Performance Assessment System for Urban Water Supply and Sanitation

Documentation of Good Practices

Public Private Partnership and Eco-friendly Solid Waste Management System Ichalkaranji Municipal Council

All India Institute of Local Self Government, Mumbai

May 2010

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Abbreviations

BOT	Built Operate Transfer
DPR	Detailed Project Report
DtoD	Door to Door
HH	Households
HT (PCD) Ltd	Hydroair Tectonics Pollution Control Department Limited
IMC	Ichalkaranji Municipal Council
MSW	Municipal Solid Waste
MSW Rule 2000	Municipal Solid Waste Rule 2000 (Handling and Managing)
MT	Metric ton
PPP	Public Private Partnership
RDF	Refused Derived Fuel
SI	Sanitary Inspector
SWM	Solid Waste Management
TPD	Tones per day
ULB	Urban Local Body
UWSS	Urban Water Supply and Sanitation

Executive Summary

Efficient solid waste management systems are a need of every city, and with rising urbanization, it is increasingly challenging to meet this need. Both systemic and non-systemic issues are involved in service delivery and are subject to local situations. Cities are adopting different strategies to deal with these and some of the initiatives stand out from the rest. One such initiative is of the Ichalkaranji Municipal Council (IMC).

Prior to 2007, IMC carried out interventions to provide maximum coverage of the SWM service across the city, but the efforts were impeded due to inefficiencies in the system itself, as well as lack of technology for treatment of waste. In order to resolve these issues, IMC opted for refurbishing the system itself which included adopting public-private-partnership and implementing advanced technology for treatment and recycling of the waste generated. The services for collection and transport of waste from residential areas and public places were privatized and separate contracts were granted for different areas. Contractors were provided with infrastructure for collection and transportation of waste. As a part of monitoring, targets and penalties were introduced which would ensure quality of the services. The community has been involved in day to day monitoring process. Moreover, the confirmation from corporators and journalists is mandatory on a monthly basis. Both the monitoring activities have guaranteed good qualitative services as well as coverage. Associations of commercial establishments and hospitals were actuated to manage the waste generated by them independently, which made them accountable towards the services. It also alleviated the pressure on resources of the IMC. A solid waste treatment and recycling plant was set up at landfill site through private partnership where waste is processed to produce eco-friendly products from waste – refuse derived fuel, bricks and compost. The city has achieved this all within three years, and the results are evident. No wonder it is being looked up as one of efficient and effective systems in solid waste management.

1. Introduction

Ichalkaranji, a city in Kolhapur District, Maharashtra is well known as 'Manchester of Maharashtra' for its flourishing textile industry. The industry has boosted its economy, but at the same time, posed a challenge to the Ichalkaranji Municipal Council (IMC) to provide adequate and quality civic services to the expanding population. Amongst these, the solid waste management services needed significant modifications. IMC tackled this strategically through restructuring the system, encouraging public-private-partnership and adopting eco-friendly technology. The present document elucidates the process behind efficient strategies, implementation and intricate mechanisms.

2. Documentation Methodology

The initiatives of the IMC were identified during secondary data collection for the project: Performance Assessment System (PAS) for Urban Water Supply and Sanitation (UWSS). Several records at IMC, at treatment plant, documents like agreement between IMC and Hydroair Tectonics (HT), (a private company working in the area of solid waste management), information from website etc were collected during the process. Primary data was collected as follows:

- Visit to the solid waste treatment plant
- Individual discussion with officials from IMC and HT officials concerned with SWM
- Focus Group Discussion with workers at treatment plant

The data was supported by photographs and audio-visual clippings.

3. Background of Ichalkaranji Municipal Council (IMC)

IMC was established in the year 1893. It is a Class "A" municipal council constituted under the Maharashtra Municipality Act 1965. It has an area of 29.84 sq. km. *(DPR, 2007)* and population is 2, 57,610[1]. The total population during 2008 was 3, 30,474[2]. The textile industry is the face of its economy, evident through the fact that 50 percent of the properties in the city support both power looms and households involved in the industry.

