



**An Initiative Towards
Decentralised Solid Waste Management**

Collaborative Efforts

Of

RWA - Defence Colony, New Delhi

And

Toxics Link (An Environmental NGO), New Delhi

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Decentralised Solid Waste Management in Defence Colony

By RWA A- Block and Toxics Link

About Toxics Link

Toxics Link is an environmental NGO dedicated to bringing toxics related information into the public domain, both relating to struggles and problems at the grassroots as well as global information to the local levels. Toxics Link also engages in on-the-ground work especially in areas of municipal, hazardous and medical waste management and food safety among others. Driven by the increasing problem of waste resulting to environmental and health implications, we engage ourselves in finding means of sustainable waste management. One of our aims is to simplify the problem by working with communities and educational institutions and help facilitate in establishing a zero waste management in the respective campuses. It has been our constant endeavor to sensitize communities including schools for participating in the development of sustainable municipal waste management practices.

Need for Solid Waste Management

India's population has expanded from 342 million in 1947 to 1027 million in 2001. The urban population is expected to grow to 470 million by 2015 A.D. Over the years there has been a progressive decline in the availability of essential services as well as in the quality of life in urban as well as rural areas.

With the growing population, urbanisation and demand for consumer goods, both quantity and quality of urban solid waste has changed significantly. This is causing serious environment problems. Urban Solid Waste is a major contributor to global warming; it leads to surface and ground water pollution through run-off from dumpsites and unhygienic unsanitary surroundings resulting in epidemics and has adverse impact on rag pickers & sanitary workers. Solid Waste collection and disposal are an important part of environmental hygiene and need to be integrated with environmental planning and policies. Improper collection, storage, treatment and disposal can lead to massive environmental damages leading to serious health hazards. On the other hand much of the waste can be a valuable resource through proper recycling.

Programme Background

“Success comes with hard work”. Toxics Link's initiative with strong support and participation of the residents of A-block, Defence Colony speaks volumes about the effort and perseverance that has gone into the success of the community-based municipal waste management, which began seven months ago.

Defence Colony falls under the Central Zone of MCD. Unsatisfied with the existing system of solid waste management, the RWA decided to take the responsibility upon itself to make its community a cleaner and hygienic place to live in.

It began in the year 2005 in the month of June when Toxics Link received a note of interest from Mrs. Shammi Talwar, a member of RWA, A-Block, Defence Colony for establishing an environmentally sound municipal waste management in their community. Having seen the intervention taken up in Sarita Vihar, the members of the RWA found confidence in Toxics Link and gave the responsibility of setting up a good management practice

There are altogether more than one thousand households (1000 HH) in the A-Block of Defence Colony, New Delhi that belong to the category of middle-high-income group. Collection of waste from every household exists but the total waste goes into the MCD dhalaos located within the community. Total four waste collectors earn their income by collecting a monthly user fee of Rs.35 from every household. Each collector caters to an average 200-225 HH and the monthly salary is supported by his or her own collection.

Based on the model of decentralized solid waste management, community is the most important stakeholder in bringing sustainability to zero waste zone initiative. Therefore, it was made clear to the RWA, A-Block, Defence Colony that unless they geared up to drive the project, such initiative would only achieve partial success. We organized meetings on the underlying dynamics of such an initiative and discussed our respective roles and responsibilities. Finally, a memorandum of understanding was laid down where both the parties gave approval. Following this, stakeholders' meeting was organized in which the MCD Commissioner, RWA members, Residents, Toxics Link, household maids and waste collectors participated. This activity helped in building a rapport amongst the stakeholders.



Shammi Talwar of RWA A Block speaking on Solid Waste Management

PROGRAMME GOAL, OBJECTIVES AND PROCESS

Goal:

To develop a demonstrable Community Based Zero Waste Management Model for managing their own solid waste in a sustainable manner through capacity building and raising awareness of all stakeholders.

