Best Practices on SOLID WASTE MANAGEMENT OF NEPALESE CITIES

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Best Practices on SOLID WASTE MANAGEMENT OF NEPALESE CITIES

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Abbreviations

BSMC	*Biratnagar* Sub-Metropolitan CIty
CBO	Community-based organisation
CBS	Central Bureau of Statistics
CKV	Clean *Kathmandu* Valley
DFID	Department for International Development
GO	Governmental organization
GTZ	German Technical Cooperation
INGO	International non-governmental organisation
ISWM	Integrated Solid Waste Management
JICA	Japan International Cooperation Agency
LSMC	*Lalirpur* Sub-Metropolitan City
MuAN	Municipal Association of Nepal
NGO	Non-governmental organization
PPP	Public-Private Partnership
PPPUE	Public Private Partnership for Urban Environment
RRR	Reduce, Reuse, Recycle
RUPP	Rural Urban Partnership Program
SWM	Solid waste management
SWMRMC	Solid Waste Management and Resource Mobilization Center
TDF	Town development fund
TLO	Tole Lane Organization
UDLE	Urban Development through Local Effort
UEIP	Urban and Environmental Improvement Project
UEMS	Urban Environment Management Society
UNEP	United Nations Environmental Program
UNDP	United Nations Development Program
UWEP	Urban Waste Expertise Program
WEPCO	Women's Environment Preservation Committee
WWF	Worldwide Fund for Nature

Foreword

Practical Action Nepal Office has initiated a project "Strengthening Local Capacities in Integrated Sustainable Waste Management (ISWM) in small and medium municipalities of Nepal" with the financial support from European Union under its EC Asia Eco Pro II programme and close partnership among Practical Action Nepal, GTZ/udle, MuAN and WASTE. The project is basically targeted to four municipalities i.e. Bharatpur, Vyas, Birendranagar and Nepalgunj. The project aims to improve the health and environmental conditions of disadvantaged people living in the project municipalities. One of the major activities of the project is to disseminate best practices on sustainable waste management technologies, processes and approaches, from which it can develop and adapt the processes that are suitable in the context of urban centres of developing countries. In this context, review of national and international best practices on solid waste management was performed in January 2008.

In fact solid waste management is a big challenge to all established and emerging towns of Nepal. Basically municipalities are giving preferences only on collecting the waste and dumping it. The principle of 3R (waste reduction, re-use and recycle) are not prioritised by the municipalities for effective sustainable waste management. Further, municipalities have not yet fully recognised the important stakeholders of waste management like NGOs/CBOs and private formal and informal sector which can be involved during the planning, implementation and monitoring for effective waste management.

This book contains a range of best practices on solid waste management from various municipalities of Nepal. It also contains the admirable initiatives of national and local NGOs/CBOs. I hope that this book will be highly instrumental regarding solid waste management to urban centres as well as emerging towns of developing countries.

I would like to thank Mr. Rajib Dhakal for collecting and writing the best practices. I would like to thank Mr. Mansoor Ali and Mr. Adrian Coad for supporting us in editing the text. I would like to thank my colleague Ms. Jun Hada, Ms. Shradha Bohara, Ms. Kalpana Basyal, Mr. Bir Kirshna Maharjan and Mr. Binaya Raj Shrestha for supporting in the publication of the book. Last but not the least; I would like to thank the institutions and the individuals who have supported to gather the best practices.

Achyut Luitel
Country Director

1.0 BACKGROUND

In Nepal, urbanisation is increasing at an alarming rate[1]. It is putting immense pressure on municipal services. One of the problems of the urbanisation and increasing consumerism is the increased generation of waste. This waste is not being adequately managed and is therefore creating a serious health and environmental hazard, particularly in the slum areas, where the residents have less capacity to pay for better services and are often ignored by the official agencies. Poor urban settlements are more affected because of indiscriminate dumping and the lack of open space. In such a setting, Practical Action Nepal has initiated a project known as "Strengthening Local Capacities in Integrated Sustainable Waste Management (ISWM) in small and medium municipalities of Nepal" with financial support from European Union under its EC Asia Pro Eco II Programme. The project is targeted at four municipalities – *Bharatpur*, *Vyas*, *Birendranagar* and *Nepalgunj*. The project is a partnership between Practical Action, GTZ/UDLE, the Municipal Association of Nepal (MuAN) and WASTE Netherlands with the respective municipalities.

When the project started, the target municipalities and community groups were found to have limited access to information on

- how to improve waste systems,
- how to use waste in an economically productive way, and
- alternative waste management techniques and practices which would significantly improve the livelihoods, health and environment of the urban poor.

Since the poor urban areas are the worst affected, the project's main objective was to improve the health and environmental conditions of disadvantaged people living in the emerging municipalities of Nepal. Specifically, the project aimed to strengthen the capacities of four small or medium-sized emerging municipalities in Western Nepal to better manage their waste through effective participatory planning and the introduction of sustainable waste management systems that cover the whole town, including low-income areas. The project works with the four chosen municipalities and a variety of local stakeholders, including the Municipal Association of Nepal (MuAN), community leaders, small-scale business entrepreneurs, and local formal and informal private sector enterprises that provide waste management services.

In Nepal, a number of solid waste management projects have been evaluated. One of the major activities of this project was to bring together all the lessons learned from these projects and disseminate them. Drawing on international best practices for sustainable waste management technologies, processes and approaches, the project developed and promoted approaches that are well suited to the selected municipalities. In this context a publication entitled "Best practices on solid waste management of Nepalese cities" is being put together. It will review replicable, community-based initiatives in Nepal and assesses potentials and constraints so that the project partner and other municipalities can build on these experiences as they adapt and develop appropriate initiatives. It is hoped that this anticipated publication will strengthen the capacity of municipal governments and other organisations in improving waste management practices.

This review work for this report has been done within a short period of time and relies on the information currently available. Maximum effort was focused on identifying effective waste management practices in the cities and towns of Nepal. This study focuses only on examples of best practice and it does not cover schemes which have failed, theoretical cases which were never implemented, and policy, institutional and legislation aspects.

[1] *At the rate of 7.1% per year (CBS, 2001)*

2.0 NATIONAL BEST PRACTICES IN SOLID WASTE MANAGEMENT

In developed countries, the main motivations for waste reduction are frequently related to legislation, environmental protection, the scarcity of sites for landfills, and the risks associated with toxic materials. The same considerations apply in developing countries to large metropolitan areas that are subject to many economic and environmental pressures. Urban centres which do not have effective collection and disposal systems should not devote resources to developing waste reduction measures until adequate waste management systems are in place. For this, or other reasons, solid waste managers in developing countries tend to pay little attention to the issue of reducing organic wastes which make up from 50 per cent to 90 per cent of the total waste generated.

Management of solid waste is a growing concern in Nepal as urban population densities increase and flat usable land is in short supply. Although small urban centres were declared to be municipalities[2], they suffer from a lack of infrastructural and technical resources to tackle the problem of waste management. With increasing public awareness about good health and a clean environment, solid waste management has now come to the top of the priorities of the municipalities in Nepal. When the environmental impacts of proposed landfills are being investigated, it is often found that residents refuse to accept landfill sites near their homes and local leaders from various political parties are often involved in protests against proposed landfill locations. Though the Local Self Governance Act of 1999 has empowered municipalities to take every necessary action at the local level, the absence of elected representatives[3] since 1998 has been causing difficulties in its implementation. Even though collection systems are still not in place, most of the municipalities are expressing their desire to develop final disposal systems. They are also promoting waste reduction, reuse and recycling among local communities.

Some of the 58 municipalities in various parts of the country are providing effective house-to-house waste collection services and some are making good progress towards final disposal. For this review, communities and private sector service providers have been selected according to their present performance in waste reduction. Priority is given to those community-based organisations (CBOs) and non-governmental organisations (NGOs) that are playing effective roles in waste reduction at source, collection, processing and recycling. Table 1 provides details of the regions and municipalities in Nepal.

[2] *Population more than 20,000 with annual revenue of NRs. 10 million.*

[3] *At the time of writing there are no elected mayors in the municipalities of Nepal and municipal administration is being handled by government bureaucrats. There have been no recent municipal elections and local bodies are not allowed to function.*

Table 1 **Municipalities and their geographical locations in Nepal**

Development Region	Location	Municipality
Eastern Development Region (EDR)	Tarai[4]	Damak, Inaruwa, Bhadrapur, Itahari, Siraha, **Biratnagar**, Rajbiraj, Lahan, Dharan, Mechinagar
	Hill	Ilam, Dhankuta, Triyuga, Khadbari
Central Development Region (CDR)	Tarai	Malangawa, **Bharatpur, Hetauda,** Janakpur, Gaur, Ratnanagar, Birgunj, Kalaiya, Jaleshwor, Kamalamai
	Hill	Panauti, Kirtipur, Thimi, Bidur, Banepa, Bhimeshwor, Dhulikhel, **Kathmandu, Lalitpur , Bhaktapur**
Western Development Region	Tarai	Butawal, Kapilvastu, Ramgram, Siddarthanagar, **(WDR)**
	Hill	Putalibazar, Lekhnath, Prithivinarayan, Vyas, Waling, Pokhara, Tansen, Baglung
Mid-Western Development Region (MWDR)	Tarai	Gularia, Nepalgunj, Tulsipur, **Tribhuvannagar**
	Hill	Birendranagar, Narayan
Far Western Development Region (FWDR)	Tarai	Mahendranagar, Dhangadi, Tikapur
	Hill	Amargadhi, Dasarathchand, Dipayal

Totals: Tarai= 31; Hill= 27

In this report, the best municipalities in terms of their waste management performance[5] were selected for inclusion and analysis on the basis of their key financial indicators[6] - as presented in the 2008 report prepared by UDLE[7] and the government of Nepal[8]. The municipalities selected for the analysis of waste management performance and financial indicators are Bhaktapur, Bharatpur, Biratnagar, Hetauda and Tribhuvannagar.

The selection of the best NGOs has been done according to their solid waste management performance and interviews with various waste management professionals. Accordingly, cases from the Nepal Pollution Control and Environment Management Centre, Suiro Abhiyan, Hetauda, the Suiro Programme of Bharatpur, the Urban Environment Management Society and the Women's Environment Preservation Committee have been chosen. Conclusions and lessons learnt are discussed in the last part of this publication.

[4] *Southern part of Nepal with flat topography*
[5] *Based on discussion with professionals , governmental staff and staff from SWMRMC*
[6] *Financial indicators: Recurring revenue, own source revenue, property rental, current expenditures, capital investment, social development, net effect, grants, relative growth, actual to budget performance.*
[7] *Urban Development through Local Effort, a programme of GTZ*
[8] *Detailed revenue and expenditure breakdown with budget and key financial indicators of 58 municipalities (for the year 2005-06)*

URBAN ENVIRONMENTAL MANAGEMENT

Solid Waste Management in *Bhaktapur*

Introduction

Bhaktapur municipality – a historical town – spreads over an area of nearly 7 km^2. It is a popular tourist destination, located only 30 minutes' drive from the capital *Kathmandu*. It is divided into 17 administrative wards[9] and 75 per cent of the area is used for agriculture. The projected population of this Municipality for the year 2008 is 85,000, the urban population growth rate being 1.7 per cent and the population density 11,058.38 per km^2. (CBS, 2001). In 2007, the total number of tourists visiting this municipality was 121,431, the peak season being from September to October (*Bhaktapur* municipality, 2007).

Rationale for selection

This case is included in the review because it provides information about effective waste collection by local community group contractors from different wards.

Case description

Earlier, *Bhaktapur* municipality had received complaints from local communities because of the ineffective collection system and haphazard dumping of solid waste. In order to address these complaints from the residents, a facility for treating organic waste was implemented. *Bhaktapur* composting facility was commissioned in 1984 with support from GTZ and it has been operating for most months of the year for 20 years.

Now the Community Development Section is responsible for waste management in the municipality. Most of the municipalities in Nepal have community development sections which are responsible for all aspects of waste management. Local community groups provide waste management services under an annual contract to the municipality in 12 of the 17 wards. However, the municipality still has overall responsibility for waste management in the five remaining wards. The community contractors range in size from three to seven employees, and are allocated to the wards according to population of each ward. Each group is responsible for one ward in order to facilitate effective waste management. The municipality also allocates one waste inspector to each of the wards.

Group contractors in all 12 wards are responsible for household waste collection, street sweeping and the collection of municipal solid waste from various unofficial collection points. The remuneration of each member of the group is same as the salary of a

Name of the Programme: Solid Waste Management in *Bhaktapur*
Location: North-East of the capital Kathmandu
Duration of the Project: 2003 onwards
Beneficiaries: Residents of urban area
Donors and Partners: Government of Nepal, GTZ, NGOs, CBOs
Municipal Vision: A clean traditional city

[9] *Population range of 2000-10,000*

permanent sweeper of the municipality. Overtime is paid for work on public and national holidays. Local residents have praised this system of waste management because it has not only provided a source of income to local residents but has also made it easier to control and complain to the group workers, since they are all known to the local community.

The municipality is responsible for transporting and disposal of all the collected solid waste. The main functions of the Community Development Section are street sweeping, cleaning of roadside drains, removal of dead animals, procurement and maintenance of waste collection vehicles, recruitment and training of waste management staff, and informing the public about the waste management system. This department is also actively engaged in waste minimisation and segregation. It has also distributed almost 500 composting bins of 50 kilograms capacity, selling them for NRs[10]. 600 each (Bhaktapur municipality, 2008 data).

Waste generation and composition

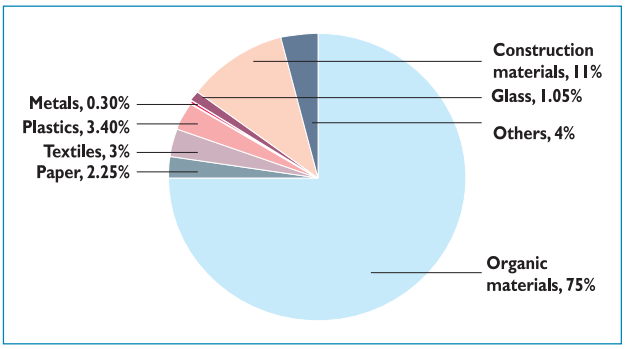
The main objective of the waste management programme in this municipality is to provide effective waste collection from households and commercial areas, street sweeping and safe transport to disposal site. According to the data provided by the Municipality and the field survey conducted in May 2008, the average per capita household waste generation rate is 0.30kg/capita/day and the total daily waste generation is 25 tons. (*Bhaktapur* municipality, 2008 data). These figures are similar to the national average waste generation rate of 0.25kg/capita/day and the value for the Kathmandu metropolitan area of 0.39kg/person/day (SWMRMC, 2008 data).

The composition of household waste at source is: 75 per cent organic or biodegradable waste, 2.25 per cent paper, 3 per cent textiles, 3.4 per cent plastic, 0.3 per cent metal, 1.05 per cent glass, 11.0 per cent construction debris and 4.0 per cent other materials. (*Bhaktapur* municipality, 2008 data).

Although the municipality does not have accurate data regarding the contribution of waste from the different types of sources, approximate data provided by the municipality indicates that total of 20 tons/day is household waste and 5 tons/day comes from commercial sources (*Bhaktapur* municipality, 2008 data).

[10] *Exchange rate 1 USD = NRs. 77 (October 2008)*

Chart 1: Composition of solid waste at source, *Bhaktapur* municipality



According to UN-Habitat, the generation rate for hospital waste in Nepal is 1.7 kg/day/bed (UNHABITAT & KMC data, 2007) and approximate data from the municipality indicates that, total generation of hospital waste is around 860 kg/day. There are four hospitals with a capacity of 500 beds (*Bhaktapur* municipality, 2008 data). Infectious healthcare waste is incinerated or buried in trenches within the perimeter of the hospital.

Waste collection

After the implementation of the solid waste management (SWM) programme, *Bhaktapur* municipality has been working systematically towards effective street sweeping, collection and transporting of waste. The services that are provided are the same in all wards, whether provided by the municipality or by a contractor. Every day waste is collected and the streets are swept according to definite schedules, at 6.00 a.m., 12.00 noon and 4.00 p.m. However, in tourist areas, street sweeping and waste collections are scheduled at four times each day – 6.00 a.m., 12.00 noon, 4.00 p.m. and 6.00 p.m.

Staff management and the monitoring of street sweeping and waste collection are very effective because municipality staff work in the area where they live. Every ward has a waste inspector who is responsible for monitoring the services. Waste inspectors have the authority to hire and fire the street sweepers and collectors who work for the group contractors. Though this arrangement was not welcomed by the sweepers and collectors of the group contractor, the municipality believes that sweepers and collectors who are employed by the group contractor receive adequate benefits and remuneration for the work that they do, and that if

someone does not work as expected, then it is fair to give the job to some other poor resident of the same area who will work more conscientiously.

