementation.....	5
IV. Problems in Management.....	10
V. Public-Private Partnerships.....	14
A. Grasim Industries MSW Processing Plant	15
B. NGO #1, Satya an NGO.....	19
C. NGO #2, Centre for Development Communication	20
D. Evaluation of PPP Success.....	21
VI. Integration of the Informal Sector.....	23
VII. Community Awareness, Involvement, and Education.....	26
VIII. Findings and Discussions.....	28
IX. Conclusions & Way forward.....	31
X. Recommendations for Further Study.....	33
XI. References and Endnotes.....	34
XII. Bibliography.....	38
XIII. Acknowledgements.....	41
XIV. Appendices	
A. Waste Management Hierarchy Diagram.....	42
B. <i>Kabari</i> Case Study.....	44

Abstract

Jaipur's rapid development has resulted in its infrastructure lagging behind population and industrial growth, which is especially evident in the unsightly and unsanitary piles of solid waste (garbage) on the roads. This project took a broad system approach to understand Jaipur's solid waste management system. It investigated how the system is carried out, some obstacles to its success, and the role of Public Private Partnerships (PPPs). The findings indicate that there is a multiple-tiered hierarchical system. The system involves a formal sector comprised of female and male sweepers, permanent and impermanent workers, and an informal sector of ragpickers and door-to-door collectors, door-to-door recyclers, NGOs, and private companies. The main problems to implementation of the system include lack of citizen awareness and commitment, no segregation of waste, corruption, technology, and funding. PPPs can help fund larger projects as well as offer expertise, but often the ventures are unprofitable, which discourages companies from undertaking them. Many new projects and regulations such as a new scientific landfill, a composting service, and stricter penalties for littering and dirtying the city are currently underway, which should greatly improve Jaipur's cleanliness.

Introduction

Like many cities in India, Jaipur is undergoing rapid development. The country's GDP has been increasing at 8% per year¹. In Jaipur, the population was 2.34 million according to the 2001 census, and is now estimated to be over 3.5 million^{2,3}. The process of development involves effects of globalization such as a growing economy, imported

resources, information and technology sharing, and more extensive infrastructure. As the growth of various sectors has exploded, more inputs are required. This necessarily means more output is also produced, manifesting itself in a large volume of waste. “Waste” is simply something that is no longer deemed useful and is discarded. However, a shift in attitude to view waste as a resource rather than as something useless is the first step needed to reduce it.

Waste can be classified into four categories: Municipal solid waste, hazardous waste, biomedical waste, and electronic waste (E-waste). Municipal solid waste (MSW) includes what is thrown out by households and the commercial sector, such as food scraps, yard clippings, and demolition debris. It is important to address because it is the waste that the general public has the most contact with, and has a high political profile because the public is made up of voters. Also, MSW is one of the harder types wastes to manage since it has so many different components, so if it can be managed effectively, then management of other types of solid waste that are more homogenous should be easier to tackle (McDougall et al, 2008).

Jaipur’s daily production of solid waste is around 1100 MT/day. Of that amount, 200-250 MT remain on the streets, meaning lifting efficiency is around 80%.⁴ The per capita solid waste production per day is 350 g, which with an average family size of five results in 1.75 kg per day.⁵ There are no data published on the composition of waste in Jaipur in particular, although the figures for India in general are a fairly accurate representation for Jaipur as well. In India, the makeup of waste is roughly 50% biodegradable, 25% inerts (construction and demolition waste), 9% plastic, 8% paper, 4% rags, and 1% glass⁶. The composition of waste varies from season to season. In the

summer there is more biodegradable waste because of more vegetation.⁷ The amount of plastic in waste has supposedly been decreasing due to the recent ban on plastic carrying bags in Rajasthan beginning August 2010.

Hazardous sanitary conditions from epidemics provided the impetus for taking solid waste management seriously and establishing a proper management system. The pneumonic plague of 1994, which started in the city of Surat, Gujarat, awakened the government to the severity of the need for proper sanitation. In response, in 1995, The Bajaj Committee was formed to make recommendations on proper SWM⁸.

Another impetus towards current SWM reforms was the Public Interest Litigation (PIL) filed by Mrs. Almitra H. Patel in 1996 against the Union of India and heard in India's Supreme Court.^{9,10} After many hearings, in 1998 the Supreme Court ordered the formation of a committee under the direction of Mr. Asim Burman, commissioner of the Kolkata Municipal Corporation to oversee SWM in Class-I cities. (Class-I cities are those with a population of over one million, and Class-II cities are those with a population less than one million.) One of the main recommendations of this committee was to include the private sector in SWM in order to receive assistance with funding and specialized expertise. Mrs. Patel was also instrumental in the drafting of the Municipal Solid Wastes (Management and Handling) Rules 2000, which outline steps that municipal authorities must take to regulate MSW.

Solid waste management was selected as the topic of this study because it is a visible environmental sustainability issue that India is confronting. Jaipur in particular was selected as the study site location because it is large enough to have a complex SWM to examine, but is small enough to be manageable for a study of less than one-month

duration. Also, since Jaipur is a rapidly developing city, effective waste management practices are especially urgent. The objective of the study was to learn as much as possible about Jaipur's SWM through a broad-based approach. In particular, the following questions were investigated: (1). Who are all the players in Jaipur's solid waste management system and how is it implemented? (2). What have been the successes and the challenges in its implementation and how are the challenges being addressed? (3). How do public-private partnerships in solid waste management work, what is their role, and are they successful?

Field work methods involved meetings and interviews with Jaipur Municipal Corporation officials who work at different levels of SWM, NGOs, the head of a waste processing plant under PPP contract, many different types of waste workers, and Jaipur residents. In addition, site visits to waste collection centers, observation of collection, and shadowing of a recycler on his route were conducted.

The findings indicate that Jaipur, under the direction of the Jaipur Municipal Corporation, is making many strides in the right direction for improving waste management. Measures in progress include implementing of new surveillance measures and fines for fouling public areas, establishing a scientific landfill site and composting plant, drafting plans for a waste management program under contract with a private company, and combating absenteeism with biometric machines. Nevertheless, much room still remains for improvement, including reducing corruption, spreading more awareness to citizens about proper disposal techniques, and better management of financial resources to best cover the city's needs.

System Implementation

Solid waste is managed by the Jaipur Municipal Corporation (Jaipur Nagar Nigam). At the political level, the mayor is at the top, accompanied by a health and sanitation committee, made of up five elected and three nominated members. The administrative hierarchy is headed by a CEO, under whom is a health commissioner, garage commissioner, and a chief engineer (CE) (Appendix A). Jaipur is divided into 77 wards grouped into eight zones. Under the health commissioner, currently Mr. Shakti Singh Sisodia, each zone has a commissioner, a health officer, and a chief sanitary inspector. One sanitary inspector for each ward employs sweepers (*safai karamchari*) who are monitored by a supervisor (*jamadar*).

The sweepers work in two shifts: a morning shift from 6-10 AM (or 7-11 AM in the winter), and an afternoon shift from 2:30-5:30 PM. The sweepers are usually formal workers paid either by the JMC or by a private contractor, if the ward where they work has been contracted out. In total, 5,644 people are permanent workers for the JMC, while 1,060 are on contract¹¹. Permanent workers earn approximately Rs 4,500-6,000 per month. Temporary, impermanent sweepers are hired by the JMC as the need arises, and earn approximately Rs 2,500 per month. All employees have the same working hours (eight hours a day) regardless of salary or permanent/impermanent status.¹² Work is segregated by gender, so the female sweepers and the male sweepers do different tasks, however their salaries are the same.

The female sweepers' tasks involve sweeping the streets with their brooms, and aggregating the waste in piles on the sides of the roads. They are assigned beats (designated area within a ward) to clean. The number of beats or the size of the designated area to be cleaned during their shift is based on population, as regulated by the MSW (Management and Handling) Rules 2000. In congested areas with high population, sweepers clean 250-350 m, in less congested areas, 400 m, and in sparsely populated areas, 500 m.¹³ All tools are provided for the sweepers, and are locked in the ward office after every day. The one exception is brooms. Ladies are supposed to bring these on their own, but they are still given Rs 75 every month to buy a new broom. Some use the same broom for 2-3 months to save the extra Rs 75-150, but then their brooms become so short that they have to bend over, straining their backs.

The male "sweepers" de-silt surface drains to ensure that water flow is not blocked, as well as lift up the waste that the women sweepers collected on the street corners and put it in their handcarts. They used to use a wheelbarrow which just had one compartment, but now they are using a cart with six separate buckets—two compartments for the material they cleaned from the surface drains, and four for the rest of the garbage, which can include grass clippings and sticks that residents put out on the street. Many of these workers work together in pairs, sometimes with a family member. One male sweeper interviewed said he and his brother cover about two beats while doing their work, for which they earn approximately Rs1700-1800 per month after deduction.¹⁴ This amount is significantly less than the Rs 4,500-6,000 permanent workers are supposed to be earning. No reason is accounted for in this discrepancy.