Objectives:

- To set-up a participatory, decentralised, and eco-friendly system of Household Solid Waste Management
- Improve the quality of life of waste collectors engaged in handling waste

Steps and Process

- Situational Analysis through base line survey
- Rapport Building, raising awareness amongst the residents and waste collectors to prepare them to anticipate in the community based solid waste management programme.
- Training and Capacity building of waste collectors and other stakeholders
- Regular Monitoring of the programme
- Community Based Composting: Effective Micro-organism (EM) for composting

Before the intervention began, there was no primary segregation of waste and the MCD dhalao overflowed making the area filthy and unhygienic. Today, almost 30% households hand over segregated waste to the waste collectors while the remaining mixed waste is segregated by the waste collectors to recover the recyclable and reusable materials for sale. Kitchen waste is then taken to the compost pits. This has to a great extent helped in reducing the dependence on MCD dhalao, leading to diversion of waste from landfill. Monthly collection fee from the residents supports the salary of the waste collectors. It is encouraging to learn that the waste collectors earn an additional income by selling the valuable dry wastes to kabariwalas of Sarai Kale Khan. The whole exercise has led to least amount of waste being actually dumped into the MCD dhalao. The initiative shows a significant impact on the cleanliness and the aesthetic sensibility of the community.

Four compost pits were constructed, two of which are located in JCO club with the size of 7x5x4 cubic ft and the remaining two in the adjacent MCD Park with the size of 12x5x4 cubic ft. Initiation of such a system requires space for locating compost pits and procurement of the required infrastructure. The RWA of this block has made an appreciable effort by constructing the compost pits and coordinating with the waste collectors. Recognizing the importance of the occupational safety of the workers, Toxics Link addresses the issue and commits to ensure that the process does not cause health hazard to the workers.



Inauguration of Community Based Composting

The strength of the initiative lies on the active involvement of the RWA members who have kept a strict vigilance on the waste collectors and the compost turners. Besides, full cooperation of the residents who are educated through meetings and distribution of information materials has contributed hugely in achieving the success so far.

ACTIVITIES CARRIED OUT

- Introductory meeting with the RWA A Block Defence Colony
- Base line survey done through door to door meeting with residents
- Awareness generation on Solid Waste management amongst the residents through door-to-door meeting and by distributing the IEC material
- Organising the orientation programme on solid waste management for the stakeholders
- Capacity building workshops and meetings with the RWAs and Waste Collectors
- Training of the waste collectors on segregation and composting of garbage.
- Regular joint monitoring of implementation by RWA and Toxics Link
- Regularly imparting awareness to emphasise segregation and waste reduction at source so that minimum waste goes for land filling



Capacity building of waste collectors



Turning of garbage by one of the worker

IMPACT OF THE PROGRAMME

The decentralised solid waste management was conducted in 1000 households in A- Block, Defence Colony. Based on the availability of the land, the composting was done with the wet waste collected from the 500 households. Since the two workers jointly cater the waste from approx 250 households, the four workers initially involved in the composting process out of the eight workers altogether in the entire A-Block Defence Colony

Quantity of waste disposed to landfill: During our survey, it was found that average daily generation of waste from each household in the whole A-Block is approximately 0.85 – 1.05 Kg comprising both wet and dry waste. Therefore, total waste generated from this block going into the landfill is approx. 1 tonne/day

Wet waste generation from each HH: The average wet waste generated by every household about 600-700 g of wet waste. Therefore, two workers jointly an amount of 150 -175 Kg wet waste per day.

Table- 1, Details of generation of Wet Waste

No. of households	Wet Waste/HH/day (g)	Total Wet waste in Kg/day	Total Wet waste in tonne/day	Total Wet waste in tonne/annum	Waste diverted from landfill/day
500	600-700	300-350	0.3-0.35	109.50-127.75	300-350 Kg
1000	-Do-	600-700	0.6-0.7	219.00-255.50	600-700 Kg
4000	-Do-	2400-2800	2.4 – 2.8	876.00-1022.00	2400-2800 Kg

Recyclables: The average recyclables produced by every household 250 – 350 g per day. Total amount of waste managed in A- Block Defence Colony: Of the one tonne of waste generated, wet waste from 500 HH is composted which means approx. total 350 Kg of wet waste is managed within the colony. It is noted that each of the four waste collectors sell approximately 32-44 Kg per day of recyclables generated from altogether 500 HH. Therefore, there is a total collection of 125-175 Kg of recyclables from 500 HH daily.