[1] Census of India, 2001

[2] According to household survey done by IMC during 2008

3.1 Situation of SWM prior to 2007

- Prior to 2007, outreach of the SWM services, mainly collection and transport was limited, and some areas were still un-served.

- IMC lacked treatment facility and hence all the waste was dumped on 'Asranagar' landfill site four km away from the city leading to a dismal condition of the landfill site.

- Given the volume of waste generated and absence of treatment facility and diminishing capacity of the site, it was clear that the IMC would soon have to look for another site, leaving behind a degraded and unhealthy environment.

In order to bring the above situation in control, it was essential to take sound measures. The systematic steps taken by the IMC in response to these needs changed the picture in three years. The present system is elaborated in next sections.

4. Solid Waste Management System in Ichalkaranji: Approach and Mechanisms

The city generates waste of 108.00 MT/day and per capita waste generation is 364.00 gm/day[3]. In order to deal with the voluminous waste and provide efficient SWM service, IMC has opted a multi pronged strategy involving restructuring of the entire system, decentralized management through public-private-partnership, active community participation and institutionalization of the multi-stage process. The restructuring has resulted in formation of subsystems for decentralized collection of waste and centralized segregation and treatment. Though multiple partners are involved, seamless integration of the subsystems is ensured and monitoring mechanisms have been introduced for maintaining quality of services. The mechanisms are depicted in figure I.

Box 1: Quantity and Composition of Waste

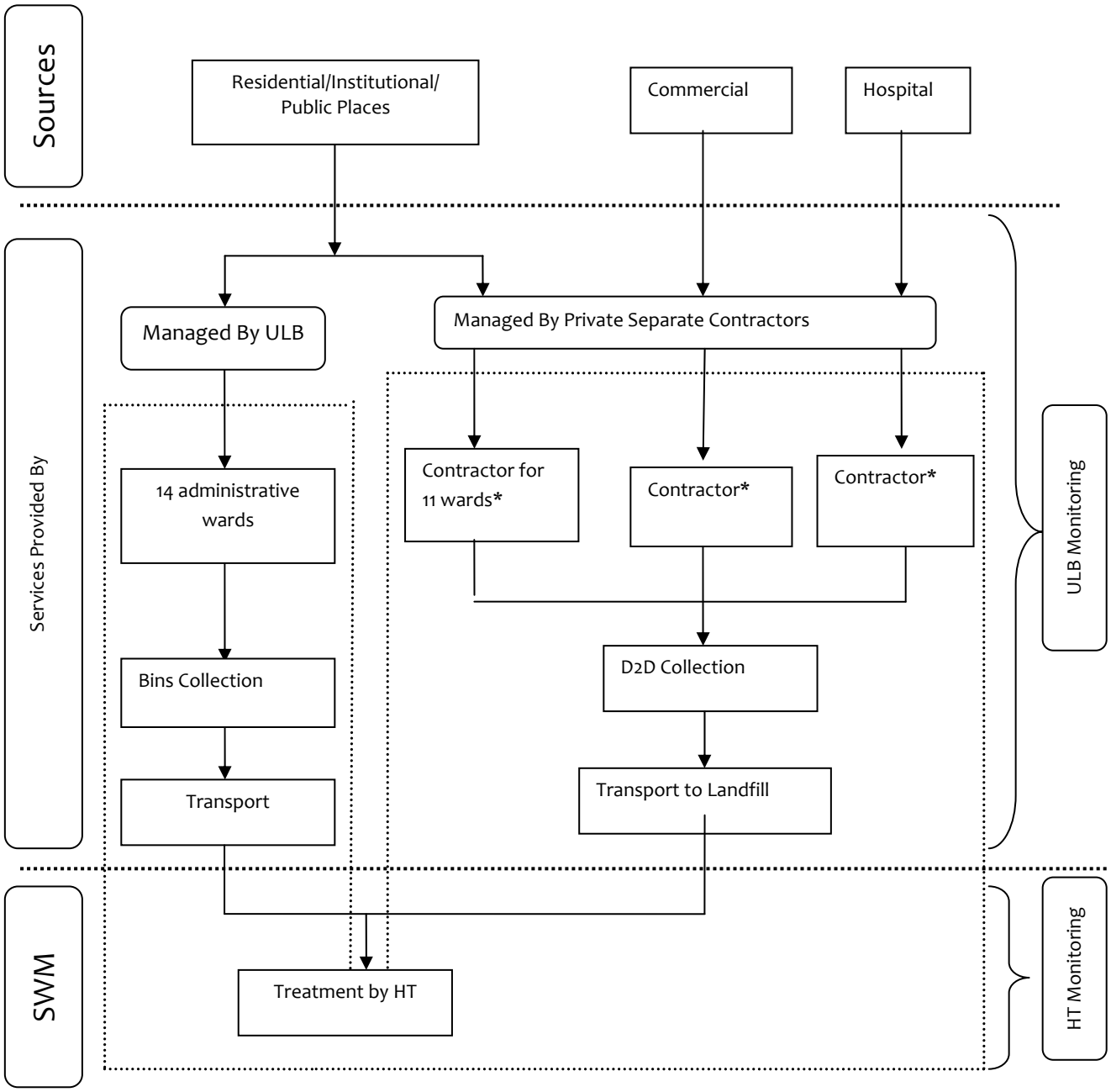
Sn.	Constituents	Quantity
1	Quantity of waste	80 TPD
2	Moisture content	45-50%
3	Volatile solids	50%
Composition by weight		
1	Compostable matter	45%
2	Paper	6%
3	Plastic	5%
4	Metal	1%
5	Glass & Crockery	4%
6	Sand	17%
7	Inert & others	22%