Every year the permanent sweepers who clean drains are given aprons, goggles, gum boots, and masks. According to the JMC, many workers only wear them for a few days and then leave them at home, or they will not wear this equipment in the summer because it is too hot¹⁵. However, according to a permanent trash worker who works for the JMC, they only got such shoes and gloves a long time ago. Now they do not receive any facilities from the government. He said this is just how the government runs: sometimes they start and sometimes they stop services without explanation.¹⁶ Apparently the JMC used to provide their workers with protective wear but have stopped after they thought the gear was not being utilized.

After their handcarts are full, these male “sweepers” bring the waste to a municipal bin. Two to three sweepers come to one container. The JMC bought 800 waste disposal bins to be dispersed throughout the city. In theory, one-cubic-meter waste disposal bins with a storage capacity of ½ ton of waste are placed every 250 meters along streets. Based on observation, there do not seem to be this many. Currently 55 of the 77 wards are “containerized” (have containers); the wards of the Old City are not containerized due to past objections, likely regarding space concerns.¹⁷ Those containers that are in usage are often in very poor condition, with holes so big that waste is spilling out the sides. There are approximately 40 such bins in Civil Lines, according to a permanent garbage worker who works there¹⁸. In Civil Lines at least, JMC lorries are observed to arrive around 7:30 AM to remove the waste. Two large bins of 2.5 or 3.5 cubic meters can fit on each lorry.¹⁹ Each bin is mechanically hoisted up onto the back of the lorry, and in its place an empty bin is left.

The informal sector plays an equally important role in waste management. It is made up of mainly ragpickers, who sift through garbage in dumping sites and remove those salvageable materials, such as plastics, glass, and metal, which can be sold to scrap dealers for recycling. Ragpickers are at the lowest strata of the social ladder, those who used to be called “Untouchables” or *harijans*²⁰. They do their work out of necessity, because they are illiterate and have no other alternative. Others included in the informal sector are door-to-door waste collectors and *kabaris* who buy recyclable materials from door-to-door and sell them at scrap dealer shops. The researcher got to meet on several occasions with a *kabari* and observe his work (Appendix B).

The method for waste collection from houses depends on the community. Currently door-to-door collection is not undertaken by the formal sector, but is being done by the informal sector in some colonies such as in Nemi Sagar Colony of Vaishali Nagar, Sarti Nagar, and Mahaveernagar. Families pay about Rs 40 per month to the waste collectors for their services²¹. The collectors usually come to a house every day, but at times they can be unreliable—there are some days when they do not come at all.²² The number of houses they service can range from 60-80 in some neighborhoods, to 150-200 in other neighborhoods^{23, 24}. Collectors often work together in pairs, sometimes with a brother or family member, and each earns about Rs 1500 per month.

In other areas such as along JLN Marg, residents dispose of their own waste in community bins which are shared by about 20-25 homes. A municipal van comes daily to pick it up. This service started about two or three years ago²⁵.

Unfortunately, many of Jaipur’s residents neither get their waste collected from their home nor dispose of it in bins. Instead, they just dump it wherever is convenient and

out of sight. Garbage abounds in empty lots next to people's houses all over the city. Even in wealthier neighborhoods like Shree Rampura Colony, empty lots are taken advantage of as small dumping grounds. It is to empty lots like these, as well as bigger dumpyards and dump sites under or near bridges, that ragpickers come to do their business.

Ragpickers can be male or female, and any age. Usually adult men and women do not work together, but rather a group of men and boys, a woman and her mother, or a woman and a group of children. It is common for working companions to be related. Ragpickers' earnings can vary from Rs 50-100 per day or Rs 100-150 per day for others from four to five hours of work^{26, 27}. They usually come to the same place every day to do their work, rather than wander around, likely in order to stay near where they live. After sorting out the recyclable goods and putting them in bags or in a metal container on a cart, the ragpickers take and sell them to a *kabari* shop, which re-sells them to companies.

Ragpickers working near *Gopalpuria Puliya* sell their collected materials near a graveyard in Mahesh Nagar, and those working near the bridge by Central Hospital sell at Pata near Sindhi Camp. Some ragpickers are very aware about health concerns such as inhaling toxic fumes from arising from their job, while others are not. When asked if this work is hard, ragpicker Mahaveer says "It's hard—you can get sick from it. You can get cut from glass." But when another ragpicker was asked if there were any health concerns from this work, she said no. Perhaps she gave this answer because she truly was unaware of the health concerns associated with waste. Or perhaps she interpreted the question as an insinuation that her work was unclean and degrading, so she was embarrassed and was defending herself.

After the collection stage, waste is transported and then taken for storage. Upon collecting waste from the municipal containers, JMC trucks take it to one of Jaipur's five or six transfer stations. From there it is brought to a dumpyard or landfill. Jaipur has three such locations where solid waste ultimately ends up. One is at Matheradaspura, which is a 46-hectare dumpyard about 17 km from Jaipur by the Delhi Bypass. Four hundred metric tonnes (MT) of waste per day are dumped there²⁸. The second is at Sewapura, a 44-hectare dumpyard about 20 km away on Siker Road. Here 250 MT of waste are taken every day. A company called Infrastructure Leasing Financial Services (ILFS), Ecosmart, will start producing compost at the site under Public-Private Partnership (PPP) in about 18 months. The third is a 121-hectare scientific landfill site at Langariyawas Village, about 25 km outside of Jaipur. Its capacity is 300 MT. Scientific landfills differ from regular landfills in a few ways. The most important distinguishing factor of a scientific landfill is the geomembrane liner. This is fitted along the sides and bottom of the pit so that leachate, or liquid from waste that can contain hazardous material, is prevented from seeping into the ground. The scientific landfill project at Langariyawas, costing 20 crore, was undertaken due to the stipulation of the federal MSW 2000 Rules. It has been under construction for about the last year and a half, and is scheduled for completion in about six months.²⁹

Problems in Management

One problem that all of India's work force faces is absenteeism, and solid waste management is no exception. In general, there is a rate of 10-20% absenteeism at the work place.³⁰ At times, rather than coming to work, workers will just send someone else

in their place. When confronted about their absence, they will simply offer a bribe to their superior in order to be marked as present. The effect of absenteeism is, of course, a shortage of manpower, which, when coupled with the shortage of machinery and equipment, yields few results. As if absenteeism alone was not bad enough, there are about 100 days off a year (including Sundays) when the formal sector workers do not collect garbage and it just sits on the streets³¹.

To amend the absenteeism problem, the Jaipur Municipal Corporation has installed two biometric machines in their main office, which scan workers' fingerprints as they come into work to ensure attendance as well as stamp a daily card. Soon biometric machines will also be installed in each of Jaipur's eight zone offices. However this effort has been met with resistance by labor unions. In early May 2011 the JMC is expecting a strike by workers in opposition to the installation of the machines. In the event of a strike the JMC usually responds by withholding salaries, taking other factions of the union into confidence (supposedly to have insiders quell the uprising), and employing a temporary workforce.³²

Another obstacle to thorough waste collection is physical accessibility. Jaipur's widespread area and the constant growth of the city make it hard to monitor all areas. Although the city is systematically divided into eight zones, not all streets of all zones are cleaned by JMC workers. Those streets that are not covered by the JMC are serviced by the informal sector. But even then there are certain areas like slums which are harder to reach and are not as well maintained. Certain areas are given higher priority for cleaning. The old walled city area, areas of historic importance, as well as VIP areas all have top priority, while the outskirts of the city are given less attention.³³

There are also temporary encroachments in the street such as animals, people, chairs and tables outside shops, and vehicles which sometimes prevent the sweepers from doing their jobs properly. Animals used to be kept on the street more, and would sometimes get in the way, but now there have been efforts to keep them in pens, especially buffalo and camels. Even the people who sleep on the foot paths, as well as vehicles kept on the roadsides prevent all areas from being accessible to cleaning. When people leave for work after 9 AM they take their vehicles with them, but some sweepers have already started working by then. To amend this problem, the number of cars on the road in general should be reduced using a technique such as has been done in Beijing, where no new licenses are issued out to cars.³⁴ Similarly, when shops open at around 10 AM, sweepers may have already serviced the area in front of the shop. Then the shop keepers sweep their shops before the day's work begins, and dump the waste right onto the streets, rather than taking it to the proper disposal bins or waiting until the evening sweeper shift comes.