Table-2, Details of Recovery of Recyclables

No. of households	Recyclables/HH/day (g)	Total recyclables (Kg)/day	Total recyclable (tonne)/day	Total recyclable (tonne)/annum
500	250 –350	125-175	0.125-0.175	45.625-63.875
1000	-Do-	250-350	0.25-0.35	91.25-127.75
4000	-Do-	1000 - 1400	1.0 – 1.4	365.0-511.0

Landfill diversion from Block-A: Calculating from the amount of wet waste managed by the community of 500 HH and the recovery of recyclables from 1000 HH of A-block, it is found that there is a landfill diversion of approx. 600-700 Kg of waste per day which amounting to more than 200 tonnes per annum of waste diverted from landfill through this small effort

Table-3, Details of Manageable Waste

No. of households	Total wet waste/day (Kg)	Total recyclable/day (Kg)	Total Waste/day (Kg)	Waste diverted from landfill/day	Approx. waste diverted from landfill/annum
1000	600 -700	250 – 350	850 - 1050	850 – 1050 Kg	346.75 tonnes
4000	2400 – 2800	1000 - 1400	3400 - 4200	3400 – 4200 Kg	1387.0 tonnes

Projecting the landfill diversion from the whole A-block and total Defence Colony: Management of wet waste by community in Block –A (1000 HH) will divert an amount of 600-700 Kg of waste taken to landfill. Therefore, if such a system would have to be started in the whole of Defence Colony (4000 HHs), an amount of 2400-2800 Kg (2.4–2.8 Tonnes) of wet waste per day will be reduced from the total waste going to the landfill. Including the recovery of recyclables, there will be a total diversion of 2650 – 3150 Kg (2.6 – 3.0 Tonnes) of municipal solid waste that is disposed into the landfill daily.

Clearing of Dhalaos and transportation: Earlier, the dhalaos and the MCD bins overflowed with garbage. The MCD would clean the dhalaos and the bins daily and transport to the landfill daily. With the start of the community initiative, the use of dhalaos is greatly reduced. In fact, only the bins are used now, which means the labor, and the transportation costs have been reduced significantly.

Cost recovery from recyclable waste: Approx. Rs.50 - 75 is generated from the sale of recyclables per waste collector. In total, there is a revenue generation of Rs.400 – 600 per day only from selling recyclables collected from 1000 HH.

Table-4, Revenue Generation from Sale of Recyclables

No. of Households	No. of waste collectors (WC)	Revenue/WC/day	Total revenue/day
1000	8	Rs.50 - 75	Rs. 400 – 600 for eight waste collectors

LONG TERM IMPACT OF THE PROGRAMME

- Earning opportunities and more livelihood options
- Recognition to waste collectors
- Up scaling Solid Waste Management in other communities
- Landfill diversion through composting and increased recycling inorganic waste
- Recovery of natural resources

STRATEGIES

The strategies are:

- Invoke the active participation of RWAs.
- Provide occupational safety measure to the waste collectors to facilitate hygienic collection of waste.
- Generate a sense of ownership over the programme amongst the RWA and the waste collectors
- Place the system of waste collection and disposal through waste collectors
- Upscale the programme to the whole Defence Colony through the skills of the workers of A - Block.
- Intensive awareness education campaigns to actively involve the children on best practices of Solid Waste Management.

CONSTRAINTS

- RWA is active but very few resident's participation in the programme
- Lack of segregation system at source
- Lack of good relation between RWA and the waste collectors
- Changing the members of RWA
- Lack of fund with RWA for initiation of Solid waste management
- Land for segregation of waste and composting
- Monitoring and supervision of the programme
- Marketing of compost

RECOMMENDATIONS

- Since solid waste management is a people's programme, the implementing agencies should adopt the participatory approach during the entire course of implementation, which can create a sense of ownership among the community people and towards the sustainability of the programme.
- Local schools should be involved. The schools can work as a bridge in dissemination of information from the functionaries to the families and the entire community.
- Institutionalization linkage between municipality and the community is critical for sustainability of the programme.
- There should be a provision of the incentives for the communities who are coming forward for the waste management programme in terms up scaling the SWM.
- For the self-sustainability of the programme, ownership must lie upon waste collectors, community (RWA, CBOs, or Committee) helps in creating sustainable interest among them.
- Incorporate waste management with livelihood, sanitation and health & hygiene issues for a sustainable interest amongst the workers as well the community

COST ANALYSIS OF THE INTERVENTION:

In the beginning the wet waste from the 500 households out of 1000 households was taken into the secondary segregation and composting. For initiating the composting process, infrastructure needs to be established first. The model takes into account the initial establishment cost, which includes procuring of rickshaw and related equipments, cost of construction of compost pits and its maintenance and the cost involved in training and building the capacity of the waste collectors.