Source: Detail Project Report for 80 TPD MSW for Ichalkaranji Municipal Council

[3] *According to Detail Project Report (DPR) for 80 TPD MSW prepared and submitted by Hydroair Techtonics to the Ichalkaranji Municipal Council in 2007-08*

Figure 1: Solid Waste Management in Ichalkaranji

*(*Individual contractor)*



4.1. Solid Waste Collection and Transport

The entire system of waste collection and transport to landfill site is jointly managed by IMC and private partners. For easy facilitation and monitoring of the services, the city was divided into 25 administrative wards. Among these, the waste from residential properties, institutions and public places in 11 wards is managed by private contractor and from rest 14 wards is managed by IMC. All 36,479 households (HHs) in 11 wards are served by door to door collection, including 1319 slum HHs. IMC utilizes community bin approach to collect waste from rest of the 14 wards. The waste from commercial establishments and biomedical waste in all the wards is managed through combined efforts of association, private contractors and IMC.

4.1.1 Community Participation in SWM

The door to door collection and transportation of waste services have been provided to 11 administrative wards. It includes the ward numbers 9,10,13,15,16,19,21,22,23,24 and 25. To ascertain daily provision of services to every household, a signature from households on receipt is made compulsory. Besides, the service provider has to take a signature of respective ward corporator and a journalist on a monthly basis. In order to cater to the needs of commercial establishments, the IMC motivated commercial property owners to manage the collection and transport of waste independently by deploying private contractors. Having conceded to this, the association of commercial properties took the responsibility of the same. According to this arrangement, contractor appointed by the association provides services for collection and transport of waste from all 25 wards up to the landfill site, where it undergoes treatment. Some of the vehicles required for transport have been rented to the contractor by the IMC itself. Thus, the association and the commercial property owners are themselves accountable for the availability and quality of the service.

Similar strategy was adopted for biomedical waste generated in hospital and clinics. The association of hospitals was formed, which manages the bio-medical waste collection, transport and scientific disposal independently.