Although penalties are in place for improper dumping, the fines do not deter many. Fines of up to Rs 20,000 have been collected at one time for vehicles dumping large amounts of garbage. Apparently violators would rather pay the fine than have their vehicles seized.³⁵ Currently new surveillance programs are being initiated to deter residents from soiling public areas. Sanitary inspectors armed with digital cameras to record evidence stand duty on the streets on the look-out for people who dirty their surroundings. As recently as May 2nd, 2011, the Watch Riders Scheme was launched. "Watch Riders" are patrolling police (one per ward) who also have digital cameras and are authorized to fine offenders on the spot. Violations include spitting, urinating,

defecating, washing clothes or utensils on the street, allowing pets or kept animals to defecate on streets, and of course, dumping garbage. This new scheme was promulgated for a week to educate people about the new laws, culminating in a rally on May 1st, 2011. Pamphlets were distributed, announcements were made over loudspeaker, and electronic media promotions were dispensed in its promotion.³⁶ Many of those who are responsible for spoiling the city are uneducated and cannot read and write, so in order to target this group, loudspeaker announcements should be emphasized. This suggestion is in response to the notion held by many SWM workers that Jaipur's laws regarding SWM are good, but the implementation is poor in part due to ignorance by the poor and illiterate.

In addition to the aforementioned areas of improvement, which were proposed by respondents who work in the system, the researcher has another reform suggestion with regards to the JMC's budget. The Jaipur Municipal Corporation's budget is broken down as follows (figures have been rounded to exclude decimals). In total 16, 344 lakhs per year are spent on Solid Waste Management. Of this, 12, 821 lakhs are spent on staff salary, 1,032 on contractor workers' salaries, 492 on electricity and fuel costs, 36 on chemical costs, 251 on repair and maintenance, and 1710 on contractor services.³⁷ It is interesting to compare the JMC's SWM budget with that of another municipality like Mumbai (although the data acquired for Mumbai are not as detailed). In Mumbai, the total spent on SWM is 1,000 crores per year. Of that amount, 60% goes for transportation, 20% goes towards employee salaries, and 20% is allocated towards operation maintenance.³⁸

The numbers cannot be compared completely objectively because the categories are not broken down the same way. However, if one examines Jaipur's budget,

combining both the permanent workers and contract workers, a full 85% is spent on staff salaries, compared to a mere 20% in Mumbai (though it is unknown if the actual salary amounts are higher). In general this trend can be explained by the sheer size difference of the cities. Mumbai requires much more equipment and transportation to service its large area and populace, so it makes sense that more funds are allocated towards those efforts. However even the percentage Jaipur spends on staff salaries seems disproportionately high. This is likely a result of hiring more employees every year without increasing each of their duties accordingly, so more people are covering the same work. The JMC should either increase the duties of each employee, or should instigate hiring freezes and instead spend more money on staff training or buying new equipment.

Public-Private Partnerships (PPPs)

Jaipur has been engaged in public-private partnerships for the last ten years. It has become necessary for the municipality to contract out some of its waste management work because it cannot recruit enough staff to cover SWM in all wards. In those cases private companies are hired.³⁹ The PPP model is ideal because often waste disposal, treatment, and operation necessitate exorbitant start-up costs, which the municipality either cannot afford, or chooses not to spend. The JMC used to levy octroi (a customs duty) as a source of revenue, but no longer do so due to resistance by various leaders. As a result, The JMC does not have much at their disposal to invest in waste management projects. Private parties, either NGOs or corporations, who are experts in a certain area such as waste management, can thus offer shared cost and responsibility as well as their specific knowledge about the project. The municipality is the owner and oversees the

project, providing some resources, while the private company carries out the work. The central government provides the rules for the partnership, the state or municipality oversees the policy, and the State Regulatory Board oversees implementation.

There are various combinations of public and private participation in partnerships. In a turn-key project, the design and construction of a waste facility is led by the municipality and then turned over to a buyer to run. The responsibilities of collection, transportation, and disposal can be given to a private company for a particular period specified (minimum three years), while land is provided by the municipality (according to MSW 2000 Rules). Alternatively, collection and transportation may be handled by a private company, while processing and disposal are overseen by the municipality. Yet another possibility is that collection is done by an NGO, transportation by the municipality, and process, disposal, design, and construction by a private company. The final option is that the municipality is not involved at all. Land ownership, collection, process and disposal are all under the control of a private owner.⁴⁰

Grasim Industries MSW Processing Plant

Grasim Industries, a cement producer and flagship company of Aditya Birla Group, has a contract with the Jaipur Municipal Corporation on BOOT (Build, Operate, Own, and Transfer) basis to operate an MSW plant. The plant, which is established right next to the Langariyawas landfill, outputs Refuse-Derived Fuel (RDF). The RDF is then used to power a cement plant, Grasim's subsidiary Ultratech Cement Limited, in Neemuch, Madhya Pradesh. Contracted under a 30-year contract in 2005 and commissioned in 2007, the facility is India's first fully-automated MSW processing plant.

JMC initially provided 25 acres of land. They also deliver 500 MT of solid waste every day. After giving 20 lakh as a security deposit to prove their earnestness in undertaking the project, the rest of the management is left up to Aditya Birla Group. Aditya Birla hired a German company called Doppstadt to build the whole plant facility and outfit it with their state-of-the-art technology. They have also sublet their labor contract to Pratham Envirotech Pvt. Ltd. at Hyderabad. Fifty workers are employed at the plant.⁴¹

The garbage has to undergo many transformations before it reaches its final product of RDF. The five general steps in the process are size reduction, homogenization, metal separation, segregation, and further size reduction. As JMC lorries carrying garbage lifted from the city enter the plant, the garbage is weighed at the weigh station before being dumped. Next, workers manually remove large and dangerous items such as batteries, big stones, tires, dead animals, and heavy machinery. What remains is loaded with a payloador into the pre-shredder, which reduces the grain size from 0-1000 mm to 0-200 mm. Subsequently it is sent into an integrated conveyor, over which a magnetic separating machine is installed. The magnetic separator removes all the metal to be recycled for the metal industry. After that is separation of biodegradable organic material from sand and grit by way of a trommel screen (separation by size). The sand and grit is to be taken away by farmers to be mixed with manure and used as fertilizer. The heavier pieces that come from the trommel screen, such as glass and ceramics, go to the ballistic separator (separation by density). The heavy, inorganic fraction gets dumped in the landfill, whereas the light, organic fraction is sent for further homogenization and fine shredding. This further size reduction results in a final grain size of 0-50 mm. What results is garbage fluff, which is sent 400 km away to Grasim's UltraTech cement plant.⁴²

However, this garbage fluff is still fairly low in calorific value. Therefore, in the last cycle of homogenization and shredding, plastic is added to increase the calorific value (recall that there is not much plastic in the waste because it has already been removed by ragpickers.) This plastic is purchased from Sainath Enterprises at Rs 3/kg, or Rs 3000/MT. Sainath Enterprises employs ragpickers to pick non-recyclable plastic (like cracker and cookie wrappers as opposed to plastic bottles).

Although the plant is doing a good service for waste management, Grasim has been suffering financially, and has lost about 20 crore just funding operational costs. About 12-15 lakh per month of the operational costs are fixed. Because there are no variable costs, Grasim has to pay whether or not they are producing RDF fuel. Since the waste initially has a high rubble and low plastic content, there is low heat value, which makes the production of enough RDF fuel to cover costs near-impossible. Of the 500 MT of waste per day that JMC provides, the RDF plant is supposedly capable of producing 150 tons of RDF per day, (roughly a 30% recovery of useable refuse), but in reality it is more like a 5-6% recovery rate.⁴³

One reason the waste has such a high composition of rubble is because the garbage truck drivers' pay is based on the weight of the waste. Since a worker will earn about Rs 400 per truckload, or 4 MT of waste, he will add "useless waste" like construction debris to the garbage to make it heavier.⁴⁴ Unfortunately, the construction debris cannot even be bought by cement companies to be re-ground into cement because it is mixed up with all the other garbage so it smells too bad. Furthermore, cement companies are already established near their source of material at a limestone quarry, so they have no motivation to spend money on extra transportation cost to go all the way to

the plant to buy the smelly construction debris. It is due to reasons like this that it is difficult to re-sell any of the waste for profit.

Grasim Industries is practically running this RDF plant as charity. But there is a catch—because they are providing this waste management service they are more likely to get favors later from the government in other work they do. That is, the government will make things easier for them and will not get in their way. One other benefit of doing this service is that they are awarded carbon credits for using RDF fuel and thereby save 9% of the coal that would otherwise be burned to run the cement plant.⁴⁵

According to a JMC health officer who prefers to remain anonymous, the above information regarding low garbage value is not portrayed entirely accurately. The JMC only recently became responsible for the transport of garbage to the Grasim plant. On June 10, 2010, the transportation contract between Grasim and the other companies who were responsible for bringing the waste to the plant was nullified. It was those other companies' workers who were paid based on weight and who added construction material to the waste. The JMC workers who transport the waste now are not paid by weight and have no such incentive. Grasim blames the JMC for not sending them high quality garbage, but for the past year at least, the amount of construction material sent to the plant ought to have been reduced.⁴⁶

Mr. Gupta, the project manager of Grasim Industries, says that the main reason they are only able to produce 5-6% instead 30% RDF from the received waste is due to its poor caloric content. But according to the aforementioned anonymous health officer, inadequate technology is also a culprit. The plant was commissioned as recently as four years ago, yet even since then new companies have come out with superior RDF-

processing technology. Although Grasim's contract is supposed to last until 2035, it is possible that it may be nullified in favor of a more efficient company taking up the job. (This nullification would be justified on the grounds that Grasim sometimes refuses to take all the garbage that is offered to them by the JMC, which is a clause provisioned in the contract.) At an RDF plant in Mumbai, for example, 80% of the waste received is converted to RDF, leaving only 20% to be dumped in the landfill. The owner of that plant in Mumbai has had such success in fact, and made sufficient profit as to establish 20 other such plants nearby.⁴⁷

In addition to PPPs taking the form of a partnership with the government, it can also take the form of a partnership with an NGO. There are two NGOs in Jaipur working on SWM: Satya an NGO (referred to hereafter as Satya), and the Centre for Communication Development (CDC).