While the establishment cost is one-time, there are other recurring costs, which needs to be supported throughout. These include the cost involved in purchasing EM solution and labor cost for monitoring the composting. The monthly maintenance of the rickshaw and the salary for the workers are also recurring costs, which need to be borne by the owner of the initiative.

The revenue generated through the programme as given here can meet the monthly recurring cost and can reach a break-even (revenue generated covering the establishment cost) point in certain time period. There are specifically three modes of revenue generation, collection fee from the residents or the user fee, the sale of compost and the recyclables. In A-block, the waste collectors takes the user fee collected from the residents in the form of monthly salary. The waste collectors also take the recyclables away for selling.

Break up of the Capital and monthly recurring cost:

Cost Analysis for 500 HHs in middle-income group community:

Establishment Cost (In Rupees)		Recurring Cost (Rupees) Monthly		Revenue Generation (Rupees) Monthly	
Elements	Cost (Rs)	Elements	Cost (Rs)	Source	Amount
Two rickshaws @ Rs.6,000/ rickshaw	12,000	4 Workers @ 4375/worker (Distribution of the monthly user fee)	17,500	User fee @ Rs 35/HH	17,500
Digging of 4 pits required for sustaining the programme @ Rs.750/pit of (6x4x3 cubic ft in size)	3,000	2 bottle of EM solution @ 210/bottle & 4 Kg Jaggery @ Rs.24/Kg	420+96 = 516	Sale of compost	3,000
Construction materials for 4 pits	12,000	Monitoring cost	500	Average sale of recyclables @Rs.50/worker/day (Additional earning of waste collectors)	6,000 (Rupees 1,500 per worker)
Pit construction labor cost 4 @ Rs. 500 /pit	2,000	Labor cost for the worker (Turning & Sprinkling)	500		
Equipment cost (barrel, spade, fork, ganti, bucket, mug, spring balance, jute and plastic sheet) Apron, gloves and 1 pair boots	5,000	Sieving cost @ Rs.500/month	500		
Capacity building of workers	5,000	Incidental cost	500		
IEC materials	5,000				
Total	44,000		20,016		26,500

➤ This model is for the middle income group community where the private door to door waste collection is already into practice and the monthly user fee and income through recyclables directly goes to the waste collectors

Monthly Income of the Workers:

- Average monthly income to four workers: Rupees 17,500 + 6,000=23,500
- Per worker average monthly income: Rupees 23,500/4=5,875

Note:

- In order to make the project self sustained the cost like (Monitoring, Labor and Sieving) should be born by the waste collectors as all earning through monthly user fee and by selling the recyclables directly goes to the workers or they themselves should perform these activities
- On the other hand, since RWA is the owner of the manure so they will be bearing the monthly cost of EM solution & jaggery and Incidental cost
- Estimated cost of organic cost: Rupees 10/Kg

Explanation to the cost analysis:

In Defence Colony A-Block, it is found that a considerable amount of recyclables is generated, which has good sale value. The waste collectors take charge of the recyclables and earn additional income by selling these items. If these items can be collected in a systematic way by the RWA, it can supplement the monthly recurring cost. Not only the saleable recyclables, sale of compost is also another source of revenue generation, which will aid in the recurring cost. It can also be seen that once the association takes charge of the program, cost of external monitoring visit is not required. It is very essential to take into account the cost recovery from sale of recyclables and compost since the user fee alone cannot support the monthly recurring cost. Therefore, it is recommended that when any association initiates such a programme, it should be planned in a way that recyclables are handed over to them.

Break-even Analysis:

In order to derive a sustainable programme, it is important to project the break-even point.

What is break even?

The break-even point is the point where revenue generated is exactly equal to costs. At this point, no profit is made and no losses are incurred.

Break-even analysis is a useful tool to study the relationship between fixed costs, variable costs and returns. A break-even point defines when an investment will generate a positive return. Break-even price analysis computes the price necessary at a given level of production to cover all costs. To explain how break-even analysis works, it is necessary to define the cost items.

