



Full length article

Encouraging urban households to segregate the waste they generate: Insights from a field experiment in Delhi, India

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ABSTRACT

Despite the Solid Waste Management Rules (SWM), 2016 stating that waste generators should segregate their waste before it is collected; most households in Delhi continue to be non-compliant. We conduct a study in 15 localities of Delhi to understand whether information, norms and economic incentive would have an effect on households' compliance to rules. The study uses field experiments to elicit the impact of the interventions.

We find that even low cost interventions such as information on segregation and its benefits are effective in changing household waste segregation behaviour. We also find that a combination of information and economic incentives play an important role in inducing the households to begin segregation at source. The efficacy of incentive highlights the importance of defining a differential user fee - lesser amount for those who segregate and a higher amount for those who do not segregate. The field observations also show that the garbage collector could nullify the actions of the household, thus highlighting the importance of educating the garbage collector as well. Our findings can inform Municipal officials and agencies involved in collection and transportation of waste, to induce households to segregate at source.

1. Introduction

As per 2015–16 annual reports, Delhi generates approximately 9620 Tonnes per day (TPD) of municipal solid waste (MSW) (DPCC). Studies have shown that there is a clear linear and positive relationship between per capita solid waste generation rates and income levels (Viswanathan, 2006). India's per capita MSW generation rates are likely to keep pace with the economic growth rates (Goel, 2008), which means that already burgeoning mountains of waste will grow further.

Generation and disposal of waste can be thought of as a public bad. While disposal of waste at the household level includes only their private cost in terms of the cost paid to the garbage collector, the social cost of waste disposed of (in landfills) also includes the cost of methane emissions to air and contamination of groundwater. These environmental impacts are also strongly related to the density of the population- they might be greater in densely populated areas as compared to less densely populated areas. Charging a flat fee for waste collection services means that the cost of every additional unit of waste generated by a household is zero, resulting in the generation of more waste. Moreover, due to lack of information on the social costs and benefits, each household chooses to either dispose or recycle depending on its

whims and fancies. As long as municipal solid waste disposal and recycling is privately costless, households will not have an incentive to recycle (Porter, 2002). In addition to the above, variability in local conditions such as awareness, climate, availability of infrastructure to process waste efficiently, all affect the waste management operations, thus making it harder to devise a long term and wide ranging policy (Da Cruz et al., 2014a).

The studies reviewed and our discussions with households during the course of this research reveals that there is a clear disconnect between the rules formulated at the level of authorities, the type of information being disseminated, and compliance at the household level. While the policy framework and the knowledge of negative externalities should be leading the society as a whole to reduce the generation of waste at source and to ensure proper disposal of waste, individual households' waste disposal behavior shows otherwise.

However, in India, it is common practice for urban households to recycle glass bottles and newspapers and for households that engage in gardening activities to compost their kitchen waste. Other forms of recyclable waste such as packaging materials and milk packets are usually collected by rag pickers to earn a living. At present, rag pickers are part of the informal sector foraging the Dhalaos (garbage collection

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points) to collect recyclables, but in the process coming in contact with animal excreta, sputum, dead animals and at times, medical waste and thus susceptible to a lot of diseases (Sarkar, 2003). The rag pickers face challenges such as deplorable work conditions, low social status in their daily life, and yet the role they perform can be considered as a positive externality (Campos, 2014).

This paper focuses on the actions of the household as this is the beginning of the problem. Segregating waste at the source would not only provide the waste pickers with better work conditions but would also reduce emissions to air, soil, and water, lead to efficient composting of biodegradable waste, increase the amount that can be recycled, and reduce the requirement for transportation of waste.

Our study uses field experiments in housing localities of Delhi with the following objectives:

- To investigate the determinants of waste segregation behavior at household level;
- To understand the effect of interventions- information, norms, and incentives, to ensure compliance with SWM Rules, 2016;
- To understand how the interventions differ in their influence across the socio-economic categories of the society;

The above questions look at the issue of ensuring effective processing of waste generated in fast growing cities in India. SWM Rules 2016 explicitly mandate the generator to segregate. The findings from the study can be used to inform concerned authorities on the effectiveness of interventions to successfully bring about a change in the present disposal system in other similar cities as well.

The paper is organized as follows: Section 2 describes the policies adopted by the Government of India to manage municipal solid waste. Section 3 summarizes findings from existing research on waste management across other countries. Section 4 describes the design and methodology of the study. Section 5 gives the analysis of survey data through summary statistics and econometric results. Section 6 provides discussion on the results and Section 7 gives the conclusions and policy implications of the study.