NGO #1, Satya

Under the SWM Rules 2000 there were no provisions for SWM in military camps. To address this issue, five years ago a tri-party agreement was formed between Satya, JMC, and Jaipur's Military Station. Satya provides the labor, JMC oversees the project, and the Jaipur Military provides the equipment. The Health and Hygiene program initiatives include door-to-door waste collection within the military compound, which cost 3.28 lakh in 2007 alone (last year for which there is data).⁴⁸ Luckily, unlike some of the other SWM projects contracted under PPP, Satya has not lost any money. The compound is divided into three areas—the official's area, the officer area, and the regency area. Dustbins are stationed throughout the campus, and afterwards waste is

transported to the dumpyard at Matheradaspora. Through regular training of the 137 workers with regards to garbage handling protocol, including the necessity of wearing gloves and which types of garbage produce which kinds of hazardous gases, the program has been met with success.

Although this PPP is a success story, Satya has not always had such luck in partnerships with the JMC. From 2005-2007 Satya experimented with door-to-door collection in ward 20 as well as in Chitrakoot, Vaishali Nagar. One thousand households were involved from ward 20. Those who could afford to pay would give Rs 30 per month per household for the service of waste pick-up, and those who were poorer were to pay Rs 20 a month.⁴⁹ However, only 100-200 of the 1000 households actually paid their dues. Because of this, Satya was operating the project at a huge loss. Moreover, 3.5 lakhs have yet to be settled between the JMC and Satya—that is, JMC owes Satya this amount of money and still has not paid.⁵⁰ According to Satya, the JMC was a poor facilitator throughout the whole project and did not provide much support. Due to inadequacies in the government, difficulties in managing payments, and corruption, the partnership was not a smooth one. Ward 20 was taken up as a challenge because the inhabitants of that area were unaware and unmotivated about proper waste disposal techniques. Satya completed the two-year contract, but the project was discontinued afterwards.

NGO #2, Centre for Development Communication

The Centre for Development Communication (CDC) is another NGO which has launched some efforts towards better urban solid waste management. CDC is a market-based, rather than a charity-based NGO which maintains a close partnership with the

JMC but does not receive financial support for its projects. They operate on the withdrawal model, which means that they work with a city for about five years and then plan to leave so as to encourage self-sufficiency. CDC has established itself in many cities. They have an office in Jaipur and used to work on SWM there in 1995, specifically in door-to-door collection and transportation. Now they have ceased work on these initiatives and instead focus on other social service projects in Jaipur.⁵¹ These social service projects include a Right to Information Campaign, Self-Help Groups and micro-enterprises, providing social security for the unorganized sector, urban health (e.g. routine check-ups), and institutional development (e.g. economic empowerment and combating forced evictions). A specific current project which indirectly relates to SWM is their food wastage program. This service picks up left-over food from large functions like weddings and distributes it to places like soup kitchens, thus reducing food waste.

Evaluation of PPP success

A prevalent opinion is that public-private partnerships in solid waste management are mostly unsuccessful because they are unprofitable. When private companies who work with SWM receive their funding from the JMC, they run into financial trouble due to JMC's lack of monetary resources. The only PPP that has been successful in Jaipur is the partnership with National Highways. Otherwise, the profit margin is only about 4-5%, which does not make the partnership viable for most companies.⁵²

Examples like the RDF plant in Mumbai show that businesses involved with the transformation of waste into other uses *can*, in fact, be profitable. When private corporations enter the business, they do it for profit. On the bright side, currently about

ten companies are showing interest for signing a contract for a “Comprehensive Sanitary Program”. This program would handle all aspects of SWM from sweeping, to secondary storage, to conversion under the BOOT (Build, Operate, Own, and Transfer) or DBOOT (Design, Build, Operate, Own, and Transfer) design. One company that has expressed interest is a German company called Hanjer Biotech Energies Pvt. Ltd, and their proposal is currently under consideration.⁵³

According to Mr. Anil Singhal, former executive engineer with the JMC, a step that could be taken to improve the PPP model is to relax and simplify regulations imposed on private corporations. For example, financial flexibility is very limited. A 10% security deposit *in cash* is required before the initiation of any contracted project, which deters many companies. To attract more companies, Mr. Singhal proposes that a bank guarantee would work better.⁵⁴ A bank guarantee allows a company who is entering business with a much bigger entity, like a government, to have a third party (the bank) give their support on the company’s behalf. The support takes the form of the guarantee, which is a percentage of the contract. The government requires this guarantee because it often has a hard time analyzing the financial track record and dependability of all the tenders submitting proposals for the contract. So the third party evaluates the company’s moveable and immoveable assets, as well as its financial reliability and vouches for the company. If the company does not carry out the contract to the government’s satisfaction, the guarantee is invoked and the bank has to pay that amount to the government. This system benefits both the government and the company. It benefits the government because the bank helps assess a company’s financial fitness. The bank guarantee also benefits the company because it does not have to pay up-front in cash.

Grasim Industries' contract document indicates that they have an unconditional Performance Bank Guarantee (if they fail to complete the project as laid out in the contract, then the JMC can claim the guarantee).⁵⁵ So it seems as though the bank guarantee method is already being implemented with at least one PPP. Grasim also paid a security deposit (but it was only 1%, not 10% of the total cost). Perhaps, then, both the deposit and the guarantee systems can be used, though that option would not necessarily be the best to attract the most tenders.

Another obstacle to the PPP mode's success is corruption. Workers under contracted labor are the most exploited, and sometimes do not even receive minimum wage. Contractors will pay a bribe to JMC to ignore the fact that they are not following wage standards.⁵⁶ According to Mr. Sanjay Agarwal, CEO of Satya, "A PPP can only be successful if there is no corruption. Smooth operation of the partnership requires reciprocal efforts from both parties, so unless both are committed, it is not possible."⁵⁷ Thus it seems that one of the main ways to improve the solid waste management is to reduce corruption. This, of course, is a huge task that will require long-sustained effort. But starting with such legislation as the Right to Information Act and the recent anti-corruption Lokpal Bill, progress can slowly be made towards this goal and necessity.

Integration of the Informal Sector

In all the discussion for waste management reforms, one group that is often neglected is the informal sector workers, especially the ragpickers. Often times they are harassed by police or people with a higher social standing, and are forcefully kept far away from dumpyards landfills. Because they are not hired by the municipality or any

company, they are also not given formal rights. Recently, for the first time however, ragpickers have been recognized in national legislation.

The Plastic Waste (Management and Handling) Rules 2011 was drafted by the Indian Government's Ministry of Environment and Forests. Some of these new rules include a ban on plastic sachets for packing or selling tobacco or pan, a ban on recycled and compostable plastics for packaging food products, and the implementation of Bureau of Indian Standards (BIS) regulations on carrying bags. The most radical part about the rules, however, is their inclusion of waste pickers, which is the first time such a special consideration has been made. The rules "require the municipal authority to constructively engage agencies or groups working in waste management including these waste pickers".⁵⁸ Though the rules oblige municipalities to engage the waste pickers, no specific stipulations as to how the municipalities should go about this have been made. It remains to be seen whether or not they will actually follow through, just as many municipal authorities did not meet all requirements of the Municipal Solid Waste (Management and Handling) Rules 2000.