Fixed costs, incurred after the decision to enter into a business activity is made, are not directly related to the level of production. Fixed costs include, but are not limited to, depreciation on equipment, interest costs, taxes and general overhead expenses. Total fixed costs are the sum of the fixed costs.

Variable costs change in direct relation to volume of output. They may include cost of goods sold or production expenses such as labor and power costs, feed, fuel, veterinary, irrigation and other expenses directly related to the production of a commodity or investment in a capital asset.

Mathematical Explanation:

Case One:

- Since the RWA is the owner of the programme and has invested towards establishing the programme
- Total establishing cost: Rupees 44, 000
- Monthly recurring cost to RWA: Rupees 1, 016 (EM, jaggery and incidental cost)
- Monthly revenue generation by selling the compost: 3, 000 (Only compost goes to RWA)

So, The break-even period will be:

$$B-E = F / (S - V)$$

where:

B-E = break-even point (number of months),

F = total fixed costs,

V = variable costs per unit of production,

S = savings or additional returns per unit of production

Based on the above calculation, break-even point can be estimated.

$$B-E = 44,000 / (3,000 - 1,016) = 22.18 \text{ Months}$$

Therefore, it will take 23 months to cover the total costs invested initially for establishing the system.

Case Two:

If Incidental cost is borne by the workers:

- Per worker incidental cost: Rupees $500/4=125$
- Then, per worker monthly income: Rupees $5,875-125=5,750$
- Monthly recurring cost to RWA: Rupees 516 (EM & jaggery cost)
- Monthly revenue generation by selling the compost: Rupees 3,000 (Only compost goes to RWA)

So, the breakeven period will be:

$$B-E = F / (S - V)$$

$$B-E = 44,000 / (3000-516)$$

$$B-E = 44,000 / 2484 = 17.71 \text{ months}$$

Therefore, it will take 18 months to cover the total costs invested initially for establishing the system.

Case Three:

If Incidental cost is borne by the workers and fee of rupees of 250 /month paid by each worker to RWA

- Per worker incidental cost: Rupees $500/4=125$
- Monthly fee paid by each worker to RWA: Rupees 250
- Then, per worker monthly income: Rupees $5,875 - 375 = 5,500$
- Monthly recurring cost to RWA: Rupees 516 (EM & jaggery cost)
- Monthly revenue generation by selling the compost: Rupees 3,000 (Only compost goes to RWA)
- Monthly fee collected by RWA @ 250/workers x 4 = 1,000
- Total monthly revenue generation to RWA: Rupees $3,000+1,000 = 4,000$ (Compost + Monthly fee collected from 4 workers)

So, the breakeven period will be:

$$B-E = F / (S - V)$$

$$B-E = 44,000 / (4000-516)$$

$$B-E = 44,000 / 3484 = 12.63 \text{ months}$$

Therefore, it will take 13 months to cover the total costs invested initially for establishing the system.

Case Four:

- If sale of compost is excluded from the monthly revenue generation, the monthly revenue generation will be rupees: 1,000 (Monthly Charges from the waste collectors to RWA)

So, the breakeven period will be:

$$B-E = F / (S - V)$$

$$B-E = 44,000 / (1,000 - 516)$$

$$B-E = 44,000 / 484 = 90.91 \text{ months}$$

Therefore, it will take 91 months to cover the total costs invested initially for establishing the system

Break-even period in months

Number of Households	No. of months if functional and incidental cost borne by the workers as well as fee of rupees of 250 /month paid by each worker to RWA	Number of months if functional and incidental cost borne by the workers	Number of months if functional cost borne by the workers and incidental cost borne by RWA	No. of months if functional and incidental cost borne by the workers and fee of rupees of 250 /month paid by each worker to RWA and exclude the compost value from revenue generation
500	13	18	23	91

➤ Functional cost includes monitoring, turning & sprinkling and sieving cost

Reference:

1. <http://www.ext.colostate.edu/PUBS/farmmgmt/03759.html>
2. <http://connection.cwru.edu/mbac424/breakeven/breakeven.cfm>
3. Break-Even Method of Investment Analysis by P.H. Gutierrez and N.L. Dalsted ¹ (¹ P.H. Gutierrez, former Colorado State University Cooperative Extension farm/ranch management economist and associate professor; and N.L. Dalsted, Cooperative Extension farm/ranch management specialist and professor; agricultural and resource economics. 9/92. Reviewed 10/04.)

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