SOLID WASTE MANAGEMENT FOR KATHMANDU METROPOLITAN CITY

Saurav Rana

Daayitwa Fellow with Kathmandu Metropolitan City

DAAYITWA
NEPAL PUBLIC SERVICE FELLOWSHIP
SUMMER 2013

EXECUTIVE SUMMARY

Kathmandu produces 479 tons of solid was per day. Solid waste disposal for Kathmandu is done at Sisdol landfill site. Although a transfer station exists for waste segregation in recycling and non-recycling waste, recycling is minimal. It is only performed informally or by NGOs. Kathmandu Metropolitan City (KMC), the authority mandated for solid waste management (SWM) in Kathmandu, does not have any formal mechanism for recycling.

Previously in the 1980s a composting plant existed and sold the compost it produced. However, the composting plant has been closed of 20 years now. Currently, some composting is performed by NGOs.

Other Nepali cities, although face their own problem with SWM, have implemented changes in their SWM which may be replicable for KMC to improve SWM in Kathmandu. Biratnagar sub-metropolitan city's use of private sector in waste collection and transportation has improved efficiency whereas Ghorahi municipality has effectively mobilized community action to increase waste segregation at source.

The NGOs working in SWM in Nepal are pioneering financially self-sustaining models of SWM. This may be new concept for Nepal but internationally public private partnerships with financially self-sustaining business models in SWM have been operating for a number of years. For example New Delhi/Delhi's Timarpur-Okhla Solid Waste Management Project, which operates a waste to energy plant. Another important lesson KMC should learn is the important social and economic benefit of incorporating the informal solid waste workers within the formal SWM framework as in Belo Horizonte.

KMC has the mandate to initiate PPP for SWM. Additionally, the Investment Board Nepal also has the authority to solicit private sector investments for SWM. The two organizations should coordinate to attract interested private sector entities and implement an effective PPP for SWM in Kathmandu.

LIST OF ABBREVIATIONS

GTZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation)
KMC	Kathmandu Metropolitan City
MCD	Municipal Corporation of Delhi
MoFALD	Ministry of Federal and Local Development
MoH&PP	Ministry of Housing and Physical Planning
NDMC	New Delhi Municipal Corporation of New Delhi
NEPCEMAC	Nepal Pollution Control & Environment Management Center
PPP	Public Private Partnership
SLU	Public Cleansing Agency
SWM	Solid Waste Management
SWM&RMC	Solid Waste Management and Resource Mobilization Centre
SWMTSC	Solid Waste Management Technical Support Centre
TOWMC	Timarpur Okhla Waste Management Company Ltd
UEMS	Urban Environmental Management Society
WEPCO	Women's Environment Preservation Committee

CONTENTS

1. INTRODUCTION 4

2. METHODOLOGY AND LIMITATIONS 5

3. BACKGROUND 6

- 3.1 GTZ SOLID WASTE MANAGEMENT PROJECT (1981-1990)
- 3.2 1990-2000
- 3.3 PRESENT SITUATION

4. RELEVANT LAWS 8

- 4.1 SOLID WASTE MANAGEMENT ACT 2011
- 4.2 INVESTMENT BOARD ACT 2011

5. CASE STUDIES 9

- 5.1 NATIONAL CASE STUDIES
  - GHORAHI MUNICIPALITY
  - BIRATNAGAR SUB METROPOLITAN CITY
- 5.2 NGOS AND INFORMAL SECTOR
  - NEPAL POLLUTION CONTROL & ENVIRONMENT MANAGEMENT CENTER (NEPCEMAC)
  - URBAN ENVIRONMENTAL MANAGEMENT SOCIETY (UEMS)
  - THE WOMEN'S ENVIRONMENT PRESERVATION COMMITTEE (WEPCO)
- 5.3 INTERNATIONAL CASE STUDIES
  - BELO HORIZONTE, BRAZIL
  - TIMARPUR-OKHLA SOLID WASTE MANAGEMENT PROJECT
  - TOMPKINS COUNTY, NEW YORK, USA

6. CONCLUSION 15

7. RECOMMENDATIONS 16

1. INTRODUCTION

Kathmandu Metropolitan City (KMC) has been facing an increasing problem over the last two decades. Population growth and urbanization has been putting greater stress on the city's solid waste management system. The city has already exhausted one sanitary landfill site and is currently disposing its solid waste at a second sanitary landfill site. Recycling activities are very limited and informal which puts further stress on the landfill site. The practice of sanitary waste management at the household level also seems to be missing.

The experience of KMC is not dissimilar to that of other cities in Nepal. However, where some of Nepal's other cities have redeeming features in their solid waste management system, which have led to improvements, Kathmandu has been incapable in improving its solid waste management system.

A further contrast is made when compared with international cities like Delhi and Belo Horizonte. Both cities faced similar developmental problems of urbanization and population growth as Kathmandu did. These cities have utilized innovative methods to solve their solid waste management problems. Lessons can be learnt from the experiences of these cities to improve the situation in Nepal.

One objective of this study is to highlight the benefit of public private partnerships (PPP) for solid waste management. The case studies show how PPPs have been used in other cities for solid waste management. The analyses of the laws governing solid waste management in Nepal also demonstrate how PPP can be implemented for solid waste management.

The study concludes with recommendation derived through analysis of Kathmandu's current solid waste management system and the case studies of other solid waste management systems. These recommendations are to assist policymakers that aim to improve Kathmandu's solid waste management system.

2. METHODOLOGY AND LIMITATIONS

METHODOLOGY

Interviews were conducted with various stakeholders to gain insights. People interviewed included government employees working in solid waste management, informal solid waste workers, and professionals from other institutions. Previous studies on solid waste management in Kathmandu were also reviewed. In addition, analysis of other solid waste management systems was performed largely through research and review of other studies. In the case of Ghorahi municipality an informal interview was held with Mr. Regmi who is in charge of solid waste management there.