In Jaipur, efforts to integrate the informal sector into the private sector in SWM are not well established. This is likely because most existent PPPs do not deal with collection of garbage—the stage in which the informal sector is most involved—but rather its disposal. Also, training of the informal sector would be too costly, and private companies are mainly concerned with profit. However there is a new integrated SWM plan in the works, in which door-to-door trash collection, including segregation of waste, would be implemented. This plan will go into effect June or July 2011 as soon as the proposal letter receives clearance. Earlier the JMC experimented with door-to-door

collection in a few wards under PPP (as previously discussed with CDC), but it failed. Currently bidding is underway for tenders (private companies) to undertake the integrated SWM project. Door-to-door collection is currently performed in some wards by the informal sector. Privatization of this service would displace some of those workers. The JMC might try to incorporate some of them into the system, but they are not sure yet.⁵⁹

Although efforts to integrate the informal sector are only on the horizon in Jaipur, such efforts have already begun to be implemented in other cities, such as Delhi. As of June 2005, Delhi contracted out collection, segregation, transportation, and disposal of solid waste in six zones to three different private companies. Segregation of waste is carried through by workers at the *dhalao* (either a waste bin, or a small building structure that houses a waste bin). It is further segregated at a central workshop, and those materials that can be recycled are sent for recycling. Before privatization, segregation of waste was only done by ragpickers. Although now the private sector is taking up some of these duties, the informal sector is still very much present. Currently, roughly 300 out of the 500 of the *dhalao* workers had previously been ragpickers. For these select few, working conditions, sanitation, and salaries have been greatly improved. The workers' jobs are made easier by the provision of separate bins for biodegradable and non-biodegradable waste, regular disinfection of the *dhalaos*, safety equipment and uniforms, sanitation trainings, and steady monthly wages. Only 300 ragpickers have benefited from formal employment, while many more ragpickers continue to work in the same conditions as before. However it is still a sign of progress that private companies are beginning to turn to the informal sector to supply some of their labor.⁶⁰

Community Awareness, Involvement, and Education

Ignorance about good SWM practices and civilian apathy have been mentioned by many as major impediments to better implementation of SWM laws. Awareness about the dire need for waste management reform certainly seems to exist at the governmental level, but is lacking at the citizen level. This is due largely to poverty and illiteracy.

At the governmental level, legislation is being developed that is geared towards putting management on the right track. Expectations, goals, and timelines are presented, holding different parties accountable for different aspects of waste management. For example, the Jawaharlal Nehru National Urban Renewal Mission is a seven year program part of which focuses on responsible urban development and governance, including SWM. It outlines goals for municipal reforms, which sectors are eligible for these reforms, and how funding is to be allocated. Every city that participates is expected to draft City Development Plans (CDPs) describing their policies and agenda for development, as well as Detailed Project Reports (DPRs) identifying areas that require attention and merit the undertaking of specific projects.⁶¹ For example the mission allocates funds to Urban Local Bodies (ULBs) (in Jaipur, the municipal corporation) for building up and attracting PPPs. Two thousand five hundred crore is to be given to the state government as aid specifically towards developing PPPs in SWM.⁶²

Similarly, the Municipal Solid Wastes (Management and Handling) Rules 2000 stipulates that it is the responsibility of the municipal authority to implement rules and develop infrastructure as well as file annual reports on the status of its progress. The ULBs were to have made the specified improvements to their SWM system by December 31st, 2003 at the latest. However, they were unable to meet the guidelines due to lack of

resources and mismanagement. Therefore in a Supreme Court hearing on February 3, 2004 it was announced that ULBs must submit an annual progress report to the State Pollution Control Board, which is then passed to the Central Pollution Control Board (CPCB) and the Ministry of Environment and Forests. The CPCB is now coming up with a new timeline for meeting the MSW 2000 guidelines, based on the progress reports of the 59 cities involved.⁶³

One of the requirements of the MSW (Management and Handling) Rules 2000 is that municipalities “organize awareness programs for segregation of wastes and shall promote recycling or reuse of segregated materials”.⁶⁴ Segregation of waste at the source is an essential and needed development since when all waste is mixed up, it is harder to reconstitute any of the components for reuse, such as construction debris for cement or organic material for fertilizer. The infrastructure to support segregation at the source must needs come hand in hand with civilian responsibility and participation. In addition to segregation at the source, civilian responsibility has to be developed in other aspects of waste management as well.

At the citizen level, NGOs are taking the lead in the area of SWM education. Previously the Centre for Development Communication was introduced as an NGO that has done work in SWM. The effort for which CDC has garnered the most acclaim is the “Swachta Doot-Aple Dari” Project, which won the UN Habitat Scroll of Honour Award in 2004. This project, based in Nagpur, Maharashtra, features door-to-door collection and segregation of waste at the source. Its creation was a response to the problems of dependence on the municipality for waste management, the “not in my backyard” attitude, non-segregation, and stigmatization of waste work. To address these issues, the

project provides employment to the socially disadvantaged and creates a sustainable community model for waste management.⁶⁵

A unique feature of the program is its emphasis on education of the public. Employees spend one out of four hours of work on education for proper waste disposal practices. These efforts have helped build community support for the program. Community members show support by using *swachta doot* waste services exclusively and giving voluntary tips to waste collectors. One shortcoming of this program is that the education portion of it targets only a certain economic class of people—those who can pay for door-to-door trash pick-up services. Those who need education about waste management the most are those who are uneducated, poor, and illiterate, and do not have access to other ways of learning about good SWM practices through other avenues such as government-posted signs.

With an area of 218 km² and a population of around 2.39 million, Nagpur is a smaller city than Jaipur.⁶⁶ However, it generates 1000 MT of waste per day, a level very comparable to that of Jaipur.⁶⁷ This similarity alone is not enough to suggest that the Swachta Doot-Aple Dari model would necessarily be met with the same success in Jaipur. Because the model relies in part on citizens' support, if Jaipur's residents are not invested in doing their part to contribute to a cleaner city, as was true in the experimental door-to-door collection in Ward 20, then even well-designed SWM may be ineffective.

Findings and Discussion

Thus far, various waste workers' roles in the waste management system have been laid out, as well as problems and how they are being addressed, and an evaluation of

PPPs. Because the first question of investigation is more factual, the second two will be focused on here for analysis.

The main difficulties in solid waste management seem to stem from lack of funding, poor law enforcement, and civilian unawareness and apathy. Further problems related to funding include out-of-date technology and lack of trained workers. Within the problem of poor law enforcement is also corruption, as officials take bribes to ignore violations (both by other workers and by civilians).

Establishing more PPPs can actually help take care of some of the funding problems. For example, in the agreement between JMC and Grasim Industries, JMC provides the land and the garbage, and Grasim takes care of the funding for all the machinery, workers, and maintenance. The JMC is not forfeiting anything that is valuable to them; in fact, they are getting the garbage disposal problem off their shoulders. If more PPPs can be established, especially ones that include some of the responsibilities like sweeping that had formerly been under the jurisdiction of the JMC, then the JMC can redirect those funds spent employing the sweepers, and use them instead on other resources like better technology or staff training. The Comprehensive Sanitary Program, in which a private company will oversee all aspects of waste lifecycle (from generation to ultimate storage), is currently in the works. But in general, more attractive payment options and reduced corruption are necessary both to attract more companies and to make the partnerships run more smoothly.

Although accessibility of garbage bins has not been cited by any respondents as a problem needing attention, personal observation suggests otherwise. In mid-March, the JMC introduced some public waste bins to the little park in Nemi Sagar colony of

Vaishali Nagar. They say “USE ME, JMC” on them. They are even shaped like fun cartoon animals to make them more user-friendly. It is encouraging to see that the JMC is providing such services. However public waste bins should not only be limited to parks—they need to be placed throughout the whole city. There are large municipal collection bins in the streets in most areas of the city, but are not actually every 250 meters as they are supposed to be. Most Jaipurites do not want to have to wander in search of one to throw out their *paan* wrapper. Also, these large bins take up a lot of space, so the areas in which they can be placed are limited. In crowded downtown areas of the Old City, or in commercial districts, smaller bins ought to be placed as well. If people were made aware of them and if they were convenient to use, this would significantly reduce the amount of waste tossed on the streets. The workload would then be lightened for the sweepers, but a new job would also be created as these small bins would need to be emptied into the large bins or collected directly by the lorries.

The study provided many opportunities for learning about the logistics of field research. One challenge that repeatedly occurred while conducting research was unforeseen holidays which rendered impromptu visits to offices difficult as they were closed. On a positive note, many people were more than willing to meet and share their knowledge. Sometimes those willing to help were not actually qualified on the topic of SWM. On one occasion a meeting was arranged with a faculty member of Rajasthan University who offered to meet and discuss Jaipur’s SWM. Upon meeting him, it soon became evident that although he was well-versed in public policy, he did not have much input to give on public policy of SWM. In addition, on two different occasions attempts to visit recyclable collection and sale centers near Sindhi Camp bus station in Jaipur and

in Sanganer were unsuccessful because the general location had been garnered by ragpickers but the exact location was not known. When these locations were reached, no one knew of the exact spot in question and no ragpickers could be found to show the way. From all of these experiences a few lessons emerge. Contacts suggested by others are preferable to those who are simply assumed might be helpful. Also, it is best to have someone who works in the industry and knows exactly where to go accompany the researcher rather than trying to locate a spot from hearsay only.

Conclusions and Way Forward

The overall objective of the study was to investigate Jaipur's solid waste management system by examining: the major players involved and how the system is implemented, the successes and challenges and how those challenges are being addressed, and the nature of public-private partnerships and how they can be improved.