4.2. Disposal and Treatment of Waste

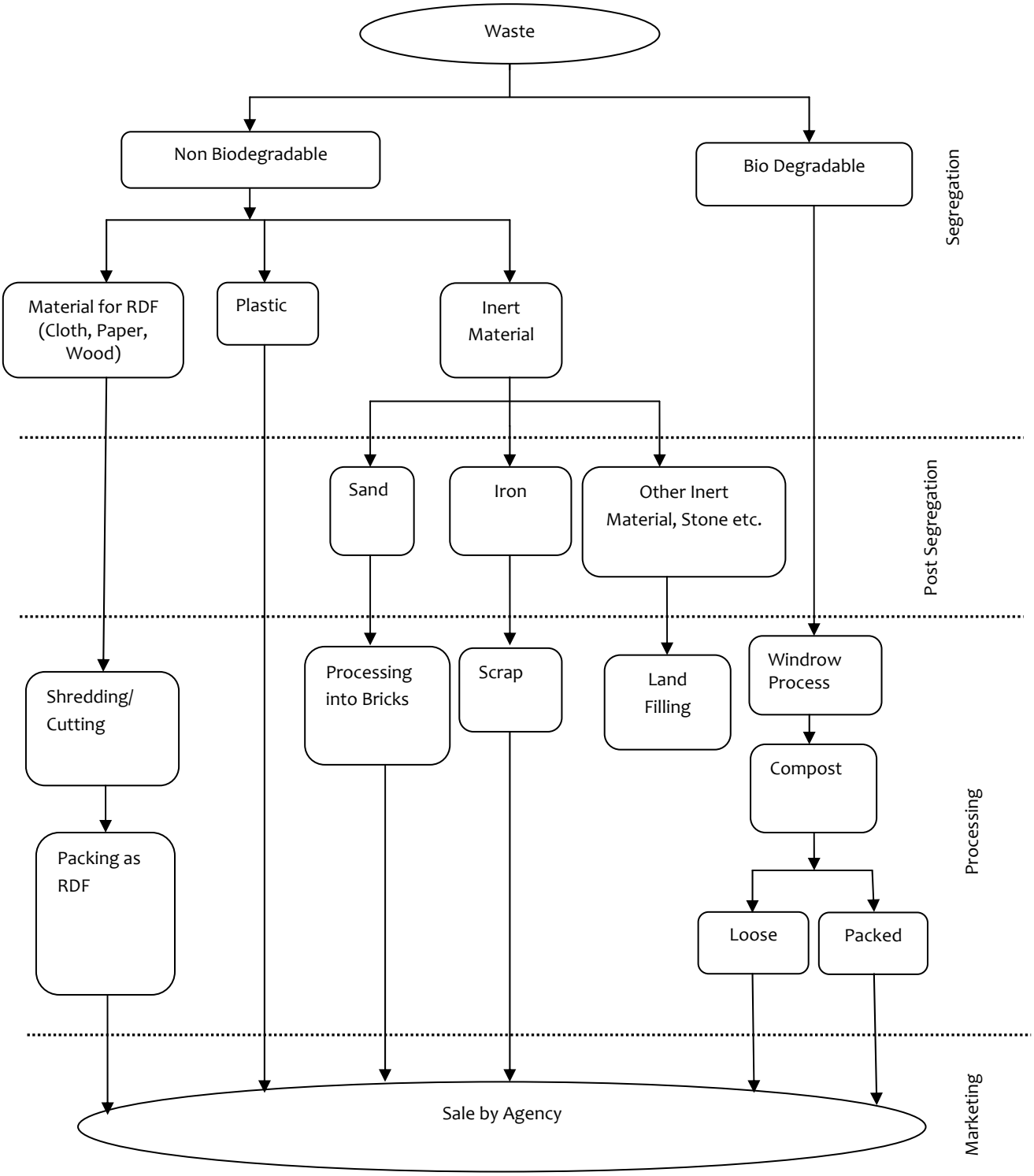
All the waste collected (except biomedical waste) is transported to the landfill site four km away from the city, where it is treated and recycled to form eco-friendly fuel and other products. The treatment and recycling has a very important role in the whole system and has created a positive impact not only on the SWM system of IMC but is also helping in conserving environment through eco-friendly treatment. The initiative is elucidated in next section.

5. Waste Treatment and Recycling

In order to undertake treatment and recycling of waste, the IMC entered into a partnership with Hydroair Tectonics (HT) in year 2007, under Build-Operate-Transfer (BOT) mode. In the initial stage, survey regarding service delivery was conducted during February to March 2007 by HT and Detailed Project Report (DPR) was prepared. Thereafter, a waste treatment and recycling plant was set-up by HT on the landfill site. As per the operational modalities, the IMC has to provide water required for the treatment and recycling without any charge as well as electricity connection to the site. HT retains the revenue generated through sale of recycled products. HT is expected to manage the plant till 2037 and hand it over to the IMC thereafter. The treatment process and eco-friendly products are further elaborated in figure 2.