It is estimated that 20 per cent by weight of both domestic and commercial solid waste is recycled by the municipality. In addition, private waste recyclers collect recyclable wastes at unofficial collection points and also at the dumping site. The municipality operates a paper recycling plant at *Kamalbinayak* and it is using the recycled paper for its office stationery including files, envelopes and cards. Furthermore, 10 per cent by weight of the organic waste has been used for composting (*Bhaktapur* municipality, 2008 data).

In order to encourage segregation by households and waste minimisation at source, the municipality is promoting HH composting by the sale of subsidised compost bins, as has already been mentioned. It is intended that households will use this compost on their gardens or on nearby agricultural land (*Bhaktapur* municipality, 2008 data). Compost is sold for NRs 200.00 for a small truck load of around 700 kg (Bhaktapur municipality, 2008 data). The prices paid for recovered paper, plastic, glass and metal are NRs.4, NRs.5, NRs.10, and NRs.35 per kg respectively (*Bhaktapur* municipality, 2008 data).

Transport and Final disposal

Two power tiller trailers (capacity 1 ton) and eight small trucks (capacity 700 kg) are mainly used for transporting solid waste. In addition, four pickups, each having a capacity of 3 tons, two tippers of capacity 3 tons, eight small pickups of capacity 700 kg, one backacter loader, one suction tanker and one jetting tanker make up the waste management fleet. (Bhaktapur municipality, 2008 data). *Bhaktapur* municipality disposes its waste on one bank of the *Hanumante* River at a point 5 km south-west of the centre of the municipality. 25 tons of wastes are dumped there each day (*Bhaktapur* municipality, 2008 data). This means that 100 per cent of the waste is collected. Waste pickers, open burning and scavenging animals were observed at the dumping site.

Organisational and financial aspects

In total 212 people are employed within the solid waste management system of *Bhaktapur* municipality. The waste management workforce comprises 1 city inspector, 17 ward inspectors, 13 drivers, 14 toilet cleaners and 167 labourers (*Bhaktapur* municipality, 2008 data). The revenue of this Municipality is derived from property tax, municipal tax, and licence fees paid by the residents and businesses. Added to these are grants from the government, grants from foreign organisations, taxes paid by tourists and other user charges.

During the field visit, it was observed that local people were paying a nominal service charge for waste collection in order to develop a habit of paying for a service. The municipality collects waste collection charges at the annual rates of NRs.30 per kitchen and NRs.60 for every 15 sq ft (1.4 m^2) of shop floor area (*Bhaktapur* municipality, 2008 data). Waste collection charges are based on the number of kitchens. The municipality has spent approximately NRs.20,870,000 for waste management in the year 2007(*Bhaktapur* municipality, 2007 data). This amount is approximately 17 per cent of the total municipal expenditure (*Bhaktapur* municipality, 2007 data). In 2007, the total municipal expenditure per person was NRs.1, 440.

Major problems and issues

Despite its effective system of waste collection, the municipality is facing problems by poor response for its efforts to encourage waste minimisation at source. Another major problem is that the waste management workforce is too small to enable the Municipality to achieve its vision. The municipality charges a very nominal yearly fee for waste management, and so does not have sufficient income to fund needed investments. The lack of authority of the Community Development Section to make financial and administrative decisions, enforcement difficulties, poor cooperation between the public and private sectors, and inadequate coordination with stakeholders are among the other obstacles.

The Community Development Section is not empowered to solve management problems. For every major decision, the department should seek the approval of the municipal Board[11]. Similarly, the lack of a local elected body is another problem affecting the operation of the municipality[12]. Riverside dumping is not a healthy or sustainable method of disposal, and therefore the municipality, SWMRMC and the Ministry of Local Development should take the necessary action to locate a landfill site for this municipality.

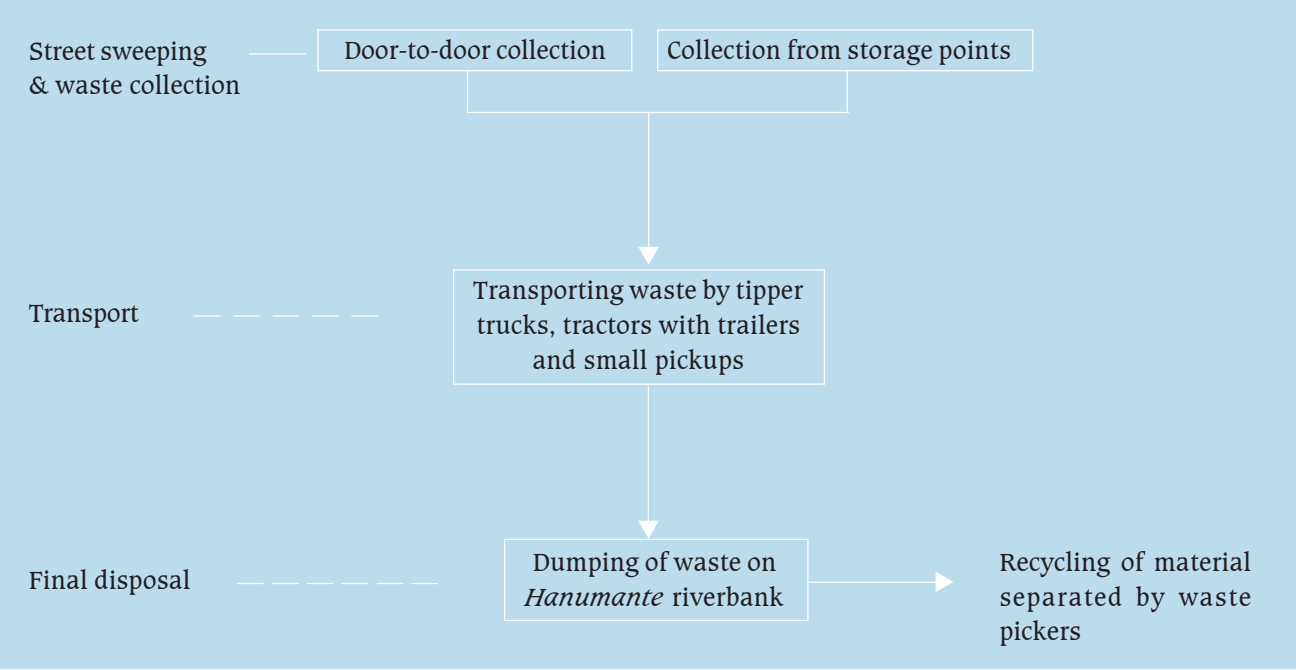
Conclusions

Involving local groups in street sweeping and the collection of solid waste is the main lesson from this case. The efforts of the municipality to generate revenue from user fees, its concern to make the citizens accustomed to paying for the waste collection service and its approach towards SWM planning are all noteworthy. Small towns of historical significance and with the potential for tourism are suitable places for initiating improvements in waste management. The municipality has also developed basic facilities for resource utilisation, including the collection, transport & composting of organic waste. Assistance from UDLE-GTZ and UNDP-PPPUE in urban service management has played an important role in improving waste management practice. These developments by the municipality are helping to achieve its vision of a clean, traditional city.

Replicable best practice and lessons learnt

Both the municipality staff and the group contractors are local residents. The resulting knowledge of the areas in which they work and their accountability to the local communities are contributing to the effectiveness of the approach. This approach can be replicated in other, similar urban centres of Nepal.

Overview of the solid waste management system



Contact details: Mr. *Indra Prasad Karki*, Mr. *Moti Bhakta Shrestha*, Mr. *Dilip Kumar Suwal, Bhaktapur* Municipality, *Bhaktapur*
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[11] *The Municipal Board is the main governing body of the municipality. The government secretary and representatives of political parties are included in the governing board.*
[12] *Because of the political turmoil, since 1998 there were no local elected bodies in Nepal, and government officials were directing the local bodies.*

Street sweeping and waste collection at various locations

Waste collection using a small pickup

Dumped waste

Filling with cover material (soil)

Waste dumping at *Hanumante* riverside

Road on old dumped waste

Clean narrow streets

Main Durbar Square

URBAN ENVIRONMENTAL MANAGEMENT

Solid Waste Management in Tribhuvannagar

Introduction

Tribhuvannagar municipality, the oldest in Rapti Zone, was established in the year 1978. It is located at a distance of 411 kilometres from the capital, Kathmandu. It has 11 wards, a few being located in the Inner Tarai region and the others are in the hilly region. The urban area of 10 km^2 comprises two wards with 4,404 households, whereas the rural area covers 64.45 km^2 with 4541 households CBS, 2001). The population growth rate is 3.95 per cent (CBS, 2001), giving a projected population of the municipality for the year 2008 of 55,000. In the urban areas the population density is 579.26 per km^2 .

Rationale for selection

This case was selected because it provides information about effective waste recycling and safe final disposal of municipal solid waste at the municipal landfill.

Case Description

Earlier, dumping of waste at the riverside at *Katuwa Khola* had created problem for local residents and visitors to the *Ambikeshowori* Temple, and Mahendra Hospital. Complaints from the local residents regarding waste disposal were severe and the efforts of the municipality to solve the problem were inadequate. With the vision of a safe and healthy municipal area, *Tribhuvannagar* municipality has established a landfill at *Karautidanda* and has been using it for the disposal of its municipal waste since 2005 (Tribhuvannagar municipality, 2008 data). In this municipality, the Environmental and Community Development Section is responsible for solid waste management. The main functions carried out by this section are street sweeping, waste collection in domestic and commercial areas, cleaning of roadside drains, removal of dead animals, procurement and maintenance of waste management vehicles, recruitment & training of waste management staff, public education, and waste handling training to local residents.

The main objectives in improving the waste management system in this municipality are to ensure effective collection of solid waste from households, businesses and industrial areas, safe transporting of waste from source to landfill, separation of some types of waste for recycling and reuse, and disposing of the residual - mostly organic - wastes safely in trenches.

Waste generation and composition

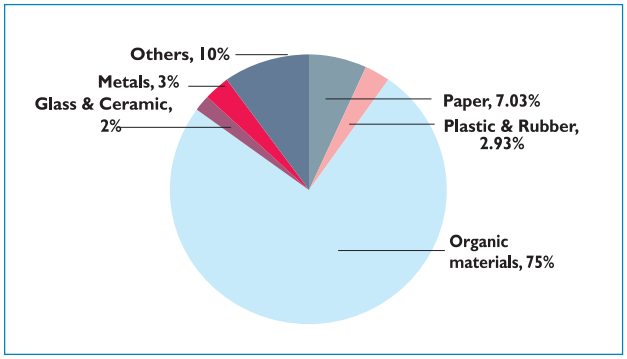
According to the data provided by the municipality and the field survey conducted in May 2008, the average per capita household waste generation rate is 0.25kg/person/day (*Tribhuvannagar* municipality, 2008 data) and this data is the same as the national average generation rate and lower than the generation rate of the capital

Name of the Programme: Solid Waste Management in *Tribhuvannagar*
Location: South-western Nepal
Duration of the Project: 2005 onwards
Beneficiaries: Residents of *Tribhuvannagar* municipality
Donors and Partners: Government of Nepal, GTZ- UDLE (for post infrastructure for landfill site), UNDP-RUPP, TLOs, NGOs
Municipal Vision: Safe and healthy municipal area

Kathmandu - 0.39kg/capita/day (SWMRMC, 2008 data). The total waste generation is estimated to be 14 tons/day (*Tribhuvannagar* municipality, 2008 data).

Unofficial data show that most of the solid waste comes from households, and that 3 to 4 tons/day come from commercial and industrial premises (*Tribhuvannagar* municipality, 2008 data. The composition of solid waste at source is paper 7.03 per cent, plastic & rubber 2.93 per cent, organic 75.04 per cent, glass and ceramics 2.00 per cent, metal 3.00 per cent and other materials 10.00 per cent (*Tribhuvannagar* municipality, 2008 data). One government hospital housing 50 beds is situated inside the municipal area. According to UN-HABITAT Nepal, the waste generation rate for hospital waste in Nepal is 1.72 kg/day/bed (UN-HABITAT, KMC data, 2007) and therefore the estimated daily generation of hospital waste is 86 kg/day.

Chart 2: Composition of solid waste at source in *Tribhuvannagar* municipality



The solid waste management system

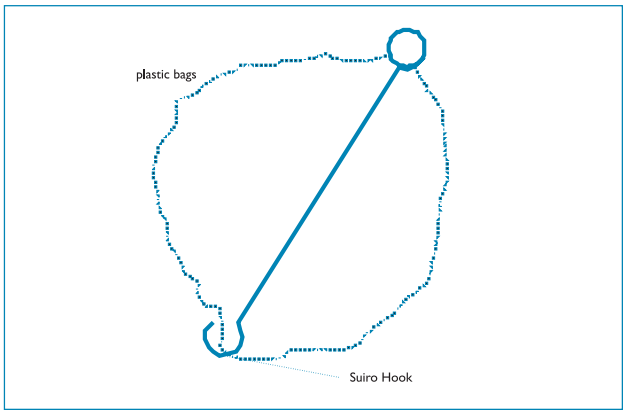
After the implementation of the SWM programme, *Tribhuvannagar* municipality has been working seriously towards effective waste collection and transport, waste separation and landfilling operations. Waste is collected from various unofficial collection points A total of 50 metal-framed plastic bins (capacity 50 kg) which are placed in different parts of the city for regular collection. Such bins are also distributed to local TLOs[13] for weekly collection. Residents put their mixed waste out for collection in plastic bags and than dump it at various unofficial collection points or in the storage bins. Eight handcarts that can each carry 50 kg and two rickshaws that can each carry up to 500 kg are used for primary waste collection (Tribhuvannagar municipality, 2008 data).

Daily collection is provided for 50 per cent of the urban population, including the commercial areas. Waste collectors from the municipality use a thick textile sheet to load the solid waste into the compactor truck. One compactor of capacity six tons and one tractor and trailer that can carry two tons are used for waste collection in different sections of the city, taking the waste to the landfill (*Tribhuvannagar* municipality, 2008 data). (The photographs at the end of this section show the collection and disposal system.) At the landfill site, municipal labourers separate the biodegradable waste and tip it into trenches for composting. It is estimated that the recycling rate for domestic and commercial waste is 15-20 per cent (*Tribhuvannagar* municipality, 2008 data).

Compost from the landfill site is sold for NRs.300 per 10cu.ft (280 litres) load. Plastic and rubber are sold for NRs.13/kg (*Tribhuvannagar* municipality, 2008 data). During the field survey, it was noted that the Municipality was planning to launch a programme to encourage household composting and the use of *Suiro*[14] hooks in order to encourage at-source segregation of recyclable wastes. A *Suiro* hook can be used to hold a bunch of used plastic bags together before they are collected for recycling. This is shown in the photos for the section 2.1 concerning Bharatpur.

Final disposal

The landfill site used by *Tribhuvannagar* municipality is owned by the municipal government and is located



[13] *TLO (Tole Lane Organisation) is community-based organization established by UNDP and the Municipality. The area concerned may comprise only one or two streets.*
[14] *Sharpened wire hook used for storing recovered plastics.*

on the western side of the municipality at a distance of 5.4 km from the city centre. The total area of the landfill site is 20 ha and the estimated life span of the landfill is 50 years. Ten tons of wastes are deposited at this site each day (*Tribhuvannagar* municipality, 2008 data). This means that 72 per cent of the generated waste was being disposed safely at the landfill. The main features of the site that ensure safe disposal include a leachate[15] collection tank, a vertical barrier, gas vents, a waste sorting area, trenches for composting and a site office.

During the field visit neither animals, waste pickers nor open burning were observed at the landfill site. Residents living near the landfill site area were demanding basic infrastructure services as compensation for the proximity of the landfill site. However, local people did not have any complaint regarding the location of the landfill site, but rather, because of the lack of elected representatives; they were using the landfill site as an opportunity for requesting infrastructure services. In order to maintain an attractive environment around the landfill site, 3,000 trees (fruit trees and other varieties) have been planted and 150 beehives installed (*Tribhuvannagar* municipality, 2008 data). These improvements not only improve the environment, but also provide a source of income for the municipality.

Special hospital waste is disposed by the hospital in trenches within its own compound (*Tribhuvannagar* municipality, 2008 data).

Organisational and financial aspects

A total of thirty-four employees are engaged in solid waste collection, transporting, sorting and landfilling operations (*Tribhuvannagar* municipality, 2008 data). This includes one administrator with nine employees at the landfill site. The revenue of this municipality derives from property tax, municipal tax, licence fees, grants from the government and foreign organisations, and user charges. In addition, the Town Development Fund (TDF) has provided loans for municipal infrastructure improvements in past years. The municipality has earned considerable income from waste recycling and the sale of honey. The municipality sold honey worth NRs. 57,090. Plastic for recycling sold for NRs.169,106, grass from the landfill site was sold for NRs.14,100, and sales of firewood from the landfill site raised NRs.31,450 (*Tribhuvannagar* municipality, 2007 data). In addition, the municipality plans to sell fruit grown on the site in future.