At the conclusion of the study, it was found that Jaipur's waste management system involves many types of workers who all have specialized jobs, including government executives in political and administrative positions, a permanent and impermanent faction in the formal sector, the informal sector (including ragpickers, recyclable collectors, and scrap dealers), and private contractors. The formal sector seems to be carrying out their duties effectively and on time, and there are few complaints from citizens about their interaction with waste service providers.

Still there are many areas for improvement, including better law implementation and reinforcement, reduction of corruption, updated technology, better-trained staff, more manpower, increased education and awareness, and more funding. Public-private

partnerships are a prudent strategy to increase efficiency in SWM because specialized companies who are better financially equipped become the overseers of SWM for a particular area or project. However they are very unprofitable for companies, so it has been difficult to attract partnerships. In addition, corruption and unclear communication between the involved parties have interfered in the success of partnerships.

There does not seem to be a large niche for NGOs in SWM. Both the Centre for Development Communication and Satya have stopped door-to-door collection in residential districts due to unprofitability and lack of community involvement. Both of these NGOs have found other ways to be involved in SWM initiatives in Jaipur, but until corruption and community education initiatives improve, NGOs cannot effectively offer their services.

Upon completion of the study, a few questions present themselves for further investigation. There are a few more details in the topic of system implementation which have not been covered in as much depth, such as which types of places informal door-to-door workers take the trash. Is it just an informal empty lot dumpyard? Similarly, more information about the transfer stations could be looked into. Are they distributed well across the city? Do they create any problems for residents nearby? Following this strand of inquiry, more of the social attitudes about waste and current waste management practices could be investigated in order to understand both the shortcomings from the citizens' side and how to educate them more effectively. In this study, most of the problems in waste management that were focused on were shortcomings from the government side.

Recommendations For Further Study

This study provides a broad overview of how solid waste management works in Jaipur, what some obstacles are to its implementation and how they are being addressed, and surrounding issues with the various players involved. Specific issues included integration of the informal sector, education and awareness endeavors, and some examples of PPPs in action. There are many options for expanding and delving deeper into the subject of solid waste management. A comparative study could be conducted between the waste management of two cities of similar size and population in which successful programs in one city could be evaluated for possible replication in the other city. Alternatively, successful PPPs that are profitable could be evaluated to see what the company is doing that works well and how. Finally, further study on informal sector incorporation could be pursued. Currently Jaipur does not have any formal plans to incorporate the informal sector into PPPs. Evaluate the feasibility of doing so with limited expenditure on training ragpickers for new tasks, similar to the project undertaken in Delhi.⁶⁸

¹ Sandhu, Davinder. P.S., Director, Prime Minister's office, personal communication, March 23, 2011.

² Government of India, Ministry of Home Affairs, Office of the Registrar General & Census Commissioner, India. Retrieved from <http://censusindia.gov.in/2011-common/censusdataonline.html?drpQuick=&drpQuickSelect=&q=Jaipur>

³ Singhal, Anil, former Executive Engineer, Jaipur Municipal Corporation, personal communication, Jaipur, April 27, 2011.

⁴ Ibid

⁵ Garg, Dr. R.K., health officer, Jaipur Municipal Corporation, personal communication, April 7, 2011.

⁶ Zhu, Da Asnani, P. U. Zurbrugg, Christian (Dec 2007). Improving Municipal Solid Waste Management in India: A Sourcebook for Policymakers and Practitioners.

Herndon, VA, USA: World Bank Publications.

- ⁷ Anonymous, ragpicker #1, personal communication, April 19, 2011.
- ⁸ Central Public Health & Environmental Engineering Organization. Solid Waste. Retrieved from <http://cpheeo.nic.in/>
- ⁹ Sahu, Dr. Amiya Kumar, President, National Solid Waste Association of India (NSWAI), personal communication, March 23, 2011.
- ¹⁰ Anonymous, ragpicker #1, personal communication, April 19, 2011.
- ¹¹ Ibid.
- ¹² Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ¹³ Ibid
- ¹⁴ Anonymous, male sweepers, personal communication, April 19, 2011.
- ¹⁵ Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ¹⁶ Anonymous, JMC permanent garbage workers, personal communication, April 19, 2011.
- ¹⁷ Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ¹⁸ Anonymous, JMC permanent garbage workers, personal communication, April 19, 2011.
- ¹⁹ Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ²⁰ Sahu, Dr. Amiya Kumar, President, National Solid Waste Association of India (NSWAI), personal communication, March 23, 2011.
- ²¹ Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ²² Chauhan, Krishna, citizen of Jaipur, personal communication, March 11, 2011.
- ²³ Anonymous, ragpicker #1, personal communication, April 19, 2011.
- ²⁴ Anonymous, impermanent door-to-door garbage workers, personal communication, March 13, 2011.

-
- ²⁵ Kumari, R., citizen of Jaipur, personal communication, March 11, 2011.
- ²⁶ Anonymous, ragpicker #2, personal communication, April 10, 2011.
- ²⁷ Anonymous, ragpicker #1, personal communication, April 19, 2011.
- ²⁸ Gupta, A.K., Sr. Manager (Projects), Aditya Birla UltraTech Cement Limited, Personal communication, Jaipur, April 13, 2011.
- ²⁹ Garg, Dr. R.K., health officer, Jaipur Municipal Corporation, personal communication, April 7, 2011.
- ³⁰ Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ³¹ Pagare, Dr. Vijay B., Executive Director, Centre for Development Communication, personal communication, April 8, 2011.
- ³² Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ³³ Ibid
- ³⁴ Ibid
- ³⁵ Ibid
- ³⁶ Anonymous, JMC health officer, personal communication, May 2, 2011.
- ³⁷ Garg, Dr. R.K., health officer, Jaipur Municipal Corporation, personal communication, April 7, 2011.
- ³⁸ Sahu, Dr. Amiya Kumar, President, National Solid Waste Association of India (NSWAI), personal communication, March 23, 2011.
- ³⁹ Bhandari, Dr. Dinesh, former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.
- ⁴⁰ Sahu, Dr. Amiya Kumar, President, National Solid Waste Association of India (NSWAI), personal interview, March 23, 2011.
- ⁴¹ Gupta, A.K., Sr. Manager (Projects), Aditya Birla UltraTech Cement Limited, Personal communication, Jaipur, April 13, 2011.
- ⁴² Grasim Industries Ltd., & Harveen. (June 2007). *Harmony: A film on Refuse Derived Fuel from Municipal Solid Waste for a Cleaner Tomorrow*. India: Dhruv Star Communication.

-
- ⁴³ Gupta, A.K., Sr. Manager (Projects), Aditya Birla UltraTech Cement Limited, Personal communication, Jaipur, April 13, 2011.
- ⁴⁴ Ibid
- ⁴⁵ Ibid
- ⁴⁶ Anonymous, JMC health officer, personal communication, May 2, 2011.
- ⁴⁷ Ibid
- ⁴⁸ Satya an NGO, Annual Report 2006, 2007, 2008.
- ⁴⁹ Agarwal, Dr. Sanjay, CEO, Satya an NGO, personal communication, April 14, 2011.
- ⁵⁰ Ibid
- ⁵¹ Pagare, Dr. Vijay B., Executive Director, Centre for Development Communication, personal communication, April 8, 2011.
- ⁵² Singhal, Anil, former Executive Engineer, Jaipur Municipal Corporation, personal communication, Jaipur, April 27, 2011.
- ⁵³ Anonymous, JMC health officer, personal communication, May 2, 2011.
- ⁵⁴ Ibid
- ⁵⁵ Grasim Industries Ltd. (2005) Contract Document with the Jaipur Municipal Corporation—BOOT Basis—Build, Own, Operate, Transfer of Land.
- ⁵⁶ Pagare, Dr. Vijay B., Executive Director, Centre for Development Communication, personal communication, April 8, 2011.
- ⁵⁷ Agarwal, Dr. Sanjay, CEO, Satya an NGO, personal communication, April 14, 2011.
- ⁵⁸ Press Information Bureau, Government of India (7 Feb, 2011). Plastic Waste (Management and Handling) Rules, 2011 Notified. Retrieved from <http://pib.nic.in/newsite/erelease.aspx?relid=69649>
- ⁵⁹ Singhal, Anil, former Executive Engineer, Jaipur Municipal Corporation, personal communication, Jaipur, April 27, 2011.
- ⁶⁰ Garg, Ankur, Varun Kumar, and Vaibhav Verma. Public Private Partnership for Solid Waste Management in Delhi: a Case Study. *Proceedings of the International Conference on Sustainable Solid Waste Management, 5 - 7 September 2007, Chennai, India*. pp.552-559. Retrieved from http://www.swlf.ait.ac.th/IntlConf/Data/ICSSWM%20web/FullPaper/Session%20IX/9_07%20_Ankur%20Garg.pdf