6. Process of WRP

Figure 2: Treatment at Waste Recycling Project



6.1. Segregation

The waste is segregated into biodegradable and non biodegradable components through segregation machine. The waste like stone, paper, cloth, wooden and plastic material is segregated at first stage. In next stage, sand, iron and other inert material is segregated. The iron is sold as scrap and plastic is sold in market for further recycling, while stone and other inert material is disposed for filling. Excluding these, rest of the waste is recycled at the plant for producing eco-friendly products – refused derived fuel (RDF), bricks from non biodegradable waste and compost from organic waste. The recycling process is detailed in sections to follow.

Segregation of waste

6.2. Production of RDF

The waste material like paper, broken furniture, tree twigs, textile cloth, etc. with moisture content less than 20 percent and calorific value greater than 2000 Kcal/kg[4] is shredded and cut into small pieces and packed as RDF in units of 2 kg, which are easy to handle. The RDF is sold in market by HT.

RDF Segregation

Shredded Material packaged as RDF Units

[4] *According to Detail Project Report (DPR) for 80 TPD MSW prepared and submitted by Hydroair Techtonics to the Ichalkaranji Municipal Council in 2007-08*

6.3. Production of Bricks

Sand and iron material segregated in stage 2 is reused. The 30 to 35 percent and is reused for mending bricks[5]. The bricks are made in different forms. The size of bricks is 6" X 8" X 12" and approximately 500 bricks are produced daily.

Compressed Machine for Brick Preparation

Different form of Bricks

6.4. Composting

Composting is undertaken for bio-degradable waste by Windrow process. Since the waste creates odor, it is sprayed with bio culture chemicals, piled up and reset twice in 20 days. Approximately 12 tons of compost is produced every day. It is sold in both loose and packaged forms. Being cheaper than packed one, loose compost has more demand.

Compost

[5] *The proportion for mending bricks includes 6 bucket sand, 1 bucket cement and 4 bucket grit. The material mixed properly and bricks made by using compressed machine.*

Box 2: Eco-friendly Technology of Waste Treatment and Recycling

- The treatment plant itself operates on electricity and environmentally hazardous chemicals are not used for treatment.
- None of the waste is unused. Most of the recyclable waste, both bio-degradable and non-biodegradable, is utilized to produce eco-friendly products like bricks and compost, and the material like plastic which is not recycled at the plant is sold.
- The waste received daily is not allowed to accumulate at the landfill site without primary segregation.
- The Windrow process ensures that the domestic waste does not create odor. This makes the place cleaner to work for the workers.
- The use of compost in place of chemical fertilizers is helpful in maintaining fertility of soil.
- The bricks are made with the use of higher proportion of ash, sand and thus are comparatively good for environment than the general bricks.

7. Monitoring of Solid Waste Management in IMC

The IMC monitors the services by way of charging penalty and setting up targets for service delivery.

Penalty system has been introduced for ensuring quality of door-to-door service. Each person involved in this service has to take daily acknowledgement in the form of signature from the recipient household and is paid Rs.20/- (US $ 0.42) per month per household for the same. Penalty of Rs.30/- per month per household is deducted from the amount payable to the person for the household missed. Similarly, a penalty is applicable for sweeping and transport of waste. The rate for sweeping is Rs. 0.05/- (US $ 0.001) per sq. ft. and penalty of Rs. 0.75/- (US $ 0.015) per sq. ft. is charged if a street or public place remains unswept. Penalty of Rs. 1000/- (US $ 21.30) per trip is applicable if transport of waste is missed. The monitoring mechanism also includes the corporator and a journalist from the respective ward, who are expected to sign the monthly reports.

- Since the waste is weighed at the landfill, records are also kept which helps in keeping a check on service delivery.

- The process of solid waste collection and transport is monitored by the Sanitary Inspector of the IMC.