According to the municipality data, in the fiscal year 2006-2007, the total income of this municipality was NRs.10 million and the total expenditure on environmental development was NRs.2.5 million (*Tribhuvannagar* municipality, 2007 data). In comparison with other municipal expenditures, expenditure in the last fiscal year on waste management was 25 per cent of total expenditure, which is a considerably higher proportion than is found in the other municipalities of Nepal. Therefore, total expenditure for environmental development which includes SWM as well per person per year in the last fiscal year was NRs.183.

The municipality does not charge any user fee for the waste collection service (Tribhuvannagar municipality, 2008 data). The municipality has the vision to expand its collection system to all the urban wards and is planning to implement a HH waste management fee according to the polluter pays concept. For this purpose, the municipality is in discussions with TLOs; they have come to an understanding to set the user charge at NRs.30 per month from each HH, starting from the next fiscal year[16] (*Tribhuvannagar* municipality, 2008 data). The municipality is waiting for the municipal Board[17] to approve the decision on waste collection charges.

Major problems and issues

Although the current system of waste management is considered effective, the municipality is facing problems resulting from rapid urbanisation, the poor response from citizens to waste minimisation initiatives, the shortage of waste management staff (more staff are required for improving the waste separation and recycling activities), financial limitations etc. In addition, the lack of authority of the Community Development Section to make financial and administrative decisions and implement enforcement measures. Other obstacles include uncontrolled growth of squatter settlements, poor co-operation between the public and private sectors, and inadequate coordination between stakeholders.

[15] *Liquid effluent from organic waste.*
[16] *New fiscal year starts from mid July in Nepal*
[17] *Each year during June-July municipality conducts municipal board meeting.*

Conclusions

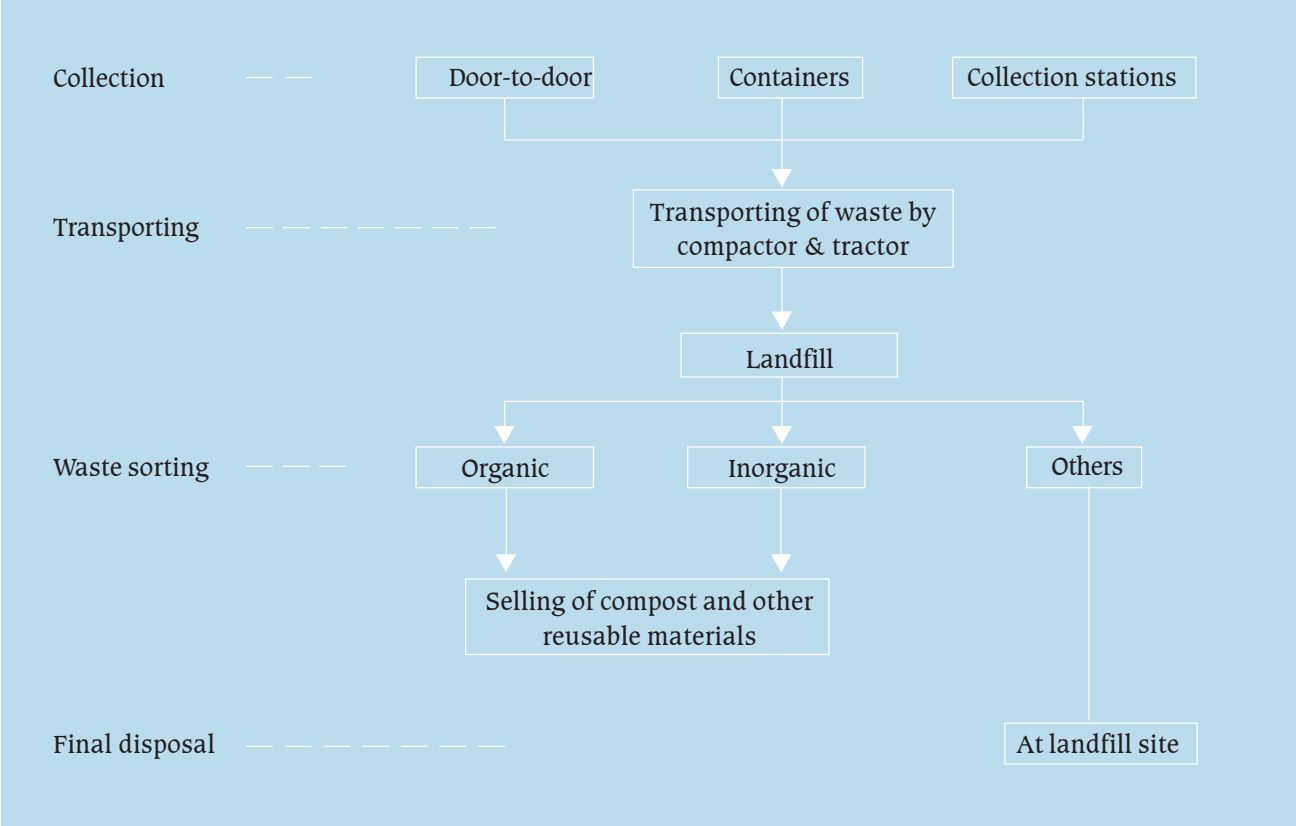
Technical measures, including waste sorting, recycling and composting, and infrastructural measures for leachate collection and gas venting are all upgrading the standard of waste management. Furthermore, the utilisation of resources, such as planting trees, introducing beehives, and other environmental measures at the landfill site demonstrate a good approach for maintaining a healthy environment. Concern for financial viability (considering income from the sale of recyclables and from the landfill site and the plan to collect user charges), and long-term planning (as seen in the life of the landfill site) for waste management are important indicators of sustainable SWM practice.

Technical and financial assistance from organisations such as UNDP-RUPP and GTZ-UDLE have played a major role in the strengthening of SWM planning. Similarly, the formation of the TLO with its motivating role in waste management at local level has been driving this practice towards sustainability. Therefore, it can be concluded that this is good practice, leading towards the fulfilment of the municipal vision of a safe and clean municipal area.

Replicable best practice and lessons learnt

The measures described reflect good practice in solid waste management in developing countries. This municipality is not only handling solid waste properly, but is also generating income from the landfill site and waste recycling. This municipality is spending a considerable amount of its revenues for managing solid waste in safe and healthy ways.

Overall process



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Street sweeping and waste collection at various locations

Bee hives of landfilled site

Waste collection

Waste unloading at landfill site

Organic waste dumping and waste sorting at landfill site

Leachate collection tank

Separated plastic ready for sale

Tree plantation at landfill site

2.1 Municipalities involving the private sector in solid waste management

In this study, cases from Bharatpur municipality, Biratnagar municipality and Hetauda municipalities are included as examples of private sector involvement for effective municipal waste management practice.

URBAN ENVIRONMENTAL MANAGEMENT

Solid Waste Management in *Bharatpur*

Introduction

Bharatpur municipality is regarded as a middle-sized municipality and the commercial centre of *Narayani* Zone in the mid-southern area of Nepal. It is 146 km south-west of Kathmandu. It has 14 wards covering an area of 162.16 km^2 with 19,910 HHs in the year 2001. The total population in 2007 was estimated to be 134,803 and the population density was 1433.58 per km^2 (*Bharatpur* municipality, 2007 data). The population growth rate of 7.1 per cent (CBS, 2001 data) is high as a result of migration because it is surrounded by fertile agricultural land and because of its proximity to the Indian border.

Rationale for selection

This case is included because it provides information about private sector participation in municipal solid waste management and about wastes recycling.

Case description

Before this project, municipality was struggling to provide door-to-door collection, especially in the core areas of *Bharatpur* city, and to dispose of the waste in a sanitary way. Mixed waste was dumped on the bank of *Narayani* River. Without a proper plan and vision for waste management, the municipality was not capable of handling the waste generated in the city area. Since 1999, *Bharatpur* municipality has initiated a public private partnership (PPP) in order to manage the solid waste. As discussed in earlier cases, the Community Development Section for SWM is concerned with the cleaning of roadside drains and public toilets, the removal of dead animals, training employees involved in solid waste management, and public education (including the concepts to reduce, reuse and recycle [RRR]. A private contractor has been engaged to provide door-to-door waste collection and to collect waste from unofficial collection points in domestic, commercial and industrial areas.

Name of the Programme: Solid Waste Management in *Bharatpur municipality*
Location: Mid-southern area of Nepal, south-west of the capital.
Duration of the Project: 1999 onwards
Beneficiaries: Residents of the urban area
Donors and Partners: Private sector, Practical Action Nepal, *Lumanti*, UNDP-PPPUE
Municipal Vision: Solid waste management by public private partnership

Waste from unofficial collection points is brought to official transfer stations which are located in two areas of the municipality. After receiving complaints of bad odours from people in the main market area, the contractor is using the transfer stations alternately, for 15 days at a time.

The main objective of the proposed waste management system in this municipality is to maintain a clean and healthy environment by involving the private sector.

Waste generation and composition

According to the data provided by the municipality and the field survey conducted in May 2008, the average HH waste generation rate is 0.276 kg/capita/day, which is slightly higher than the national average of 0.25 kg/capita/day and lower than the rate for the Kathmandu valley, which is 0.39kg/capita/day (SWMRMC, 2008 data). Using this generation rate it is estimated that the total generation of waste in *Bharatpur* municipality is 37 tons. The municipality estimates that only 20 tons are being collected by the municipality each day, 6 tons/day being of commercial origin and the remaining 14 tons/day being HH waste (*Bharatpur* municipality, 2008 data). Therefore, only around 54 per cent of the generated waste was being collected and dumped by the municipality. The waste generation may be slightly lower than the estimate because most of the Bharatpur's population lives in relatively rural and semi-urban areas.

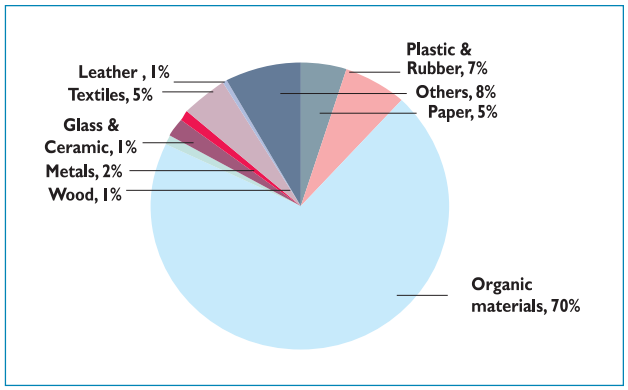
Healthcare waste is supposed to be managed by the hospitals and nursing homes themselves by incineration and dumping in trenches within the compound, but during the field visit it was observed that private nursing homes were not serious about the management of infectious healthcare waste. There are altogether three government hospitals and ten private nursing homes, providing a total bed capacity of 1975 (*Bharatpur* municipality, 2008 data). According to UN-HABITAT Nepal, the waste generation rate for hospital waste in Nepal is 1.7 kg/day/bed (UN-HABITAT, KMC data, 2007); on this basis it is estimated that about 3.3 tons of healthcare wastes are generated in this municipality each day.

The composition of municipal solid waste at source is found to be paper 5 per cent, plastic & rubber 7 per cent, organic materials 70 per cent, glass and ceramic 1 per cent, metal 2 per cent, wood 1 per cent, textiles 5 per cent, leather 1 per cent and other miscellaneous materials 8 per cent (*Bharatpur* municipality, 2008 data), as shown in Chart 3 below.

Waste collection and recycling

Waste is collected from unofficial collecting points in almost 70 per cent of the areas in the urban wards. The contractor is responsible for collecting waste from various stations to dispose in the disposal site. Previously, metal containers were used for waste storage, but the residents objected to them because of the bad odours it produced. Every day at 7.00 a.m., the contractor starts the collection of waste from wards 1, 2, 3, 4 & 5 (*Bharatpur* municipality, 2008 data).

Chart 3: Composition of solid waste at source , *Bharatpur* municipality



In order to encourage waste reduction at source, HH composts and the segregation of plastic waste using *suiro* hooks for storage have been promoted in some of the wards. In Shaulibazar-10 area the local community has initiated segregation of waste at source for composting and vermicomposting (which uses worms?and the recovery of plastics. Similarly, in order to collect waste from surroundings, residents of Shantinagar-7 area have installed small waste bins; especially for inorganic waste, in peripheral areas.

With the partial support from *Lumanti*[18] , Practical Action Nepal and local NGOs, a 40 m^3 biogas plant is under construction in ward no.5 of *Bharatpur*. There are 180 low-income residents in this area. The input for the plant will include wastewater from 18 low-income HHs (*Bharatpur* municipality, 2008 data).

[18] *An NGO especially working for the welfare of slums and squatter communities.*

In *Bharatpur*, it is estimated that 15 per cent of municipal solid waste is recycled and that almost 50 per cent of the domestic waste and 25 per cent of institutional waste is collected at source each day (*Bharatpur* municipality, 2008 data). In order to encourage HH segregation and waste minimisation, Practical Action Nepal has been distributing compost bins[19] and *suiro* hooks to the residents of various wards of Bharatpur.

A total of 530 compost bins (capacity 50 kg), 550 plastic buckets (capacity 10 kg) and 1200 *suiro* hooks have been distributed by Practical Action throughout *Bharatpur* municipality (Practical Action, Bharatpur, 2008 data. The municipality is also selling compost bins for NRs.700 and *suiro* hooks for NRs.10 (*Bharatpur* municipality, 2008 data). Compost is sold for NRs.15/kg (*Bharatpur* municipality, 2008 data). Local itinerant waste buyers buy plastics for NRs.10/ kg (*Bharatpur* municipality, 2008 data), paper for NRs.12-13, glass for NRs.2 and ferrous material for NRs.37/kg (*Bharatpur* municipality,2008 data).

Transport and the final disposal

Since 2006, *Bharatpur* municipality has been dumping all of its waste at the *Ramnagar* dumping site, which is 11km from the city and 4.5 km east of *Ramnagar Bazaar* area. One loader, 25 one wheeled barrows that can carry 50 kg, 15 tricycles of capacity 300-500 kg, and two tractors with trailers that can carry 2 tons each are used by the contractor for waste collection and dumping (*Bharatpur* Municipality, 2008 data). Municipal records show that every day 15 tons of waste are dumped at the dumping site and that the site is expected to be used for another 5 years (*Bharatpur* municipality, 2008 data). During the field visit it was observed that the waste was burning and that dead animals had been dumped there. However no waste pickers were observed. The municipality has sometimes sprayed pesticides after dumping the waste in an attempt to minimise health risks.

Organisational and financial aspects

The contractor, *Mr. Shayam Kumar Shrestha*, employs a staff of 53 for waste collection, transportation and disposal operations (*Bharatpur* municipality, 2008 data). The daily operation and management system is supported by one officer from the municipality, with two supervisors, two drivers, ten helpers, and one cleaning assistant (*Bharatpur* municipality, 2008 data).

The income of this municipality is derived from various sources, including property tax, municipal tax, licence fees, grants from the government, grants from foreign organisations, and user charges. The Town Development Fund (TDF) has provided loans for municipal infrastructure improvement in past years. The UNDP-PPPUE programme has chosen this case for their PPPUE research because *Bharatpur* is one of the most rapidly growing urban areas of Nepal. The business activities and its location are also factors that favoured its selection.

In comparison with other municipal expenditures, municipal expenditure on waste management was 5 per cent in the fiscal year 2006-2007(*Bharatpur* municipality, 2007 data). For the solid waste management service, the municipality is contracted to pay NRs.4.6 million each year to the contractor (*Bharatpur* municipality, 2007 data). In the fiscal year 2006-2007 the total municipal expenditure was almost NRs.96 million (*Bharatpur* municipality, 2007 data). Total municipal expenditure per person for the year was NRs.710.33. During the field visit, it was noted that the contractor does not collect any fee for waste collection from the residents. However, local TLOs[20] have agreed to pay NRs.50 and NRs.100 per month respectively for residential and commercial premises to improve the collection and disposal of waste (*Bharatpur* municipality, 2008 data). With this in mind, the municipality is planning to approve the decision from the municipal board on waste collection charges.

Major problems and issues

Despite its effective system of private sector partnership for waste collection, the municipality is facing the problems of rapid urbanisation, the poor response of residents to calls for waste minimisation, a shortage of waste management staff and financial limitations. Other difficulties include the lack of authority to make financial and administrative decisions, the lack of trained personnel, the lack of standardised vehicles and frequent breakdowns of vehicles, the need for enforcement

[19] *Capacity 50 kilograms*

[20] *In many urban areas of Nepal, Tole Lane Organizations have played a significant role in motivating local people.*

measures, uncontrolled squatter settlements, poor co-operation from the public as well as the private sector and inadequate stakeholder coordination. In addition, the transfer station at the main road of Bharatpur is causing problems for the local people.