The above citation is the source of all the data for that paragraph

-
- ⁶¹ Ministry of Urban Employment and Poverty Alleviation and Ministry of Urban Development, *Jawaharlal Nehru National Urban Renewal Mission Overview*. Retrieved from <http://www.jnnurm.nic.in/nurmudweb/toolkit/Overview.pdf>
- ⁶² Central Public Health & Environmental Engineering Organization. Solid Waste. Retrieved from <http://cpheeo.nic.in/>
- ⁶³ Ibid
- ⁶⁴ Municipal Solid Wastes (Management and Handling) Rules 2000. Retrieved from <http://envfor.nic.in/legis/hsm/mswmhr.html>
- ⁶⁵ Agarwal, V. and V. Mathur (2008). Urban Solid Waste Management in India—‘Swachta Doot-Aple Dari’ a Case Study of Nagpur City. *Urban Issues and Solutions*, X-1-X-10.
- ⁶⁶ Banerjee, Falguni (2011, April 14). City’s Population Rises to 2,398,165. Retrieved from http://articles.timesofindia.indiatimes.com/2011-04-14/nagpur/29417289_1_literacy-rate-population-number
- ⁶⁷ Pagare, Dr. Vijay B., Executive Director, Centre for Development Communication, personal communication, April 8, 2011.
- ⁶⁸ Garg, Ankur, Varun Kumar, and Vaibhav Verma. Public Private Partnership for Solid Waste Management in Delhi: a Case Study. *Proceedings of the International Conference on Sustainable Solid Waste Management, 5 - 7 September 2007, Chennai, India*. pp.552-559. Retrieved from http://www.swlf.ait.ac.th/IntlConf/Data/ICSSWM%20web/FullPaper/Session%20IX/9_07%20_Ankur%20Garg.pdf

Bibliography

Primary

Agarwal, S., CEO, Satya an NGO, personal communication, April 14, 2011.

Anonymous, impermanent door-to-door garbage workers, personal communication, March 13, 2011.

Anonymous, JMC health officer, personal communication, May 2, 2011.

Anonymous, JMC permanent garbage workers, personal communication, April 19, 2011.

Anonymous, male sweepers, personal communication, April 19, 2011.

Anonymous, ragpicker #1, personal communication, April 19, 2011.

Anonymous, ragpicker #2, personal communication, April 10, 2011.

Bhandari, Dr. Dinesh., former Chief Health Officer, Jaipur Municipal Corporation, personal communication, April 26, 2011.

Chauhan, Krishna, citizen of Jaipur, personal communication, March 11, 2011.

Garg, Dr. R.K., health officer, Jaipur Municipal Corporation, personal communication, April 7, 2011.

Gupta, A.K., Sr. Manager (Projects), Aditya Birla UltraTech Cement Limited, Personal communication, Jaipur, April 13, 2011.

Khan, Majeet, *kabari*, personal communication, April 12, 2011

Khan, Majeet, *kabari*, personal communication, April 23, 2011

Kuresi, Majeet, *kabari* scrap shop owner, personal communication, April 24, 2011.

Kumari, Rama, citizen of Jaipur, personal communication, March 11, 2011.

Pagare, Dr. Vijay B., Executive Director, Centre for Development Communication, personal communication, April 8, 2011.

Sahu, Dr. Amiya Kumar, President, National Solid Waste Association of India (NSWAI), personal interview, March 23, 2011.

Sandhu, Davinder. P.S., Director, Prime Minister's office, personal communication, March 23, 2011.

Singh, Uttam, *kabari* scrap shop owner, personal interview, Jaipur, April 26, 2011.

Singhal, Anil, former Executive Engineer, Jaipur Municipal Corporation, personal communication, Jaipur, April 27, 2011.

Secondary

Agarwal, V. and V. Mathur (2008). Urban Solid Waste Management in India—‘Swachta Doot-Aple Dari’ a Case Study of Nagpur City. *Urban Issues and Solutions*, X-1-X-10.

Banerjee, Falguni (2011, April 14). City’s Population Rises to 2,398,165. *The Times of India*. Retrieved from http://articles.timesofindia.indiatimes.com/2011-04-14/nagpur/29417289_1_literacy-rate-population-number

Bose, Anu and Ian Blore (1993). Public waste and private property, an enquiry into the economics of solid waste in Calcutta. *Pubic Administration and Development* 13: 1-15.

Central Public Health & Environmental Engineering Organization. Solid Waste. Retrieved from <http://cpheeo.nic.in/>

Garg, Ankur, Varun Kumar, and Vaibhav Verma. Public Private Partnership for Solid Waste Management in Delhi: a Case Study. *Proceedings of the International Conference on Sustainable Solid Waste Management, 5 - 7 September 2007, Chennai, India*. pp.552-559. Retrieved from http://www.swlf.ait.ac.th/IntlConf/Data/ICSSWM%20web/FullPaper/Session%20IX/9_07%20_Ankur%20Garg.pdf

Government of India, Ministry of Home Affairs, Office of the Registrar General & Census Commissioner, India. Retrieved from <http://censusindia.gov.in/2011-common/censusdataonline.html?drpQuick=&drpQuickSelect=&q=Jaipur>

Grasim Industries Ltd., & Harveen. (June 2007). *Harmony: A film on Refuse Derived Fuel from Municipal Solid Waste for a Cleaner Tomorrow*. India: Dhruv Star Communication

Grasim Industries Ltd. Contract Document with the Jaipur Municipal Corporation—BOOT Basis—Build, Own, Operate, Transfer of Land.

McDougall, Forbes R, Peter R White, Marina Franke, and Peter Hindle (2008) Integrated Solid Waste Management: a Life Cycle Inventory 2nd ed., Wiley. p 1-547.

Ministry of Urban Employment and Poverty Alleviation and Ministry of Urban Development, *Jawaharlal Nehru National Urban Renewal Mission Overview*. Retrieved from <http://www.jnnurm.nic.in/nurmudweb/toolkit/Overview.pdf>

Municipal Solid Wastes (Management and Handling) Rules 2000. Retrieved from <http://envfor.nic.in/legis/hsm/mswmhr.html>

Post, Johan. Jaap Broekema, and Jason Obirih-Opareh (2003). Trial and Error in Privatisation: Experiences in Urban Solid Waste Collection in Accra (Ghana) and Hyderabad (India). *Urban Studies* 40 (4): 835-852.

Press Information Bureau, Government of India (7 Feb, 2011). Plastic Waste (Management and Handling) Rules, 2011 Notified. Retrieved from <http://pib.nic.in/newsite/erelease.aspx?relid=69649>

Satya an NGO, Annual Report 2006, 2007, 2008.

Sharholly, Mufeed, Kafeel Ahmad, Gauhar Mahmood, and R.C. Trivedi (2008). Municipal Solid Waste Management in Indian Cities—A Review. *Waste Management* 28: 459-467.

Times News Network (2009, August 1). City Lacks Proper Solid Waste Management. *Times of India*. Retrieved from http://articles.timesofindia.indiatimes.com/2009-08-01/jaipur/28180332_1_solid-waste-management-transfer-stations-garbage

Wilson, David C. (Dec 2010). Comparing Solid Waste Management in the World's Cities. *ENVIS Urban Municipal Waste Management Newsletter, National Solid Waste Association of India*. (21), 2-10.

Zhu, Da Asnani, P. U. Zurbrugg, Christian (Dec 2007). Improving Municipal Solid Waste Management in India: A Sourcebook for Policymakers and Practitioners. Herndon, VA, USA: World Bank Publications.

Acknowledgements

I would like to thank the following people for their support in my project:

Mr. Trilochan Pandey, Ms. Tara Dhakal, Mr. Awadhesh Aadhar, Ms. Rama Kumari, Ms. Archana Mehr, Dr. Dinesh Bhandari, Mr. A.K. Gupta, Mr. Majeet Khan, Mr. Anil Singhal, Mr. A.K. Ojha, Mr. Pradip Saha, Mr. Amiya Kumar Sahu, Dr. Sanjay Agarwal, Dr. Vijay Pagare, Mr. Chabra, Dr. R. K. Garg, and the waste workers who I interviewed.