8. Financial aspects

- The IMC spent Rs. 31,140,636/- (US $ 663413.63) and Rs. 12,425,990/- (US $ 264,720.70[6]) in 2007-08 and 2008-09 respectively on entire SWM and these costs were met from capital grant of Rs. 42,195,652 (US $ 898,927.39) and Rs.77,216,101/- (US $ 1,644,995.76) during the same financial year 2007-08 and 2008-09 respectively.
- The door to door collection and transportation contract of Rs. 277, 666,000/- (US $ 5,915,338.73) and 3,300,000/- (US $ 70302.51) has been given respectively to private contractors.
- The IMC rents its infrastructure for collection and transport of waste to the contractors. At present, 150 containers of 4.50 cubic meter capacity for Rs. 3100/- (US $ 66.04) per month and 400 containers of 1.50 cubic meter capacity for Rs.500/- (US $ 10.65) per month have been rented.
- Annual income generated by HT from bricks and RDF alone is approximately over 10 lakh (US $ 21,303) per year. The income from compost varies as per demand. The financial aspects of production and sale of recycled and recyclable material are presented in Table 1.

Table 1: Financial Aspects of Waste Treatment and Recycling

Sn.	Particular	Output*	Rate	Annual income
1	Compost	Average 12 Ton per day	Rs. 800/- (US $ 17.04) per ton	
2	Eco friendly bricks	Average 500 bricks per day	Rs. 9/- (US $ 0.19) per piece	Rs. 6,42,500/- (US $ 13687.68)
3	RDF	5.5 Ton per week	Rs. 1450/- (US $ 30.89) per ton	Rs. 4,14,500/- (US $ 8830.42)
4	Plastic	50 kg per day	Rs. 0.20-0.25 (US $ 0.0042-0.0053) per kg.	
5	Iron	250 kg in a month	Rs 8 to 10 (US $ 0.17-0.21)	

**Subject to demand, market value and quality of the product.*

[6] 1 US $ = 46.94 INR as on 24th May 2010

9. Impact

- Improvement in efficiency of SWM system.
- Better service delivery throughout the city.
- Landfill site is used at its optimum. Previously, 16 sq km of land was occupied, but at present, only the 7.5 sq. km. is required.
- Optimum utilization of material and human resources.
- Increase in soil fertility due to use of compost in fields

10. Limitations

- **Nature of waste**

  The processing of waste depends upon its components i.e. RDF can be produced if the proportion of material like cloth and wood in the waste is adequate. In absence of this type of waste, RDF cannot be economical. IMC has base of textile industries and other industries, thus there is no dearth of such specific waste content. If such content is not available, the present treatment may not be feasible and specific modifications will be required. Also, the minimum requirement of waste treatment plant is 80 TPD. So the same project can be replicated where the daily generation of waste is equal or more than 80 TPD.
- **Lack of segregation of waste at source**

  The daily intake waste comes without segregation. Due to lack of segregation at source both time and human resources have to be engaged, which could have been utilized more productively.
- **Less demand for RDF material**

  Lack of segregation of waste at the source retains traces of plastic and other material, which is not suited for use as fuel for boilers in industries. Due to this, demand for RDF is less.

11. Learnings

- The streamlining at IMC for SWM was successful since integration of sub-systems has been achieved and appropriate mechanisms have been introduced.
- Proper coordination among the private partners and the community is necessary for implementing such structured projects.

- The products produced by treating waste should be marketable else, the activity may not be financially viable.
- The penalty system has resulted in developing a sense of responsibility amongst different stakeholders.

12. Replication and niche suitability analysis

The replication is feasible to the areas where same amount and content of raw material is available. The pre-requisite is effective participation of all stakeholders and immense interest of ULB officials in the endeavor.

13. Futuristic

The IMC intends to privatize the collection and transportation of waste from 7 of 14 wards exclusively served by IMC at present through community bins, which means complete door to door collection from these wards. IMC plans to concentrate on dealing with issues like control of epidemics like malaria at city level.

14. Conclusion

The IMC has successfully revamped its SWM system and improved the services through elaborate mechanisms within a period of 3 years, which is an achievement in itself. The strategy of public-private-partnership, prudent integration within the system and use of appropriate technology has enabled IMC to improve services and conserve environment as well.

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