Conclusions

This municipality is located on the trade route between major urban centres such as *Birgunj, Nepalgunj, Kathmandu and Pokhara*. Considerable numbers of private industries are located around *Bharatpur*. The municipality's mechanism for coordinating the public and private sectors has played a vital role in waste management. However, the daily monitoring of waste management by the Community Development Section has not been sufficient.

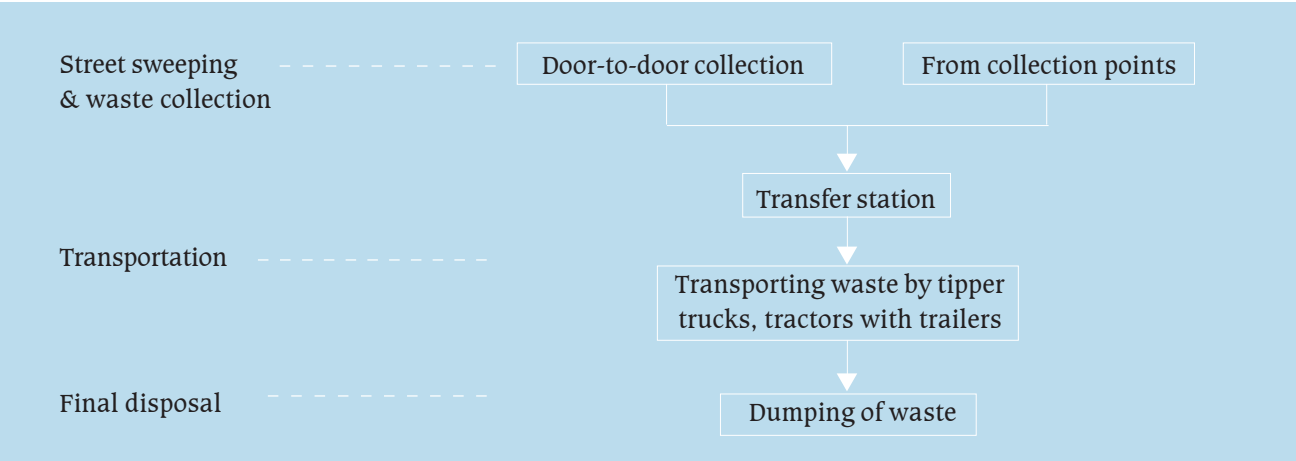
Effective involvement of both private and public sectors has made it possible to improve waste management and provide door-to-door collection. The role of the private sector in recycling is important and it can contribute to sustainable waste management by reducing the quantities of plastics. Furthermore, Practical Action Nepal, UNDP-PPPUE, UDLE and *Lumanti* have together played a significant role by motivating private sector operators to get involved not only in waste collection and disposal but also in recycling, thereby creating a significant number of jobs and benefits.

Lastly, sound financial management and regular and reliable payment of the contractor are important for satisfactory private sector participation. The Municipality has achieved its target of waste management with active involvement of the private sector, minimising municipal expenditure by means of effective management practice.

Replicable best practice and lessons learnt

Both for waste management and in recycling activities, considerable numbers of private organisations are expressing their interest. It is believed that significant numbers of jobs can be created for poor people and increased effectiveness in waste management can be achieved with minimal additional municipal expenditure.

Overview of the solid waste management system



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Street sweeping and waste collection at various locations

Transporting waste to the dumping site

Waste collection

Vermicomposting at *Shaulibazar*- 10

Compost Bin

Use of community bins at Shantinagar -7

Biogas plant partially supported by Practical Action

Dumping of waste

URBAN ENVIRONMENTAL MANAGEMENT

Solid Waste Management in *Biratnagar*

Introduction

Being the second largest city in Nepal, *Biratnagar* is a major industrial hub of the country. It is located near the Indian border in the south-east and is 490 km from the capital, Kathmandu. Covering a total area of 58.48 km^2, *Biratnagar Sub-Metropolitan* City[21] (BSMC) has 22 wards (BSMC, 2008 data). In 2001 the total number of HHs in this sub-metropolitan city was 33,678 and the population was 166,674 (CBS, 2001). The population growth rate of this sub-metropolitan city is 3.36 per cent per year and the population density is 2850.1 persons per km^2 (CBS, 2001). The projected population for the year 2008 is 205,876.

Rationale for selection

This case is included in this study because it is the first municipality to involve the private sector in solid waste management. The citizens are familiar with private sector provision of sustainable waste management services in their city.

Case description

The situation was much worse before recent interventions. Garbage was left in the open in the public places of *Biratnagar*. The municipality was not able to provide neither a door-to-door collection service nor a sanitary disposal of solid wastes. Because of the strength of the local business sector, the municipality had proposed that waste management services should be provided by the private sector. This concept was introduced in 1997-98, and *Biratnagar* became the first municipality in Nepal to introduce this kind of partnership approach for solid waste management.

Because of the unstable political situation and the lack of clear government policy, the partnership with the first contractor to be engaged - Americorp - ran into difficulties (GHK Working Paper, 2001). Subsequently, a contract with another contractor - Silt - was signed, and this contract was operational until 2007. Silt established an effective partnership environment with the city in which a satisfactory service was provided. In addition the partnership paved the way for the introduction of waste management charges for HHs, shops and other businesses.

Now *Samajik Sudhar Tatha Batabaraniya Bikas Manch* (a private company) has taken over the contract for providing services that include door-to-door waste collection, transport and dumping. Local people and politicians have appreciated the work of the private sector in waste management; however they are dubious

Name of the Programme: Solid Waste Management in *Biratnagar*
Location: South-eastern Nepal, near to the Indian border
Duration of the Project: 1997 onwards
Beneficiaries: Residents of the sub-metropolitan city
Donors and Partners: Private sector, NGOs, CBOs, UNDP
Municipal Vision: Building municipal capacity in waste management by private sector involvement

[21] *Sub-metropolitan cities have populations more than 100,000 and annual revenues of at least NRs.20 million.*

about the role of government in policy formulation because, since 1998, local administration has been conducted without elected representatives. This situation has added to the problems of implementing the Local Self Governance Act, 1999.

In this sub-metropolitan city, the Environment Section has overall responsibility for waste management. The main functions carried out by this section are, street sweeping, roadside drain cleaning, removal of dead animals, procurement and maintenance of waste management vehicles, recruitment & training of waste management staff, and public education, including providing training to local residents. The contractor is responsible for HH collection, transportion and dumping of solid waste.

The main objectives of the waste management system are to ensure effective collection, transport and sanitary disposal of solid waste from HHs, businesses and industrial areas.

Waste generation and composition

According to the most recent data provided by BSMC, and the field survey conducted in May 2008, the average HH waste generation rate is 0.33kg/person/day (BSMC, 2008 data), which is more than the national average of 0.25kg/capita/day and lower than the rate for Kathmandu Valley, which is 0.39kg/capita/day (SWMRMC, 2008 data).

The daily waste generation of *Biratnagar* Sub-Metropolitan City is 55 tons/day (BSMC, 2008 data). Approximate data indicates that 15 tons/day of waste arise as a result of various business and commercial activities, and the remaining 40 tons/day is HH waste (BSMC, 2008 data). The composition of waste at source was found to be paper 6.4 per cent, plastic and rubber 8.8 per cent, organic materials 75.6 per cent, metal 0.2 per cent, textiles 1.9 per cent, leather and other materials 7.1 per cent (BSMC, 2008 data).

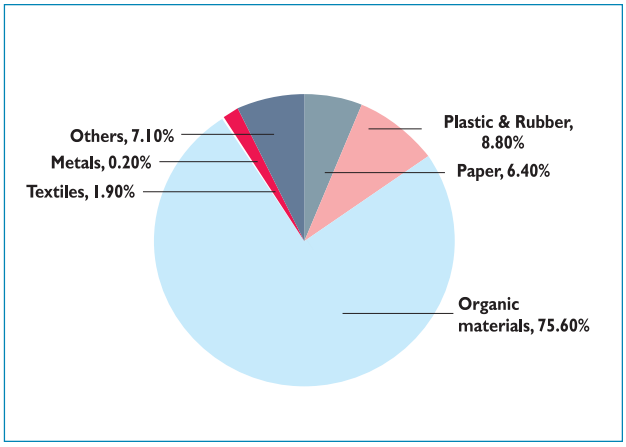
The total number of hospital beds (in both government and private establishments) in the city is 1,000 (BSMC, 2008 data). According to UN-HABITAT Nepal, the generation rate for hospital waste in Nepal is 1.72 kg/day/bed (UN-HABITAT, KMC data, 2007). Therefore, it is estimated that the generation rate for healthcare waste in BSMC is 1.8 tons/day.

Waste collection and recycling

Waste is collected from designated open collecting points in almost 95 per cent of the urban area. The contractor is responsible for the collection, transportion and dumping of solid waste. Each morning, starting at around 7.00 a.m., waste is collected door-to-door using tricycles that can carry 300-500 kg. Previously, plastic containers were used by the Silt Service Management, but local people rejected these containers because of the continuous bad odour that they omitted (because waste was being deposited into them at any time of the day and some of the waste was decomposing in the containers for nearly 24 hours before the containers were emptied). In order to encourage waste minimisation and waste reduction at source, the municipality is planning to launch HH composting and the use of suiro hooks for recovering plastic. A municipality source verified that waste management in the industrial area is the responsibility of the factories themselves.

One model compost plant with a capacity of 4 tons/day of organic waste is operating in Ward no. 1 (BSMC, 2008 data). It is estimated that 30 per cent of both domestic and commercial waste is recycled each day (BSMC, 2008 data). The compost is sold for NRs.10 per kg and plastic for NRs.6 per kg. The prices paid per kg for other recovered materials are: metal NRs.35, paper NRs.12, plastic NRs.6 and glass NRs.2 (BSMC, 2008 data). As BSMC is on the border with India, the recycling business is flourishing.

Chart 4: Composition of Solid Waste generation at source, Biratnagar Sub Metropolitan city



Transporting and final disposal

BSMC is dumping its waste at three different sites. Two leased sites which are allocated by BSMC are 6 km from the main market. According to BSMC, the estimated remaining life span of both of these open sites is two years. The third area is on the bank of Singe Khola, at a distance of 4 km from the main market area. The contractor is filling a section of the river bank with waste; a municipality source mentioned that they had not calculated the remaining lifespan of this site. They also mentioned that they are discouraging riverside dumping after the end of 2007. During the field visit, the contractor was seen dumping filling material (ash) at the Singe Khola site in order to avoid pollution risks.

Two tippers, each with a capacity of 3 tons, six tractors with trailers that can carry 2 tons each, one excavator, one power tiller , 25 rickshaws, each capable of carrying 300-500 kg and three handcarts with a capacity of 50 kg are used for waste collection and dumping (BSMC,2008 data). It is estimated that total of 50 tons of mixed waste is dumped every day. Rough data from the municipality show that waste generation from residential areas is only 30 tons/day.

Using the growth rate provided by CBS Nepal, the projected population of BSMC for the year 2008 is 205,876. Multiplying this by the per capita generation rate of 0.33 kg/capita/day gives the result of 68 tons for the daily generation of waste. Hence, 74 per cent of the waste that is generated is being collected and disposed. During the field visit, there were no signs of open burning, waste pickers, or scavenging animals at the dumping sites. It was observed that special or hazardous wastes were mixed with municipal solid wastes at various collection stations and that the municipality and contractor are facing problems caused by hazardous wastes.

Organisational and financial aspects

One engineer, one public health inspector, four technical assistants, five supervisors, five drivers and seventy-nine manual workers are working in solid waste management (BSMC, 2008 data). According to approximate data from BSMC, 50 employees of the contractor, *Samajik Sudhar tatha Batabaraniya Bikas Manch* are involved in door-to-door collection. The Municipality spent NRs.9.56 million in the 2006-2007 fiscal year for solid waste management (BSMC, 2007 data). The contractor charges NRs.30 to NRs.1,500 per premises according to the service provided.

Approximate data shows that the contractor was collecting approximately NRs.100,000 per month from various service beneficiaries, including both residential and commercial premises. During the BSMC-Silt contract, Silt collected annual fees totalling NRs.1.0 million from the door-to-door collection service (SWMRMC, 2006 data). According to BSMC data, the total expenditure of the sub-metropolitan city in the last fiscal year was NRs.132 million (BSMC, 2007 data). BSMC expenditure per capita for that year was NRs.641.00. It is calculated that BSMC expenditure on waste management was 7.3 per cent of total expenditure in the last fiscal year.

Major problems and issues

Despite its effective system of partnership for waste management, the municipality is facing problems of increasing population, a poor response of the citizens towards waste minimisation, staff shortages, financial constraints etc. Obstacles that add to these problems are: the lack of authority to make financial and administrative decisions, a shortage of trained personnel, the lack of a standardised vehicle fleet and frequent breakdowns, a lack of enforcement measures, uncontrolled squatter settlements, poor cooperation between public and private sectors, and inadequate stakeholder coordination.

There is an urgent need for a landfill site for sanitary disposal of solid waste. The present arrangements may cause serious water pollution because the contractor is dumping waste on a river bank and the other two open dumping sites are also not safe for dumping. The municipality should take proper action in order to control haphazard dumping of infectious waste from various private nursing homes. Nevertheless, the municipality has achieved its goal of building municipal capacity in municipal solid waste management. It has also considerably reduced municipal expenditure after implementing the measures that have been described.

Conclusions and lesson learnt

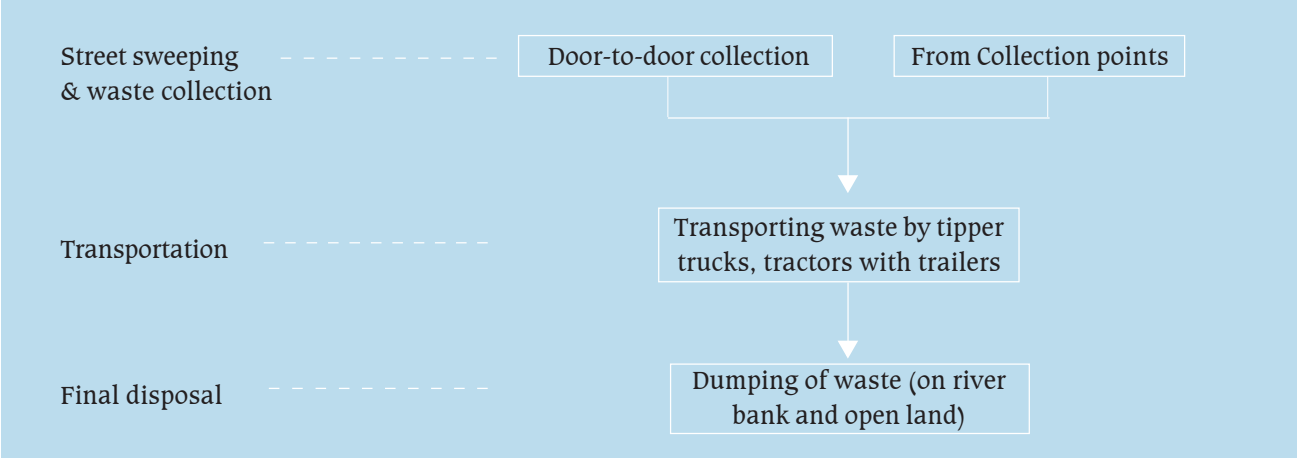
It can be concluded that the involvement of the private sector can contribute to effective waste handling and door-to-door collection. Programmes supported by INGOs such as UNDP-PPPUE/RUPP have played a significant role in the implementation of the model of partnership between the private sector and local government. The partnership between BSMC and the contractor Silt had previously made useful progress by introducing waste collection charges, and by improving coordination with stakeholders. Improved customer satisfaction and acceptance of service charges have been important steps towards sustainability. The setting of service charges for different categories of user has been a notable achievement by BSMC which could usefully be adopted by other municipalities in Nepal.

Replicable best practice

This case shows that a significant number of jobs can be created for poor people and that the effectiveness of waste management services can be improved with minimal municipal expenditure by a well structured partnership with the private sector. For such partnerships to be effective, the municipality should be able to attract and motivate private sector partners.

Overall process

(The service is provided by a contractor approved by the municipal board.)



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Street sweeping and waste collection at various locations


Street sweeping and waste collection at various locations


Covering the waste with ash to sanitise the dumping site


Dumping of waste on the river bank of Singe Khola

URBAN ENVIRONMENTAL MANAGEMENT

Solid Waste Management in *Hetauda*

Introduction

Hetauda is a mid-sized municipality with an area of 47.77 km^2. It is located in mid-south of Nepal, 225 km from Kathmandu. It is divided into 11 wards. According to municipality data (CBS, 2001), the population was 68,482 in 2001, living in 14,271 HHs, and the growth rate was 4.5 per cent. Based on these data the projected population for the year 2008 is 90,054. In 2001 the population density was estimated to be 1433.58 per km^2 (CBS, 2001).