Appendix A

Jaipur's Waste Management Hierarchy

As described by Dr. R. K. Garg, from Jaipur Nagar Nigam

Political Hierarchy

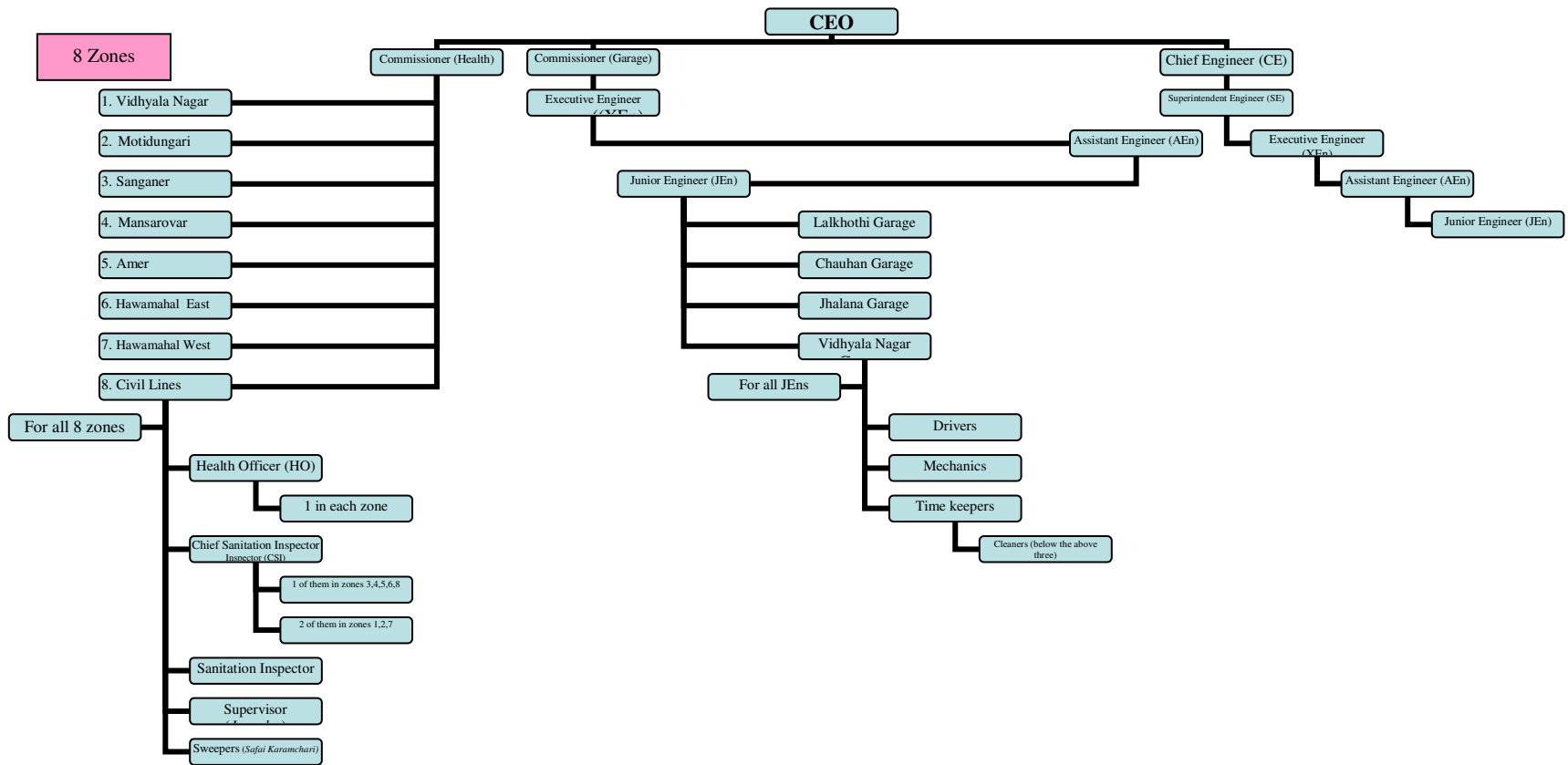
1. Mayor
2. Health and Sanitation Committee (Includes 5 elected and 3 nominated members)

Administrative Hierarchy

(See chart on next page)

Notes: Garage commissioner section oversees vehicles and transportation

CE section oversees development of landfill sites, processing plants, and civil development for SWM



Appendix B

Kabari Case Study

Majeet Khan has been doing *kabari* work for fifteen years. Daily (including holidays) he comes with his wooden pushcart to collect newspapers, old books, glass and plastic bottles, and iron scraps from houses and shops. Calling out “paper, *ratdi*” (“paper”), bottles!” he notifies people of his passing, and those who have things they want to sell him will come out of their homes to do so.



Majeet sets his own route, and always goes to the same places, which are C-Scheme (including places like Gopal Bari), Mani Park, Civil Lines, Vaishali Nagar, Gadget, Ajmeri Gate, Sanganeri Gate, Bais Godam, and even Chamod, which is more than two hours away. In his

experience, the best area for business is Shivaji Nagar, in Civil Lines.¹ When asked whether people living in wealthier areas usually have more stuff to give, the answer was unclear (and when the same question was asked of another *kabari*, he said no, there was no difference). Perhaps this is because poorer people are in more need of the money, so though they might have fewer plastic bottles and newspapers to sell, they are more

¹ Khan, Majeet, *kabari*, personal communication, April 12, 2011

committed to selling them. Wealthier people might have more stuff they have accumulated, but since they are not as in need of money they are not as eager to sell it.

One Monday the researcher accompanied Majeet on his route from about 9:30-10:00 AM, but he did not collect anything. He said the shortage of business was partly due to the fact that people were sleeping and resting. Usually he is able to buy more stuff on weekends, supposedly because more people are home then, so he said to come back with him on a Saturday or Sunday. Even on Saturday from 8:15-10:15 AM only one person came out to sell him something—one glass bottle and three plastic milk sachets (all for one rupee). Majeet said that usually he is able to get more than that, but because of the researcher's presence, fewer people were coming. Perhaps people were confused about why there was a foreigner with him and thought they ought to do business with him another time. It is unclear. Perhaps if he had been followed at a distance rather than alongside, the influencing variable would have been eliminated.

After working from about 7 AM until the late afternoon, Majeet then takes his goods to a *kabari* shop. The usual shop he sells to is run by Munna Kuresi in Raju Nagar. There are about 40-50 scrap shops in that area. Majeet earns Rs 10 per kg of newspapers he sells. Plastic fetches the same amount, and metal goes for Rs 20 per kg. Although other materials may technically be recyclable, they are less often recycled because it costs more to do so than the money they fetch in the marketplace.² On his cart Majeet keeps a scale to weigh the goods himself, but they are weighed again at the scrap shop. The shop sells the scraps to any company, it does not matter which (and they have no contracts

² Wilson, David C. (Dec 2010). Comparing Solid Waste Management in the World's Cities. *ENVIS Urban Municipal Waste Management Newsletter, National Solid Waste Association of India*. (21), 2-10.

with specific companies). As an example, one company purchases bottles which are taken to a factory in Delhi, cleaned, and refurbished. The scrap shop, which employs about 50 people, can receive anywhere from Rs 5,000-20,000 worth of scraps (assumedly in a day).³ Surprisingly, there is no leftover stuff that cannot be sold—everything is sold eventually.

Not all *kabari* scrap shops sell directly to companies. Some sell to bigger scrap shops. From those shops, cartons go to Sanganer, some glass bottles go to Madhya Pradesh, others things go to Panjab, Haryana, and Uttarakhand. Plastic bottles are ground up and reconstituted, while glass bottles are cleaned for repacking. Scrap metal is sold locally in Jaipur. One interesting determinant of where certain materials go is how much water is required for their refurbishing. Those states which have more water resources such as Panjab and Haryana do more recycling because water is required to clean the bottles. That is why the large glass bottles are sent there.⁴

Jaipur's water scarcity has serious implications for its recycling capabilities. Although recycling is an integral part of waste management, due to such constraints as water scarcity it would appear that Jaipur cannot be entirely self-sufficient and self-contained in all of its endeavors relating to processing waste, and must continue to send many of its recycled materials to other states. The necessity of sending materials to other states likely increases product costs as transportation costs are factored in, which works against *kabaris* and *kabari* scrap shop owners. To what extent the cost of recycled goods is affected by their destination distance has not been calculated.

³ Kuresi, Munna. *kabari* scrap shop owner, personal communication, April 24, 2011.

⁴ Singh, Uttam, *kabari* scrap shop owner, personal interview, Jaipur, April 26, 2011.

Space is a very relevant concern for some of the smaller scrap shops, such as that run by Uttam Singh. Due to the small confinement they cannot keep all their goods within one room. As a result, many of the goods are out on the street or the sidewalks, which is technically land to which they do not have a right. When government workers come by and complain, scrap shop owners have to pay a small fee to appease them. Theft is another consequence of keeping goods on the streets. This is the greatest difficulty in Uttam Singh's work.

Kabari work is unsatisfying for Majeet—he hopes to find a different job someday soon. Although Majeet's wife knows he works to earn money, she does not even know what kind of work he does. When asked why he has not told her, he responded “What advantage would that bring? It would only bring pain.” Supposedly the job is shameful, though it does not seem as shameful as picking through garbage. He would like to be a rickshaw driver, but to rent a rickshaw it costs Rs 100 a day. So he would need about Rs 40,000 to start him off for a year, which he cannot afford.

The researcher also had the pleasure of meeting Majeet's family, who live on Khatipura Road in Raju Nagar. Although Majeet is only 27 years old, he has been married for 15 years and has four sons, one of whom is a newborn. He has four brothers and a sister, who is well-off and owns a jeep. One of his brothers does the same work as him, as does at least one of his cousins. Fifteen people live in his small house compound; his wife and sons sleep in one room, and his parents and one of his brother's families live in the other rooms. Other relatives live just across the street.