2. Municipal solid waste regulations and schemes in India

The Environment Protection Act enacted in 1986 gave power to the central government to regulate all forms of waste and to tackle specific problems that may be present in any region of India. Under the Act, the central government has the power to take measures to protect and improve environment. In particular, such measures include preparation of manuals, codes or guides relating to prevention, control or abatement of pollution.

The 74th Amendment act (1992), endowed the municipalities with such powers and authority as may be necessary to carry responsibility conferred on them including the responsibility of public health, sanitation and solid waste management under this act.²

The Municipal Solid Waste (Management and Handling) Rules (SWM Rules), 2000, highlighted that it is the responsibility of the generator of waste to ensure delivery of waste in accordance with the collection and segregation system notified by the municipal authority. In order to encourage this, the municipal authorities shall undertake a phased programme to ensure community participation in waste segregation. The Rules also specified that landfilling will be permitted only for non-usable, non-biodegradable and non-recyclable inert waste (MoEF, 2000).

In 2006, the National Environment Policy (NEP) identified municipal waste as a major cause of soil pollution. It recognized the need for strengthening the capacity of local bodies for segregation, recycling and

reuse of municipal solid waste to efficiently deal with the problem. The policy emphasized the importance of substituting biodegradable and recyclable materials for non-biodegradable materials. It called for and developing and implementing strategies for the recycle, reuse, and final environmentally benign disposal of non-biodegradable waste through promotion of relevant technologies and use of incentive based instruments (MoEF, 2006). National Mission for Sustainable Habitat sub-committee report emphasized the need for community participation in waste management activities by the ULBs along with segregated storage at source for effective recycling (MoUD, 2014). The Clean India Mission, 2014 (Swachh Bharat Mission) guidelines advise ULBs to distribute two dustbins to promote segregation at source. Further in this direction, for promoting and scaling up production of compost, the central government in 2016 introduced a policy for providing market development assistance of Rs. 1500 (about 23 USD) per tonne of city compost for scaling up production and consumption of the product.³

The SWM Rules 2016 which replaced MSW Rules 2000 are the latest regulation to efficiently handle municipal solid waste. The major provision under the new rules is that they mandate the waste generator to segregate the waste into biodegradable and non-biodegradable waste before it is collected, thus, shifting the onus of segregation onto the household. (MoEF, 2016). Further to the new rules, the National Green Tribunal (NGT) in its judgment on December 22, 2016, has directed every State and Union Territory to implement and enforce the MSW Rules 2016 in all respects and without any further delay.⁴

3. Insights from international experience

Countries have employed different regulations to manage waste efficiently, from voluntary participation to using the 'polluter pays principle'. For example, the mandatory one-way deposit system implemented in Germany in 2003 resulted in 98.5% of refillable bottles being returned by the consumers. Similarly, in Sweden recovery rates reached 86% for cans and 77% for PET bottles after the introduction of the scheme in 1984 for PET bottles and in 1994 for cans.⁵

Information plays an important role in collection and recycling of households' waste. Lim-Wavde et al. (2017) find public education related to household hazardous waste to have increased the amount of household hazardous waste collected. In another study Rhodes et al. (2014) evaluated the effect of instructions on depot recycling behaviour. The study highlights that even simple instructions, providing definition of depot recycling and the types of products that can be recycled at these depots, are effective in increasing depot recycling efforts.

Unit pricing of the traditional waste collection provides an incentive for households to divert their waste flows towards recycling collection thereby increasing social welfare (Van Houtven and Morris et al., 1999). Incentive based mechanisms such as reward mechanisms and receipt of money for every kilogram of organic waste separated by the community were found to be most effective as compared to simple placement of organic collector tanks placed next to the common collecting bins and mechanism using educational program, providing bins for organic waste, increasing the coverage of large organic collector tanks in the community and commendation and acknowledgement (Boonrod et al., 2015). In addition to unit pricing acting as an incentive for households, 'Pay As You Throw (PAYT)' schemes have also been found to influence recycling rates, even at the municipal level since such schemes provide fiscal benefits in the form of reduced landfill tipping fees and increased revenue from selling collected recyclables

³ <http://pib.nic.in/newsite/PrintRelease.aspx?relid=134638> (Accessed 28 December, 2017).

⁴ <http://www.indiaenvironmentportal.org.in/content/438543/judgement-of-the-national-green-tribunal-regarding-municipal-solid-waste-management-in-india-22122016/>

⁵ <https://www.zerowasteurope.eu/tag/germany-deposit-refund-system/>

² <http://indiacode.nic.in/coiweb/amend/amend74.htm> (Accessed 28 December, 2017).

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