Rationale for selection

This case has been selected because it provides information about effective waste collection and at-source segregation.

Case description

In previous years, when there was no proper waste collection system, the municipality used to receive complaints from residents about inadequate waste collection and dirty streets. Haphazard dumping was practised throughout the area of *Sukumbashi*[22] *Tole*. After the implementation of the solid waste management programme, the Community Development Section was made responsible for solid waste management. Two private organisations[23] were engaged for waste management services. 'Clean Nepal' is working in Wards 3, 4, 10 and parts of Wards 1 and 11, serving a total of 2,000 HHs (*Hetauda* municipality, 2008 data). Simultaneously, `*Samajik Sarokar Manch*` is working in Wards 2, and 5, in the city area and in part of Ward no.1, serving a total of 900 HHs (Hetauda municipality, 2008 data).

The main responsibilities of the Community Development Section are street sweeping, roadside drain cleaning, removal of dead animals, procurement and maintenance of waste management vehicles, recruitment & training of waste management staff, public education and promotion of recycling. The Community Development Section is actively engaged in waste minimisation and segregation programmes. It has distributed 400 compost bins with a capacity of 50 kg and 500 suiro hooks for separating organic and inorganic waste (*Hetauda* municipality, 2008 data). The municipality is distributing suiro hooks and compost bins with financial assistance from UN-HABITAT and UDLE-GTZ Nepal. One district hospital with 50 beds is situated within the municipality (*Hetauda* municipality, 2008 data).

The main objective of the waste management system in Hetauda municipality is to ensure effective collection of solid waste from HHs, businesses and industrial areas, and safe transport of solid waste from source to dumping site.

Name of the Programme: Solid Waste Management in *Hetauda*
Location: Mid-southern Nepal
Duration of the Project: 2002 onwards
Beneficiaries: Residents of Hetauda municipality
Donors and Partners: UDLE-GTZ, UNDP, UEIP, UN-Habitat, NGOs, CBOs,
Municipal Vision: Clean and healthy Hetauda city through partnership with the private sector.

[22] *Sukumbashis are squatters or internally displaced persons living in public land.*
[23] *Municipal employees have permanent status whilst the employment status of the staff of private organisations is usually temporary.*

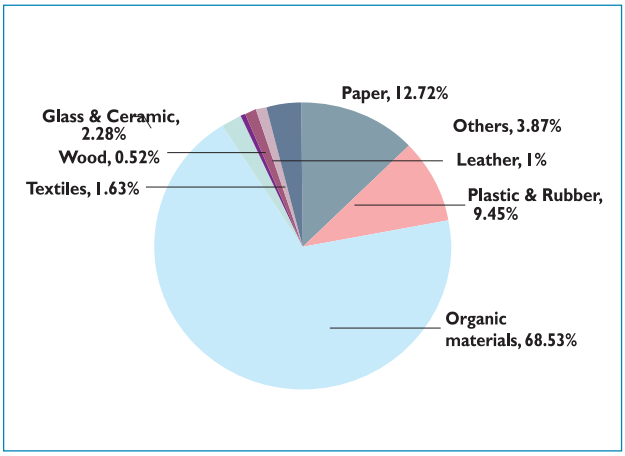
Waste generation and composition:

According to the data provided by the municipality and the field survey conducted in May 2008, the average HH waste generation rate in this municipality is 0.25 kg/person/day (Hetauda municipality, 2008 data). This rate is same as the national generation rate and it is lower than the waste generation rate of the capital Kathmandu, which is 0.39 kg/person/day (SWMRMC,2008 data). The daily waste generation of Hetauda municipality is 14 tons (Hetauda municipality, 2008 data).

The composition of waste at source was found to be: paper 12.72 per cent, plastic & rubber 9.45 per cent, organic waste 68.53 per cent, glass and ceramics 2.28 per cent, wood 0.52 per cent, textiles 1.63 per cent, leather 1.00 per cent and other materials 3.87 per cent (*Hetauda* municipality, 2008). In order to reduce the amount of plastic material in the waste, the municipality is encouraging the use of durable textile bags instead of plastic bags.

According to UN-HABITAT Nepal, the generation rate for hospital waste in Nepal is 1.72 kg/day/bed (UN-HABITAT, KMC data, 2007). Therefore, it is estimated that *Hetauda* municipality generates 86 kg of hospital waste each day.

Chart 5: Composition of solid waste at source, Hetauda municipality



Waste collection and recycling

Contractors are responsible for the collection (from various unofficial collection points), transportion and dumping of waste. Door-to-door collection from residential and commercial areas is done using tricycles that can carry 300 to 500 kg, operating in the morning from 6.00 to 9.00 a.m. and from 1.00 to 5.00 p.m. in the afternoon (*Hetauda* municipality, 2008 data). Previously, metal containers had been used in order to improve the efficiency of the collection operation. However, the local people rejected this method of storage because of the unpleasant smell coming from the containers and the scattering of waste around the container by animals. In order to encourage waste reduction at source, community-based composting facilities of 500kg capacity and suiro hooks for plastic segregation have been promoted in *Hetauda* municipality.

The municipality is actively promoting recycling and composting at the HH level. It has distributed composting bins to 400 HHs and also provided regular training (*Hetauda* municipality, 2008 data). A few years ago, *Hetauda* municipality banned the use of plastic bags within the city premise. After experiencing difficulties from the residents[24] and because of the complete ban on plastic bags, the city has adopted the strategy of promoting reduction and recycling of plastic bags. *Hetauda* municipality has distributed wire Suiro hooks for segregating plastic waste. *Hetauda* municipality encourages the recovery of plastic by providing training at ward level by waste inspectors[25] and it also buys plastic at NRs.6 per kg (Hetauda municipality, 2008 data). Local TLOs like *Navajiwan Jyoti* Club have been promoting plastic separation from the beginning of the waste management programme. In order to encourage citizens to recycle on World Environment Day 2008, prizes worth NRs.1000 and certificates of appreciation were awarded by *Hetauda* municipality to HHs that made a big contribution towards recycling (*Hetauda* municipality, 2008 data).

It is estimated that total of 15 per cent of both domestic and commercial waste is recycled by composting and at-source segregation, and that almost 60 per cent of domestic and 25 per cent of institutional waste are collected by the municipality each day (*Hetauda* municipality data, 2008 data). However, solid waste from the *Hetauda* industrial area is managed by the companies themselves. During the field visit, no data were provided about the waste generation of the *Hetauda* industrial area. After composting, local people sell their

[24] *Difficulty in getting shopping bags*
[25] *One waste inspector is allocated for each ward*

product for NRs. 20 per kg to the local nurseries, and some of them use it themselves for agricultural and gardening purposes. Local dealers buy paper, plastic and glass for NRs.12, NRs.6, and NRs.2 per kg respectively (*Hetauda* municipality, 2008 data).

Transportation and final disposal

Hetauda municipality dumps its waste on the bank of the Rapti River. The site is 1.5 km south of the east-west highway. The waste collection fleet comprises two tipper trucks of capacity 3 tons, two tractors pulling trailers that can each hold 2 tons, three rickshaws of capacity 300-500 kg, three handcarts that can carry up to 100 kg, and 30 one-wheel barrows of capacity 50 kg. One suction tanker is also available (Hetauda municipality, 2008 data). Almost 12 tons of waste is dumped at the dumping site daily and it is planned to use this site for the next 10 years (*Hetauda* municipality, 2008 data). Calculating with the projected population of 90,054, the daily waste generation of the municipality is estimated to be 22 tons. This means that 55 per cent of the generated waste is dumped and 15 per cent of waste is being recycled. During the field visit there were no waste pickers or animals at the Rapti river bank dumping site and no open burning was observed (this site is owned by the government of Nepal.) Infectious hospital waste is disposed of in trenches by the hospital.

Organisational and financial aspects

In total, sixty-six people are employed by the private organisations for the collection, transportation and dumping of solid wastes. In addition, the municipality has 39 staff to support, monitor and supervise the work (*Hetauda* municipality, 2007 data). The municipality staff are also responsible for sweeping approximately 8 km of streets on a daily basis.

The income of this municipality is derived from property tax, municipal tax, licence fees, grants from the government and foreign organisations, and user charges. During the field visit, it was noted that service charges have been imposed for waste collection. This charge is NRs.30 per month for HHs, NRs.50 per month for schools, NRs.100 per month for business premises and NRs.200 per month for hotels (*Hetauda* municipality, 2007 data). These charges were fixed by the municipality in coordination with the leaders of TLOs, representatives from users' groups, the contractor and representatives from the district chamber of commerce.

Municipal expenditure on waste management was 5 per cent of the total yearly budget in the fiscal year 2006-2007 (*Hetauda* municipality, 2007 data). According to the municipality, the total municipal expenditure of Hetauda in that fiscal year was almost NRs.80 million (*Hetauda* municipality, 2007 data). Therefore, the annual per capita expenditure of the municipality was NRs.884.

Major problems and issues

Although the partnership with the private sector has proved effective, the municipality is facing problems related to rapid urbanisation and because of political disturbance in the tarai areas, staff shortages, financial constraints etc. Other obstacles include the lack of authority of the Community Development Section to make financial and administrative decisions, the lack of trained personnel, the lack of standardised vehicles and the frequent breakdown of vehicles, inadequate enforcement measures, uncontrolled squatter settlements, poor cooperation between the public and private sectors, and inadequate stakeholder coordination.

There is an urgent need for a landfill site for sanitary disposal of waste. The current arrangements may create water pollution because they are dumping their waste beside a river. Furthermore, the dumping sites may not only cause serious disruption for the wildlife of *Chitwan* National Park[26] but also impact on the tourism industry of that region. The Community Development Section does not have enough authority to allocate municipal resources for the improvements that are essential for solid waste management of the area.

Nevertheless, the municipality has definitely achieved its goal of a clean and healthy Hetauda city by means of its partnership with the private sector.

[26] *Chitwan National Park is the major tourist destination of Nepal, and is only 30 km south-west of Hetauda municipality*

Conclusions and lesson learnt

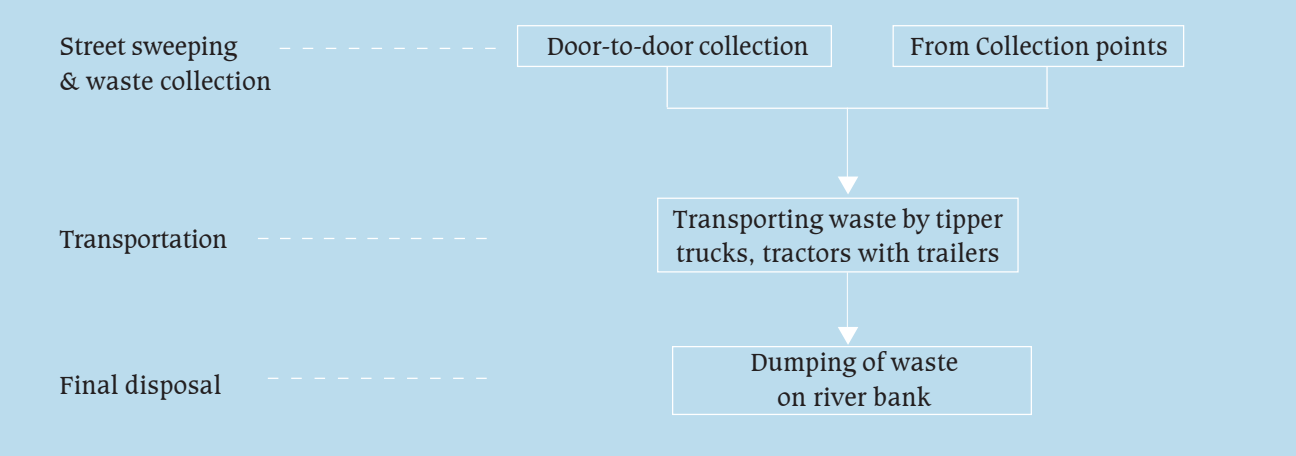
The approaches used by Hetauda municipality, CBOs and NGOs for mobilising the community to reduce waste quantities form the major lesson that can be learnt from this case. These approaches have benefited from the effective involvement of a considerable number of civil society organisations, such as the *Navajiwan Jyoti* club. Conditions have been established that encourage at-source segregation, waste sorting, the trading of recyclables, and the use of compost bins and *suiro* hooks. In addition, the involvement of organisations like GTZ-UDLE, UNDP, UEIP, and UN-Habitat has played a vital motivational role. The municipality has been able to support civil society's involvement in promoting waste reduction at source.

Replicable best practice

Approaches from private organisations and TLOs could play a significant role in developing at-source segregation of solid waste. The *suiro* programme plays a major role in promoting the recovery of plastic waste. Ultimately, this case demonstrates that partnerships for training and community mobilisation are effective tools for developing sustainable waste management.

Overall process

(The service is provided by a contractor approved by the municipal board.)



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Street sweeping and waste collection at various locations

Waste collection and cleaning of drains

Street sweeping and waste collection at various locations

Waste collection

Transporting waste on the dumping site

Dumping of waste on riverbank

Dumping waste beside the river

Hetauda city area

2.2 Cases of NGO involvement in solid waste management

In this section, individual cases show how various NGOs are making significant contributions in door-to-door collection, and in the reduction and recycling of organic and inorganic wastes.

URBAN ENVIRONMENTAL MANAGEMENT

NEPCEMAC involvement in door-to-door waste collection

Introduction

Nepal Pollution Control and Environment Management Centre (NEPCEMAC) established in 1997 is a non-profit independent organisation. It has been working in solid waste management with various communities of Nepal. Aware of the impacts of rapid urbanisation, NEPCEMAC is working in areas of *Kathmandu* metropolitan city, *Lalitpur* sub-metropolitan city, *Biratnagar* sub-metropolitan city, Itahari municipality and Triyuga municipality. In this study, the case of *Lalitpur* sub-metropolitan city is considered (NEPCEMAC, 2008).

Rationale for selection

This case was selected because it discusses the NGO's efforts in door-to-door solid waste collection. NEPCEMAC runs this service on a financially viable basis, which is important for sustainability.

Case description

Lalitpur sub-metropolitan city (LSMC) is south of *Kathmandu* and is the third largest city in Nepal. This municipality comprises 22 wards and covers an area of 15.47 km2. The population in 2001 was 162,991, 34,996 HHs (CBS, 2001). The population growth rate for this municipality is 3.5 per cent per year (CBS, 2001).

NEPCEMAC started its project in *Kusunti* area with a small team. Its area of operation in the beginning was limited to only fifty HHs. At that time government policy for solid waste management was not clear in a number of areas, for policy issues such as private sector participation, service charges, coverage area, and waste management techniques. HHs in LSMC was facing problems of waste collection and disposal. Since its establishment in 1997, NEPCEMAC has been involved in solid waste management (collection, source reduction, recycling and reuse) in various communities of Nepal. Similarly, other NGOs in *Kathmandu* metropolitan city, LSMC, *Bharatpur*, *Biratnagar* have also been working in waste management according to the UNDP's Public Private Partnership in Urban Environment (PPPUE) concept.

The main objectives of NEPCEMAC are: to encourage people to participate actively in waste management, to provide training on various methods of composting, to generate employment by extending waste management coverage,

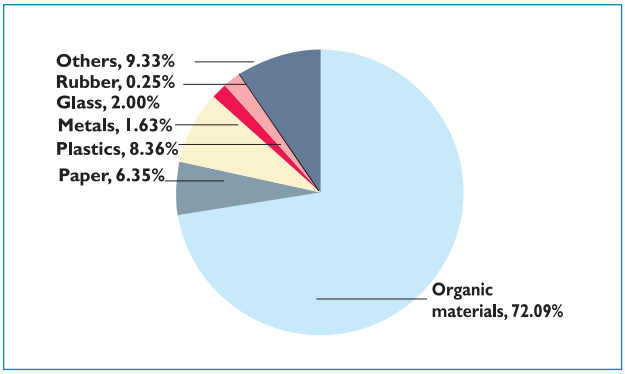
Name of the Programme: **NEPCEMAC for door-to-door collection**
Location: Wards No.3, 4, 5 and13, Lalitpur sub-metropolitan city
Duration of the Project: 1997 onwards
Beneficiaries: Residents in selected wards of *Kathmandu, lalitpur, Biratnagar, Itahari, and Triyuga*
Donors and Partners: Municipalities
Municipal Vision: Waste collection, recycling, proper handling and a clean urban environment

to coordinate with governmental organisations, NGOs and INGOs for effective management and partnership, and to extend an effective door-to-door solid waste collection service to different urban centres in Nepal. To ignite this process, NEPCEMAC started with an area cleanliness campaign, in which they involved all the residents in an area, to come together and clean their surroundings.

Waste generation and composition

According to the data provided by NEPCEMAC and the field surveys conducted in June 2008, the average HH waste generation rate in LSMC area is 0.37kg/capita/day (NEPCEMAC, 2008 data). This rate is higher than the national average of 0.25kg/capita/day and less than the rate for Kathmandu metropolitan, which is 0.39kg/capita/day (SWMRMC, 2008 data). The composition of the waste has been found to be: 72.09 per cent organic waste, 6.35 per cent paper, 8.36 per cent plastic, 1.63 per cent metal, 2.00 per cent glass, 0.25 per cent rubber, and 9.33 per cent other materials (NEPCEMAC, 2008 data).

Chart 6: Composition of solid waste of Lalitpur



Waste collection and recycling

The NEPCEMAC programme has expanded its door-to-door waste collection into other areas of Lalitpur. Now, the working area of NEPCEMAC covers 13,000 HHs - all of Wards no. 3, 4, 5 and 13 and parts of Wards 2, 14, 19 and 20 of *Lalitpur* sub-metropolitan city area and Wards no. 2, 3, 4, 5, 15 and 16 of Kathmandu metropolitan city (NEPCEMAC, 2008 data). It has slowly extended its operational area to other urban centres of the country. NEPCEMAC is collecting HH waste from door to door between 7 a.m. and 9 a.m. each morning. The NGO has promoted HH composting. All non-recyclable waste is dumped at locations designated by the respective municipality[27] .

Transport and final disposal

There are different means of final disposal, according to the provisions made by the respective municipalities. In the case of LSMC, NEPCEMAC unloads some of the waste it collects into containers (capacity 6 tons) and also at the Bagmati river bank dumpsite (allocated by LSMC). In Kathmandu metropolitan city, NEPCEMAC transports waste using its own vehicles (two tipper trucks of 4 tons capacity) to the *Sisdol* landfill site. NEPCEMAC has become one of the major NGOs working in solid waste collection, composting and haulage.

Organisational and financial aspects

According to the data provided by NEPCEMAC, it employs 174 staff - 21non-technical, 52 technical and 101 general - as regular full-time staff, and 100 daily-waged labourers (NEPCEMAC, 2007 data). The income of this organisation is derived from waste collection charges, and sales of compost etc. In 2007, the income of NEPCEMAC was NRs.20 million (NEPCEMAC, 2007 data).

Waste collection charges are NRs.125 per house and NRs.50 to NRs.75 per shop (NEPCEMAC, 2007 data). The expenditure of this organisation is approximately the same as the income, according to a NEPCEMAC source, so they have achieved breakeven status as far as operational costs are concerned. It is one of the largest NGOs working in waste management in Nepal. This NGO is not only improving its waste management system, but is also creating many jobs for poor urban citizens.

Major problems and issues

Despite its effective door-to-door waste collection service, NEPCEMAC is facing a poor response to its calls for citizens to minimise the amount of waste that they discard. It has distributed red and green bins (each with a capacity of 10 kilograms) for waste segregation at source to 1000 HHs but waste collectors from

[27] *Regarding LSMC case, it has provided containers of capacity 7 tons in working areas of NEPCEMAC*

NEPCEMAC have observed that only mixed waste is put out for collection by these HHs.

Other problems include the shortage of labour, financial limitations and a lack of vehicles. Additional obstacles are the poor institutional set-up of government organisations and the lack of a clear policy for encouraging private sector participation. In order to minimise the generation of organic waste from the central zoo complex at Jawalakhel, a composting plant of capacity 1ton/day has been implemented (NEPCEMAC, 2008 data). Similarly, there are composting and vermicomposting facilities at Handigaun and at NEPCEMAC's central office at *Satdobato*.

This NGO is conducting periodic educational campaigns and awareness programmes in various schools and communities. They have established a scheme for the collection and safe disposal of dog carcases - a person bringing in a dog that has died because of an accident or from other cause is paid NRs.50 by the NGO as an incentive (NEPCEMAC, 2008 data). NEPCEMAC has established a paper recycling plant at the Siddartha *Vanasthali* Institute area of Kathmandu (NEPCEMAC, 2008 data). They are also raising awareness by composing songs that promote good waste-related behaviour, every Friday from radio station - Metro FM 94.6 MHZ. NEPCEMAC has also invested in the production of a television serial '*Sabhyat*'. NEPCEMAC has definitely achieved its goal regarding effective waste collection and recycling.

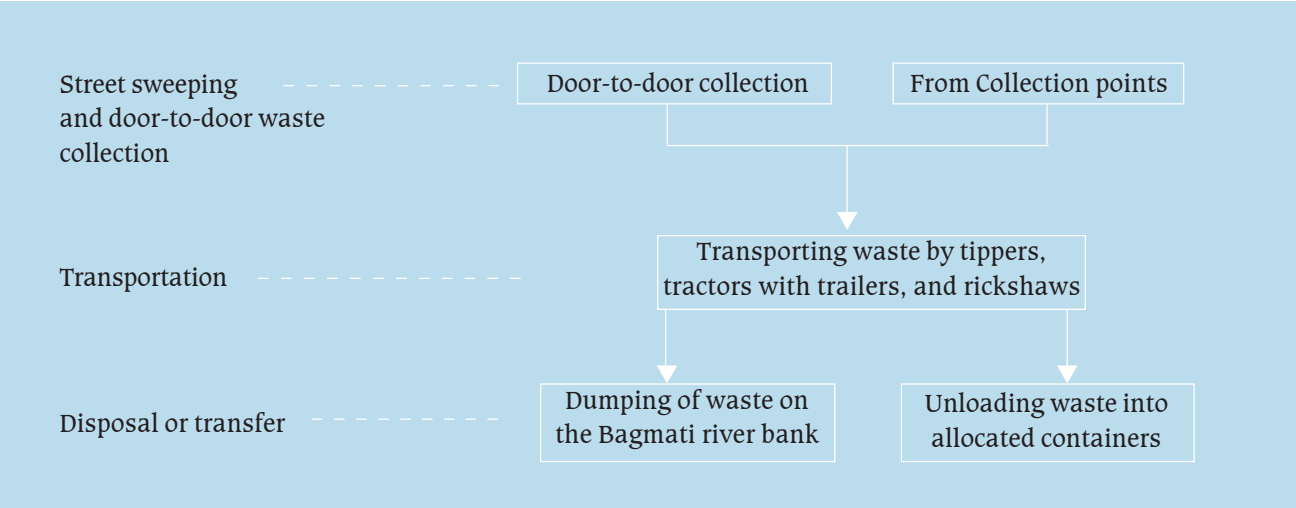
Conclusions and lessons learnt

Information from various sources backs up observations made during a field visit that this NGO encourages proper waste management - composting, vermicomposting, recycling etc. It is also creating jobs (more than 255 in LSMC) for low-income groups of the society. NEPCEMAC has received support from local residents who are willing to pay for door-to-door collection for solid waste. NEPCEMAC claims to have worked with the government to define and develop the role of the private sector role in urban solid waste management. Its practical approach and the self-financing nature of the operation are important targets for other NGOs to aim at. NEPCEMAC has become one of the best examples of an NGO working in urban solid waste management.

Replicable best practice

NEPCEMAC has made an inspiring contribution to waste management in several urban areas of Nepal. Its awareness campaigns for HHs and schools are impressive. Similarly, waste collectors from NEPCEMAC are encouraged to recycle waste because they are officially allowed to keep any income they receive from the sale of recyclables.

Overall process (*Lalitpur* case)



Main person in-charge: *Mr. Laxmi Ghimire*
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Street sweeping and household waste collection

Waste pickers separating recyclables

Transferring waste to a container provided by LSMC

Compost bins ready for sale

Organic waste for vermicomposting

Packs of NEPCEMAC compost

Waste composition pie chart for use in schools

Poster with motto: "Live like this"

URBAN ENVIRONMENTAL MANAGEMENT

Suiro programme at *Bharatpur*

Introduction

The *Suiro* programme claims to be a movement for reducing the generation of plastic waste at HH level. It has become an exemplary practice in which local women's groups encourage HHs to segregate plastic bags from other waste and push them onto a *Suiro* so that they are not scattered by the wind. *A Suiro* is a metal hook with a long stem that can hold large numbers of plastic bags. This programme is the combined effort of five different organisations actively working for social welfare in *Bharatpur* municipality. These organisations are - the Rhino Club of *Narayangadh*[28], the Rotary Club of *Narayangadh*, the Rotract Club of *Narayangadh*, the Plastic Entrepreneurs' Committee and the *Narayani Abudaiya* Centre (*Suiro* programme, *Bharatpur*, 2008 data). The networking and education is mainly done by volunteers.

Rationale for selection

This programme is included in this study because it provides information about simple techniques for at-source segregation of plastic waste.

Case description

Before 2003 it was common to see garbage in the open in all public areas of the municipality. Local residents were careless about the problems associated with the excessive use of plastics. Starting in 2003, local women's groups began to take action to reduce the amounts of plastic and that movement became the Suiro programme in *Bharatpur*. These women's groups are also involved in a number of welfare activities, such as supporting the education of less able children and providing financial help to the urban poor from the sale of materials for recycling. Significant environmental improvements have been achieved by the recovery of plastic. Adoption of this technique is helping to reduce the quantities of mixed waste and careless dumping of waste, resulting in better drainage. This movement is not only reducing the amounts of plastic waste in the urban area but also making people aware of the environmental problems caused by plastics.

Waste generation and composition

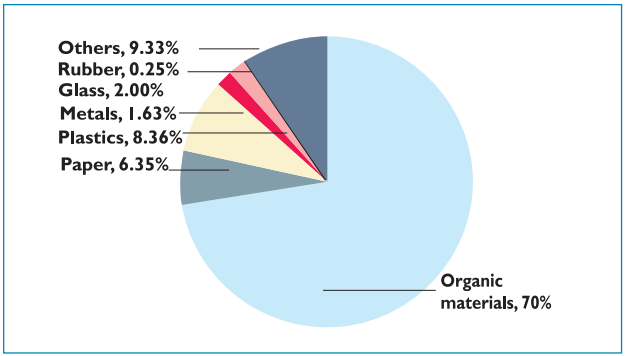
According to the data provided by the municipality and the field survey conducted in May 2008, the HH waste generation rate is 0.276 kg/person/day (Bharatpur municipality, 2008 data). This rate is more than the average value for Nepal (which is 0.25kg/capita/day) and less than the rate for *Kathmandu* Metropolitan City - 0.39kg/capita/day (SWMRMC, 2008). Using this rate, the daily waste generation of Bharatpur municipality is 20 tons (*Bharatpur* municipality, 2008 data). The composition of the waste at source was found to be: paper 5 per cent , plastic & rubber 7 per cent, organic materials 70 per cent, glass and ceramic 1 per cent, metal 2 per cent, wood 1 per cent, textiles 5 per cent,

Name of the Programme: *Bharatpur Suiro* Programme
Location: Bharatpur municipality (Wards no. 1, 2, 3, 4, 6, 10, 11 and 12)
Duration of the Project: 2005 onwards
Beneficiaries: Disabled people and urban poor
Donors and Partners: TLOs, NGOs, municipality, Practical Action Nepal
Municipal Vision: Storage of plastic waste on suiro hooks (for the recovery of plastic from urban solid waste).

[28] *Narayangadh is also represented at Bharatpur*

leather 1 per cent and other materials 8 per cent (Bharatpur municipality, 2008 data). These data show that plastic constitutes almost 7 per cent of the waste - i.e. 1.4 tons/day at source - and it is believed that the waste being an inorganic matter will remain in the environment for a long period.

Chart 7: Composition of solid waste at source



Waste collection and recycling

Initially the Plastic Entrepreneurs' Committee had distributed *Suiro* hooks to 2,000 HHs in the main market area of Bharatpur (SWMRMC, 2006 data). This initiative became a source of inspiration for plastic waste separation. Women's groups from TLO have distributed *suiro* hooks to HHs and collected plastic waste on a monthly basis. The *Suiro* programme collects 1-1.2 tons of plastics every month from the eight wards within Bharatpur municipality. The recovered plastic sells for NRs.10/kg (*Suiro* Programme, 2008 data).

Two rickshaws that can carry loads ranging from 300 to 500 kg are used to collect recovered plastic waste from eight wards, (comprising approximately 6,000 HHs and 500 shops (*Suiro* Programme, 2008 data). Residents living in the selected areas are given a Suiro hook at no charge. With the partial support from Practical Action in Nepal, various training activities, field visits and speech competitions were conducted.

Transport and final disposal

Since 2006, *Bharatpur* municipality has been dumping its waste at Ramnagar dumping site. The site is 11km from the city centre and 4.5 km towards the eastern side (jungle area) of *Ramnagar Bazaar*. Plastic wastes that cannot be recycled are transported by the Suiro Programme to the dumping site designated by Bharatpur municipality using the rickshaws (*Suiro* Programme, 2008 data). The contractor of *Bharatpur* municipality takes the remaining wastes to the dumping site. The contractor[29] dumps all kinds of waste but the Suiro Programme dumps only plastic which can not be recycled. The municipality takes care of the dumping site.

Organisational and financial aspects

This programme has demonstrated that, with adequate motivation, a considerable income can be generated from solid waste. Four full-time collectors and one office secretary are engaged for plastic collection and the associated administration. They collect around two tons of plastics every month, out of which 1-1.2 tons of plastics can be sold. The total income from plastic recycling is NRs.30,000/month (*Suiro* Program, 2007 data). Each year, Suiro donates approximately NRs.50,000 to handicapped people, poor students from various schools and low-income HHs in various slum and squatter communities within the municipality.(*Suiro* Programme, 2007 data).

Major problems and issues

The *Suiro* programme has not only had a beneficial impact on the environment but has also assisted the women involved in this initiative. Women are developing the skills and confidence to be able to speak in front of large groups to share their knowledge and feelings. Women are learning to recycle waste at the HH level; they are also working together to build social ties with other communities. This activity has disseminated knowledge on at-source waste reduction. Despite these successes there are still obstacles, among them, poor public cooperation and the lack of sufficient transportation.

Nevertheless, this programme has definitely achieved its goal of reducing the amounts of plastic waste in *Bharatpur* municipality.

[29] *Municipal Solid Waste Management of Bharatpur municipality is discussed in an earlier case.*

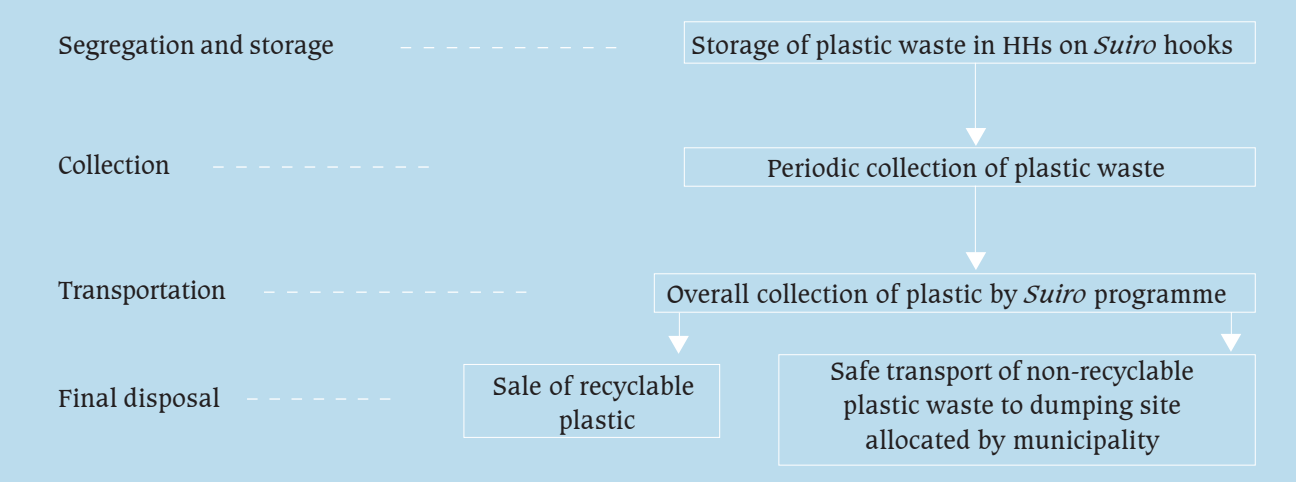
Conclusions and lessons learnt

This is a very simple and safe process for reducing and recycling plastic. This movement concentrates on recovering plastic waste and earns a considerable income by selling it for recycling. Furthermore, it is also creating jobs for five persons and improving the urban environment. This NGO's approach for waste separation has helped citizens to understand the solid waste management system. Organisations like Practical Action, GTZ-UDLE, and UNDP have played a supportive role. Finally, appropriate training and clarifying roles and responsibilities of the stakeholders are important steps towards sustainable management practice.

Replicable best practice

After seeing what has been achieved, residents of other wards of Bharatpur municipality are showing interest. This encourages confidence that it can be replicated in other urban centres of Nepal.

Overall process



Contact details: *Ms. Mana Sen, Mr. Rohit Kumar Shrestha, Suiro Programme Narayangadh , Bharatpur* municipality
Partner contact: *Bharatpur* municipality
Phone: 056-528188

Poster *for Suiro* Programme of *Bharatpur* Municipality

Plastic hooked using *Suiro* hook

Demonstration of hooking method

Speech competition on waste recycling and reuse organized by Practical Action, Nepal, *Bharatpur* branch

Glimpses of a speech competition programme especially for housewives (organized by Practical Action Nepal, *Bharatpur* office)

URBAN ENVIRONMENTAL MANAGEMENT

Suiro Abhiyan at Hetauda Municipality

Introduction

Suiro Abhiyan is a movement of Hetauda municipality concerned with the collection from HHs and recycling of plastic bags. It has become an exemplary practice in which members of each Tole Lane organisation encourage HHs to segregate plastics from other wastes and hook them onto a *Suiro* hook. This is the first municipality to introduce this kind of programme in Nepal.

Rationale for selection

This case was selected because it provides information about a TLO initiative for at-source segregation of plastic waste.

Case description

The situation in Hetauda has improved considerably. Previously it was a common sight to see piles of garbage in public places within the municipality. Local residents were careless about their health and the environmental hazards caused including drain blockage caused by plastic waste. Measures to reduce this problem were introduced by TLOs and these initiatives grew into *Suiro Abhiyan* in Hetauda. A major objective of this movement in Hetauda municipality is to ensure effective recovery of plastic from HH wastes. It should be pointed out that 20.3 per cent of women in the municipality are members of such TLOs (*Suiro Abhiyan*, 2008 data). They are involved in activities that help them to enhance their own skills with regard to improving the environment. Women's groups have also benefited from a saving and credit programme as well as from income derived from the sale of plastic waste for recycling.

Significant environmental improvement has been achieved by recovering plastics and the adoption of composting. Similarly, improved waste management has resulted in better drainage and improved soil conditions. As residents become more aware of environmental problems caused by plastics and the benefits of recycling, this movement is making real progress towards reaching its goal.

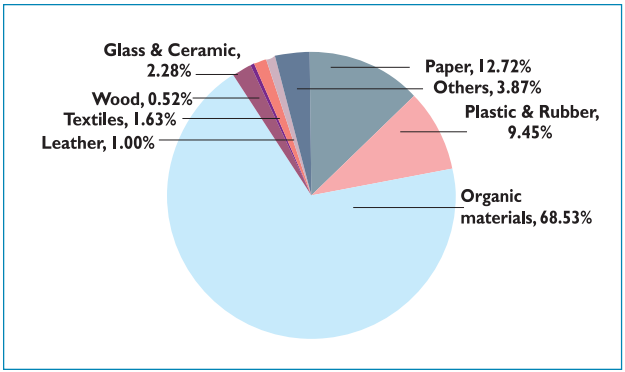
Waste generation and composition

According to the data provided by the municipality and a field survey conducted in May 2008, the average HH waste generation rate in this municipality is 0.25kg/person/day (*Hetauda* municipality 2008), which is same as the national average for urban areas and less than *Kathmandu* metropolitan city (0.39 kg/capita/day - SWRMC,2008 data). The daily total generation in this municipality is 14 tons/day (*Hetauda* municipality, 2008 data).

Name of the Programme: *Suiro Abhiyan* at Hetauda
Location: All 11 wards of *Hetauda* municipality (initially only Wards 3 & 6)
Duration of the Project: 2002 onwards
Beneficiaries: Urban residents
Donors and Partners: TLOs, NGOs, municipality, UDLE-GTZ
Vision of the programme Hooking of plastic waste on a Suiro (at-source segregation of plastic in households)

The composition of waste at source was found to be paper 12.72 per cent, plastic & rubber 9.45 per cent, organics 68.53 per cent, glass and ceramics 2.28 per cent, wood 0.52 per cent, textiles 1.63 per cent, leather 1 per cent and other materials 3.87 per cent (Hetauda municipality, 2008). Therefore, this data indicates that 1.4 tons of plastic wastes are generated each day in *Hetauda* municipality. In order to reduce the plastic waste in the municipal area, Hetauda municipality is encouraging the use of textile bags instead of plastic bags.

Chart 8: Composition of solid waste at source



Waste collection and recycling

Previously, women's groups from TLOs used to distribute Suiro hooks to all member HHs in Wards 3 and 6 to collect plastics bimonthly. Now, the Community Development Section of *Hetauda* municipality has taken on the responsibility of recovering plastic waste (*Hetauda* municipality, 2008 data). The municipality has hired one room (having an area of 225 ft sq. [21 m^2]) near the central bus park for sorting plastics. The main stakeholders assisting this project are: Clean Nepal, *Yug Prabhat Youth Club,* Tole *Bikas Sanstha, Sri Krishna Pranami, Hetauda* municipality, the Drinking Water Corporation and Nava *Jeevan Jyoti* Club. The main input of the TLOs and women's groups is plastic collection from HHs usually on a bi-monthly or monthly basis.

Transport and final disposal

One rickshaw that can carry between 300kg and 500kg has been provided by Hetauda municipality for collecting and transporting the plastic waste. *Hetauda* municipality dumps all of its waste beside the *Rapti* River. The site is 1.5 km south of the east-west highway.

After the recovered plastic waste are sorted out at the sorting centre, non-recyclable plastic waste are taken to the dumping site on the *Rapti* river. During the field visit, there were waste pickers and animals at the dumping site and some of the deposited waste was burning.

Organisational and financial aspects

Two full-time employees have been engaged for collecting and transporting plastic. The municipality pays their salaries (NRs.2,500 per month). The collected plastic is sold for NRs.6 per kg. It is estimated that, in 2007, almost 1.5 tons of plastics waste was being collected each month (*Hetauda* municipality, 2007 data). Of this, 800-900kg each month was sold for recycling purpose (*Hetauda* municipality, 2007 data). Therefore, the total income from the sale of recyclable plastic by this *Suiro Abhiyan* in *Hetauda* municipality was NRs.5,000 per month (*Hetauda* municipality, 2007 data). In order to increase plastic recovery from HH waste, Hetauda municipality distributed Suiro hooks free of cost, initially with some operational training.

Major problems and issues

Suiro Abhiyan has had a positive impact not only on the environment but also on the lives of women involved in this initiative. Women involved in safely managing their waste at HH level are also working together to build links with other communities. Their experience has increased knowledge regarding waste reduction and recycling. In spite of these successes, challenges remain, including management, co-ordination between the TLO and the Hetauda municipality, building trust between the stakeholders and the lack of a motor vehicle.

Conclusions and lesson learnt

It has been demonstrated that local people are willing to participate in plastic reduction campaigns. This is a very simple process leading to the reduction and safe recovery of plastic. This movement, while concentrating on plastic waste reduction and separation, has earned a considerable income from recycling. Furthermore, capacity building activities - education campaigns and

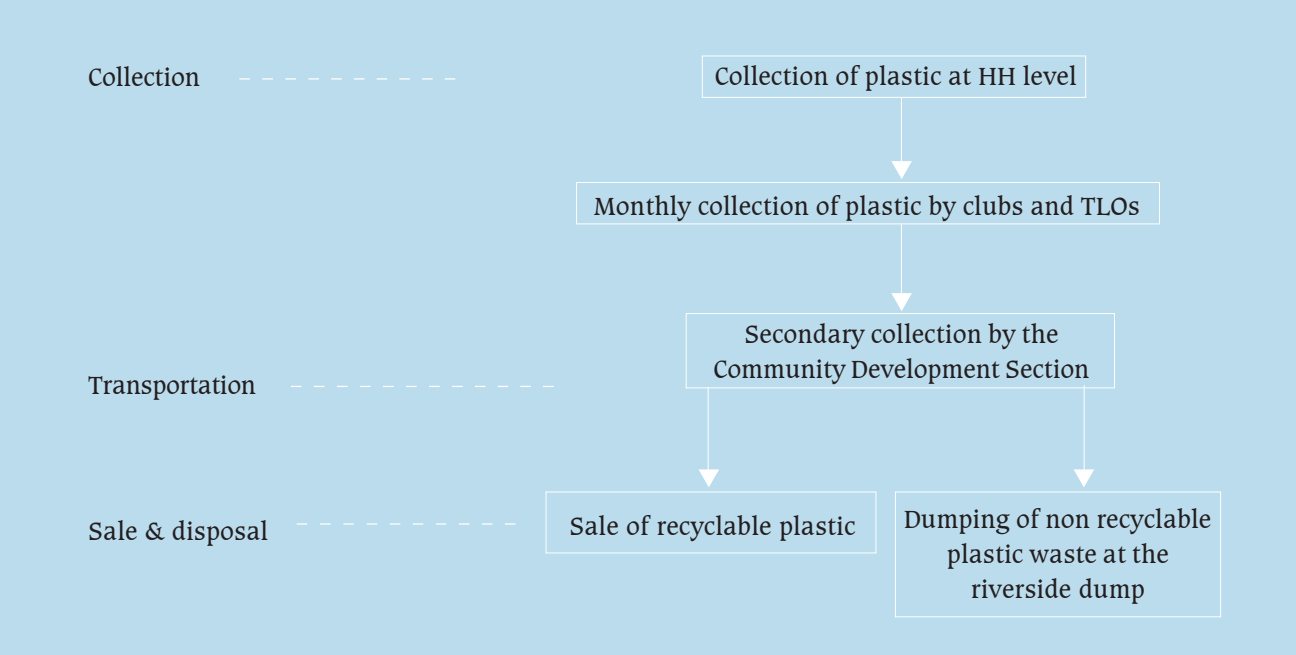
training by involved stakeholders - have reinforced the progress. The resource management movement (Reduce, Reuse, and Recycle) is providing a useful direction to the project.

The approach used by Hetauda municipality, CBOs and NGOs to mobilise the community to reduce its waste at source, has effectively developed understanding of the solid waste management system. Similarly, the involvement of civil society (there are considerable number of civil society organisations working in waste reduction) has created conditions that are conducive to sustainable waste management. The involvement of GTZ-UDLE, UNDP, UEIP and UN-Habitat has played an important role in upgrading waste management in Hetauda. The municipality's capacity to support civil society's involvement is an additional factor that has supported waste reduction measures. In summary, this movement is contributing to the achievement of the programme goal.

Replicable best practice

By demonstrating success in reducing the amounts of plastic waste that are scattered and dumped, this programme has also assisted in building a valuable relationship between women's groups and TLOs.

Overall process



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Plastic bags on *suiro* hook in the yard of a house

Sorting and collection of plastic by the Municipality

URBAN ENVIRONMENTAL MANAGEMENT

UEMS for household composting

Introduction

The Urban Environment Management Society (UEMS) was established in 2002 with a vision to provide safe drinking water and proper sanitation, and to minimise the quantities of domestic solid wastes, through coordination with government offices and mobilisation of local volunteers. (UEMS, 2008 data)

Rationale for selection

This case was selected because it provides information about HH composting activities for organic waste reduction.

Case description

Lalitpur Sub-Metropolitan City (LSMC) is located immediately south of *Kathmandu*. The total area of *Lalitpur* is 15.47 km2, and it comprises 22 wards with 34,996 HHs in 2001 (CBS, 2001). Various communities, NGOs and CBOs are working to improve the environment in the core area of LSMC. Until recently, in core areas the common approach to waste management was 'throw and forget', and scattered waste was found on every street. Residents had no knowledge of recycling and HH composting. Saugal is a core area that used to exemplify such attitudes and problems and was therefore considered as a pilot programme by UEMS.

The activities of UEMS in solid waste management are said to be completely dependent on volunteers. The main objectives of UEMS are to enhance solid waste management at HH level by mobilising local resources, to promote networking between concerned organisations, and to strengthen the organisational capacity of UEMS.

UEMS initiated its household-based solid waste management programme by involving housewives in selected areas. In addition, it conducted awareness-raising activities by means of training, orientation, exhibitions, community mobilisation and education. UEMS worked to strengthen the capacities of local volunteers through appropriate training, orientation, observation tours, organise and participate meetings and workshops related to solid waste management. After successfully implementing HH composting in the *Saugal* area of LSMC, UMES is now planning to extend its activities to other core areas of *Lalitpur*.

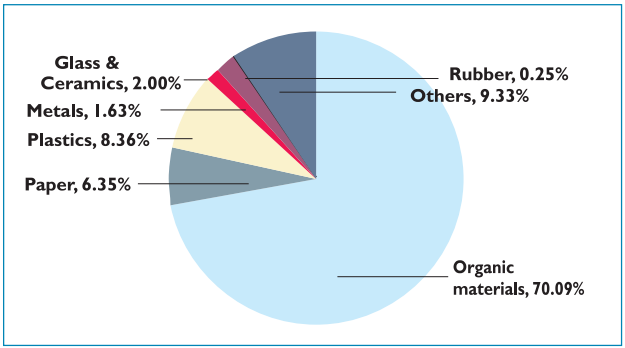
Waste generation and composition

According to the data provided by UEMS and a field survey conducted in June 2008, the average HH waste generation rate in *Lalitpur* is 0.37kg/capita/day (LSMC, 2008 data). This rate is more than the national average generation rate of 0.25kg/capita/day and less than the rate for *Kathmandu* Metropolitan City, which is 0.39kg/capita/day (SWMRMC, 2008 data). The composition of

Name of the Programme: UEMS for HH composting
Location: *Saugal*, Ward no. 11 of Lalitpur Sub-Metropolitan City
Duration of the Project: 2002 onwards
Beneficiaries: Residents of Ward no. 11 Saugal area LSMC
Donors and Partners: Lalitpur Sub-Metropolitan City, United Mission to Nepal (earlier)
Vision of the programme: Organic waste handling and recycling

the waste is: 72.09 per cent organic waste, 6.35 per cent paper, 8.36 per cent plastic, 1.63 per cent metal, 2.00 per cent glass, 0.25 per cent of rubber, and 9.33 per cent of other materials. (UEMS data, 2008). National waste composition data also show that most of the waste is either organic or biodegradable. Therefore, UEMS has initiated a HH composting programme in the core area of LSMC.

Chart 9: Composition of solid waste at source



Waste collection and recycling

Each participating HH segregates organic waste and puts it in the compost bin, which can hold up to 50kg of waste. In order to encourage composting and assist marketing, residents can sell compost to UEMS at the price of NRs.6 per kg (UEMS, 2008). Then UEMS refines and packs the compost and sells it to local flower nurseries and other customers for NRs.10-12 per kg (UEMS, 2008 data). UEMS claims to collect 900 kg of compost each month (UEMS, 2008 data). The initiation of the HH composting programme has raised awareness so that others started asking for compost bins and were eager to know how to use them. Similarly, UEMS discovered that residents became more aware about the health hazards caused by careless dumping of waste - especially organic waste.

Transportation and final disposal

Local people themselves bring their compost to sell it at the UEMS office, and UEMS sells it to the local market for use as a soil improver.

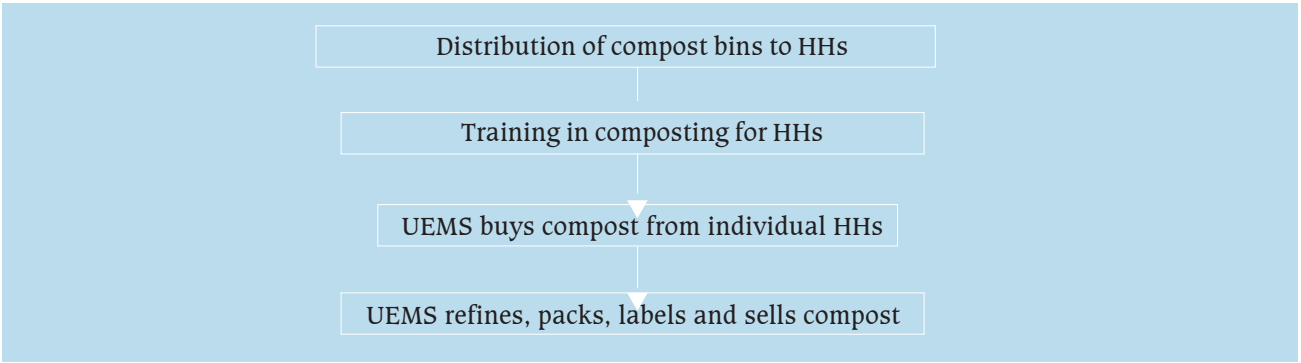
Organisational and financial aspects

According to the data provided by UEMS, four members were working at the office as volunteers in composting programme (UEMS, 2008 data). UEMS have trained 100 local volunteers[30] to promote HH composting and waste recycling techniques (UEMS, 2008 data). In 2008, their target has been to sell or provide 1,000 compost bins of capacity 50 kg in the various wards of the core areas of LSMC. UEMS has now started discussing with local communities about constructing a community composting facility with a total capacity of 1000 kg. According to UEMS, working in a core area is more effective than working in suburban areas, because information is shared very effectively among people of the same ethnic origin. UEMS records show that each month it buys compost worth NRs.5400 (UEMS, 2008 data).

Major problems and issues

Despite its effective HH composting scheme, UEMS is facing problems due to insufficient staff, financial

Overall process



[30] *These volunteers are engaged in other community mobilization activities (like water supply)*

limitations, and the lack of a vehicle. Other obstacles includes, poor institutional set-up of governmental organisations[31] and the lack of legislation to encourage NGOs. The organisation continues its efforts to reduce ignorance about environmental issues by conducting educational campaigns, including training and awareness programmes on waste recycling and composting in other core area communities of LSMC. UEMS is planning to expand HH composting in similar urban areas of adjoining Kathmandu Metropolitan City.

Nevertheless, the UEMS has definitely achieved its goals for composting and recycling.

Conclusions and lessons learnt

After implementing HH composting and at-source segregation, the value of compost was appreciated by local residents. As with the water supply programme[32], the community initiative for waste management is considered to be very satisfactory especially in Saugal. Adequate training and awareness programmes have facilitated proper resource management (Reduce, Reuse and Recycle). UEMS`s approach of improving the environment by effective management of organic solid waste is regarded as a model for other NGOs working in solid waste management.

Replicable best practice

After achieving a good response from the community, UEMS is encouraged to expand its activities all over the LSMC. The concept of compost trading seems to be an effective mechanism for organic waste reduction in urban areas. By far the largest constituent of urban solid waste in Nepal is organic material that can be composted, and HH composting appears to be the most effective approach for managing organic waste.

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[31] *According to UEMS, to get one simple authorization it is necessary to visit at least three governmental offices.*
[32] *The community initiative for water supply in that area is considered to be impressive.*

Compost bins ready for distribution

Prepared organic compost

Compost collection at UEMS

Label for finished product

Labelled product

Compost ready to sell

URBAN ENVIRONMENTAL MANAGEMENT

WEPCO for Urban Environmental Protection

Introduction

The Women's Environment Preservation Committee (WEPCO) is a popular non-governmental organisation, established in May 1992 in Ward no. 1 of Lalitpur Sub Metropolitan City. WEPCO believes that most HH solid waste can be handled properly by women according to the Nepalese social traditions. A group of 35 housewives were initially trained by an NGO on managing solid waste (WEPCO, 2008). The group found many ways to convince local people about the need to tackle the problem of careless dumping of solid waste in public places.

Rationale for selection

This case was selected because it provides information on what women can do to improve the urban environment and on the impact of an NGO.

Case description

Before the intervention described here, the residents of Kupondol were not aware of the serious problems caused by inadequate management of solid waste. There was a widespread problem of open dumping because of inadequate waste collection. Likewise, people were not aware of the benefits of segregating waste and recycling.

The main objectives of WEPCO activities is to work with local communities to establish clean and hygienic urban environments, to empower women to manage solid waste issues in their localities, to increase environmental awareness among urban communities and school children with the 3R (Reduce, Reuse, Recycle) concept, and to use solid waste management as a catalyst for institutional development (WEPCO, 2008 data). Training is provided in the fields of composting and vermicomposting, paper recycling, leadership, capacity building and gender issues.

A major focus for WEPCO activity is educational campaigns, running school environment training camps, and helping to establish school eco-clubs to raise awareness on waste and environmental issues among school children. It also promotes Green Circle initiatives that involve businesses in Nepal. Various foreign consulates and embassies, the Chaudary group, Dabur Nepal, and INGOs are supporting the paper recycling activity by segregating their paper waste and donating it to WEPCO.

After inputs from WEPCO on waste minimisation and recycling, residents in ward no. 1 realized that the central Government and the Municipality could not handle the problem of solid waste without their co-operation. WEPCO's efforts changed the common perception of solid waste management. A clear demonstration of this change of attitude was seen during the three-week nationwide

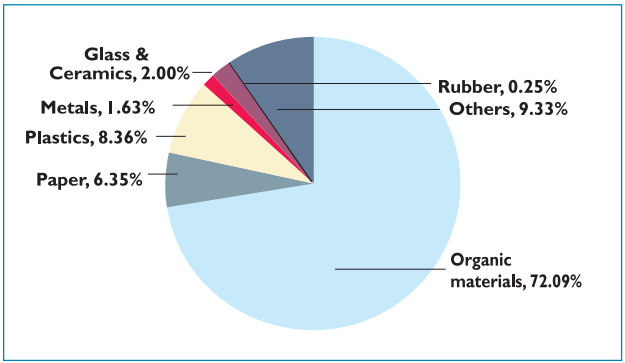
Name of the Programme: WEPCO for Urban Environmental Protection
Location: Ward no. 1, *Lalitpur* Sub-Metropolitan City
Duration of the Project: 1992 onwards
Beneficiaries: Residents of Ward no. 1 and parts of Wards no. 2 & 22
Donors and Partners: LSMC, Foreign consulate offices and embassies at Kathmandu, Chaudary group, Dabur Nepal etc.
Vision of the programme: To live in a clean and pollution-free urban environment in the Kathmandu valley

strike[33] in 2006, when local residents refrained from dumping waste in public places (WEPCO, 2008 data).

Waste generation and composition

According to the data provided by WEPCO and a field survey conducted in June 2008, the average HH waste generation rate in ward no. 1 of Lalitpur is 0.35kg/capita/day, which is more than the national average of 0.25kg/capita/day and less than Kathmandu metropolitan city, which is 0.39kg/capita/day (SWMRMC, 2008 data).

Chart 10: Composition of solid waste at source (WEPCO data, 2008)



Waste collection and handling

Daily collection from HHs is provided for 1200 HHs of ward no.1 and for some parts of wards no. 10 & 20 (approximately 400 HHs). Ten rickshaws, each with a capacity to carry 300 - 500 kg, are used for waste collection and later dump it at the transfer point designated by LSMC. During the field visit it was learned that door-to-door waste collection is considered to be a WEPCO pilot programme. There is a paper recycling plant and a composting plant with monthly production capacity of two tons of compost.

In order to ensure effective waste collection, WEPCO distributed red and green bins – big enough for 10kg – to every HH in the project area for paper and plastic collection. The "*Give plastic and take compost*" campaign is also a popular WEPCO programme that aims to generate awareness of organic and inorganic solid waste reduction and segregation.

Transport and final disposal

There are four handcarts that can each carry 50 kg, ten rickshaws each able to transport 300 to 500 kg and two environmentally friendly, battery-powered vehicles of 1 ton capacity for solid waste collection and transport (WEPCO, 2008 data). WEPCO deposits its 3 tons of waste each day in a 2-ton container provided by LSMC or dumps it at the *Bagmati* riverside dumping site (WEPCO, 2008 data).

Organizational and financial aspects

According to information provided by WEPCO, it has 35 full time staff (WEPCO, 2008 data). The income of this organisation is derived from waste collection charges and the sale of compost, paper for recycling, and recycled products. In the fiscal year 2007, the income earned from solid waste recycling and reuse was about NRs.1 million (WEPCO, 2007 data). The waste collection charges per month are NRs.30-100 from HHs and NRs.50-100 from shops (WEPCO, 2007 data). Expenditures are about the same as the total income, suggesting that the WEPCO model is financially sustainable.

Major problems and issues

Despite its effective system of door-to-door waste collection, WEPCO needs additional finance to extend the coverage. WEPCO suffers from a shortage of staff, vehicles and other resources. Additional obstacles are caused by the poor institutional set-up of government organisations and the lack of legislation to encourage NGOs.

Nevertheless, WEPCO has definitely achieved its goal regarding effective waste collection and waste reduction. It was honoured by the award of the UNEP Global 500 Environmental Award in 2003, a Ministry of Population award in1996 and the WWF Nepal Programme Abraham Conservation Award in 2003.

Plans and developments

WEPCO plans to expand training in resource management to all the wards in five municipalities of *Kathmandu* valley area.

[33] *A nationwide strike against autocratic rule lasted for 19 days in 2006*

WEPCO already has separate composting and vermicomposting facilities with capacities of 500 kg at its central office in *Kupondol*. One biogas plant (capacity 6 m^3) is also under trial phase operation at the central office area (WEPCO, 2008 data).

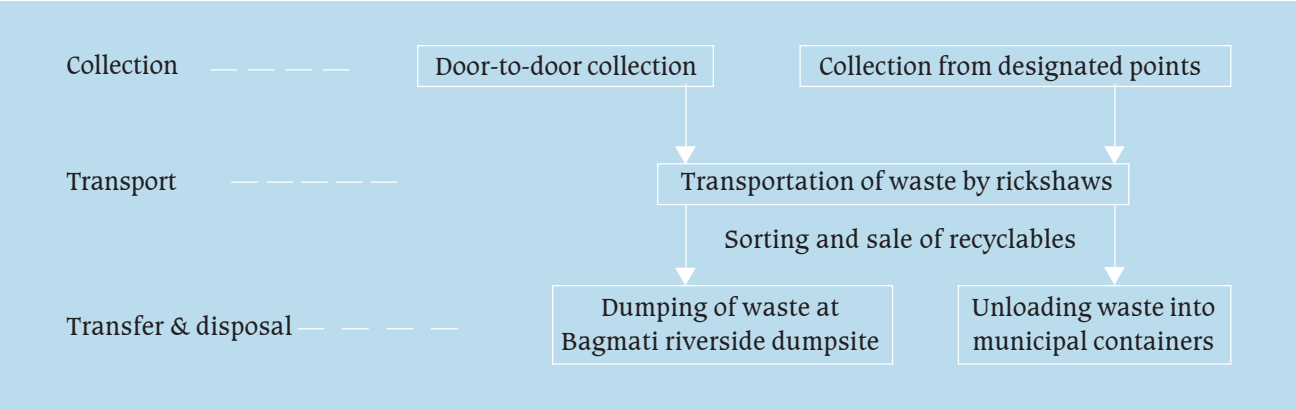
Conclusions and lessons learnt

The demonstration of HH waste reduction, composting and source separation helped the residents to understand these processes. Capacity building activities and education campaigns from WEPCO have developed environmental awareness and facilitated waste reduction and improved solid waste and resource management (*Reduce, Reuse* and *Recycle*) in all LSMC areas. WEPCO's inputs in solid waste management have played a very vital part in the development of a sustainable urban environment.

Replicable best practice

After achieving a good response from local residents, WEPCO has conducted a comprehensive campaign in order to minimise solid waste. The impact on the overall urban environment is impressive. This type of programme can be replicated in other municipalities in Nepal.

Overall process



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Household waste collection


Selling of recyclable waste


Waste separation process


Biogas plant at WEPCO


Organic waste for vermicomposting


Recycled paper


Composting by WEPCO


Various paper products made from recycled paper

3.0 CONCLUSIONS AND LESSONS LEARNT

The aim of this report is to share the findings from several cases of best practice and to help readers to understand the roles of various organisations. This mapping is necessary in the context of integrated and sustainable waste systems, for which an understanding of people, systems and technologies is fundamental. Considerable effort has been invested by municipalities and NGOs to improve solid waste management in Nepal. Various organisations from the private sector and NGOs are involved. The main areas of focus for these organisations have been primary collection, composting and recycling. The municipalities have become interested to make improvements in final disposal, which is often a neglected aspect of waste management. Much still needs to be done to upgrade many aspects of solid waste management systems. Lessons learnt and tentative conclusions drawn from this report are as presented below.

- **Minimising solid waste at source:** Minimisation is one of the important aspects of solid waste systems and it can be effective in urban centres in Nepal. In order to reduce the amount of solid waste sent for final disposal, at-source minimisation and effective waste collection systems play a major role. Municipalities and NGOs can work together to improve current practices and policies in this area.

- **Immediate need of landfill sites:** In order to dispose non-recyclable waste, landfill sites are necessary for safe disposal of solid waste. Most municipalities in Nepal do not have a permanent landfill site and so are dumping their solid wastes either on river banks or on open land. This dumping process, especially if done close to rivers, may be creating long-lasting environmental and health risks. For long-term environmental protection and to avoid public health hazards, safe disposal of waste is essential. Therefore, all municipalities of Nepal should learn a lesson from *Tribhuvannagar* municipality on the subject of sanitary disposal.

- **Waste management as part of the initial infrastructure:** For any type of construction, either residential or commercial, a municipality should enforce basic requirements in order to reduce or segregate waste at source. For example, municipalities should consider making provision for measures such as HH composting and separate containers for recyclables before approving a construction proposal. This provision should be monitored and penalties enforced if necessary, in order to enforce such requirements. Municipal boards should make this provision a high priority.

- **Greater participation of local communities:** Lessons from the cases presented in this report have demonstrated how community awareness of waste management issues can play a major role in upgrading management practice. Measures such as at-source segregation, recycling and reusing of waste require major efforts to raise the awareness of the community and develop participation. Local government could effectively co-ordinate community participation and awareness-raising programmes as well as developing new policy measures.

- **Support for private sector partnership:** It is noted that, due to limitations of local government finances and resources, engaging private sector waste management service providers is an option that merits consideration. However, private sector operators may not be attracted without the necessary policy measures and investment environment. Municipalities should take the necessary measures to monitor the

performance of any private sector partner. The involvement of the private sector can generate employment for the urban poor.

- **Involve local recycling businessman in waste management planning:** Local businessman who are dealing in recyclable materials should be involved in waste management planning because their insights and experience could improve planning for sustainable solid waste management. They should be invited to take part in the annual meetings of municipal boards when waste management issues are being discussed.

- **Tax waiver for recycling enterprises:** During the field visit it was learnt that recycling is an important part of sustainable waste management. Enterprises that deal with recycled materials could be encouraged by a waiver of local government taxes in every municipality.

- **Greater effort for HH and community composting:** The cases that have been presented clearly show that HH composting is the best option for reducing and treating organic wastes. Data showed that almost 70 per cent of the solid waste in Nepal is organic waste.

- **Solid waste management needs a separate department:** It is noted that provision of solid waste management services in all the municipalities is the responsibility of the Community Development Section. There are some other responsibilities that need to be given to this department such as community mobilisation for infrastructure development. Therefore, in order to achieve effective and efficient waste management services, a separate department should be created in each municipality.

- ***Suiro* for Plastic separation:** Waste recovery and segregation at source are not considered seriously in many urban centres of Nepal. The storage of segregated plastic waste by hooking it on a *Suiro* hook is a simple and sanitary method of handling this type of inorganic waste.

- **Empowerment of low-income communities for recycling:** Low-income communities (if united) could recycle their own waste themselves in their areas, thereby avoiding collection by outsiders. This exercise could improve local people's perception of waste segregation and reuse. People could learn that useful incomes can be earned from waste if it is handled properly.

- **Systematic effort for financial management:** Most municipalities in Nepal have limited resources to facilitate proper solid waste management services. A systematic and organised approach to waste management could result in waste management systems that are more sustainable.

- **Roles and responsibilities:** Municipal programmes that raise awareness and create an understanding of the roles of various stakeholders in waste management could enhance sustainability. There are various GOs, NGOs and INGOs working in urban development planning and their roles and responsibilities should be clearly defined before the planning starts. Municipalities could coordinate, encourage and work with local NGOs and communities which are working for reduction, reuse and recycling.

- **Mechanism to encourage users:** The cases have shown that users or beneficiaries can play an important role in ISWM. If users are aware, waste management systems could be better managed. Therefore, interactive programmes, television and radio broadcasts, educational tours, exhibitions etc. should be used to encourage users to take on a greater role.

- **Honour a good waste handler:** Municipalities could honour individuals who make outstanding contributions to resource management. This practice would increase the interest of citizens and create competition among the residents resulting in improved standards of resource management. For example, in 2008 *Hetauda* municipality honoured its service providers with a prize worth NRs.1,000 for making a good contribution to reducing, reusing and recycling HH waste.

- **Training centres:** Solid waste management training and resource centres could be established in order to improve the standards of solid waste management in all the municipalities of Nepal. The Ministry of Local Development could formulate a clearer role for its Solid Waste Management and Resource Mobilisation Centre. Necessary instructions could be given to SWMRMC in order to improve the solid waste management capacities of municipalities.

- **More research and studies:** In order to increase the quality and efficiency of services in the local operational context, more research and studies in waste management should be undertaken. SWMRMC should work with the institutions which are educating urban planners at various universities in Nepal.
- **Short-term and long-term planning:** In order to implement effective solid waste management in the municipalities, all municipal administrations could formulate short-term and long-term plans for waste management. Every municipality could employ one urban planner for overall urban development planning.

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