LIMITATIONS

The study juxtaposes Kathmandu's solid waste management system with other systems. Using the examples of the case studies of other cities the study points towards improvements that can be made in Kathmandu. The study does advocate for implementing PPP. However, how to implement the PPP is beyond the scope of this study. Also, the study falls short of analyzing technological solutions for improving the solid waste management system – this would require a technical analysis by an engineer.

3. BACKGROUND

Historically and prior to urbanization of the Kathmandu valley, majority of the solid waste in Kathmandu consisted of organic waste. Households managed the waste they created at the household itself. Most of the waste was composted at the individual household or the waste was reused and recycled within each household.

Urbanization along with the increase in commerce and consumption in the 1960s led to greater waste generation. As there was no formal waste management system in place people simply started dumping household waste along the Bagmati River. To solve this problem international aid agencies were consulted in 1971 for the first time and in 1981 GTZ's solid waste management project started (see below for detail of project).

GTZ's solid waste management project operated for approximately 10 years through the 1980s until the Government of Nepal assumed responsibility for managing the project. During the 1990s the waste management system in Kathmandu went into disrepair. After the ultimate closure of the Gokarna landfill site in 2000, waste started being dumped sporadically along riverbanks. Eventually, in 2003 the Bagmati River's banks were officially being used for the final disposal of solid waste. The construction of Sisdol landfill site in 2005 stopped the dumping along the Bagmati.

3.1. GTZ SOLID WASTE MANAGEMENT PROJECT (1981-1990)

The GTZ Solid Waste Management Project was established in 1981 with technical and financial support from the German Society for International Cooperation (GTZ). The project was implemented by the Ministry of Work and Transportation with cooperation with local municipalities.

The Trial phase of the project (1981-1983) researched and developed new ideas for waste management in Kathmandu. With the development and implementation of new brooms and push-cars greater amount of waste was collected. However, waste was still being dumped along the Bagmati River.

In the Acting phase of the project (1983/84-1990) a holistic approach to waste management was implemented. To alleviate the environmental pressures of waste dumping on riverbanks the Gokarna landfill site was constructed and began operation in 1986. The Teku Transfer Station and composting plant also opened in the same year. Communal waste collection containers and new more efficient vehicles were introduced. To oversee the waste management activities the Solid Waste Management and Resource Mobilization Centre (SWM&RMC) was set up. Towards the end of the Acting phase the project was moved under the Ministry of Housing and Physical Planning (MoH&PP).

At the Final phase of the project (1990) GTZ reduced its technical and financial assistance to the project. The responsibility of managing the Gokarna landfill site was transferred to the SWM&RMC.

3.2. 1990-2000

After 1990 SWM&RMC assumed responsibility to manage the Gokarna landfill site. With more urbanization and rapid increase in population in the Kathmandu valley the volume of solid waste being generated increased putting greater stress in the waste management system. In addition, negligence and lack of maintenance further aggravated the system.

The closure of the Teku composting plant in 1992 led to more waste being sent to the Gokarna landfill site for final disposal. The problems at the Gokarna landfill site were compounded by inadequate infrastructure. Insufficient preparation of the site and the waste was not being covered properly resulting in waste being dispersed in surrounding areas. Protests initiated by the locals of the area led to the closure of the Gokarna landfill site but it started operations within a few weeks in 1993.

Further protests from locals ensued and the Gokarna landfill site was closed again in 1994 and was not operational again until 1995. During the 1994-1995 period when the Gokarna landfill site was closed waste started being dumped along the Bishnumati River. Gokarna landfill site began operating again in 1995 after commitment from the government to manage the site in an environmentally sustainable manner. The responsibility for the management of the Gokarna landfill site was also transferred to KMC.

3.3. PRESENT SITUATION

Waste management for Kathmandu is the responsibility of KMC. The Environment Management Division of KMC manages waste collection and disposal.

Majority of the domestic waste is disposed on the streets or in public waste containers. Some waste is collected through door-to-door collection. Waste collection is performed by individual waste collectors on modified cycle-carts and then loaded on to trucks or tractors. The collected waste is first taken to the Teku Transfer station where waste is segregated, loaded onto bigger vehicles and sent to Sisdol landfill site.

Sisdol landfill site is currently the only final disposal place of Kathmandu's solid waste. It began operation in 2005. The Solid Waste Management Technical Support Centre (SWMTSC) manages the landfill site. SWMTSC is an autonomous body under the Ministry of Federal and Local Development (MoFALD). The Secretary of MoFALD is the chairman of the Board of SWMTSC.

There is no formal set up for recycling in Kathmandu. Some of the waste is sorted at the household level and a few Non Governmental Organizations are involved in recycling. However, a large proportion of waste is sorted by "scavengers," the urban poor, on the streets or at the Teku Transfer Station. The materials – such as plastics, paper, glass and metals – that are sorted and collected by the scavengers are sold to private companies who in turn sell it mostly in India.

4. RELEVANT LAWS

In regard to solid waste management provisions there are two laws that govern it. The Solid Waste Management Act 2011 provides the duties and responsibilities for providing the services. The Investment Board Act 2011 gives authority to the Investment Board Nepal to evaluate and approve solid waste management projects and mobilize investments towards implementation of such projects. Relevant sections of both laws, regarding PPP in solid waste management is described below.

4.1. SOLID WASTE MANAGEMENT ACT 2011

Chapter 2 of the Solid Waste Management Act 2012 imposes responsibility on the Local Body to make arrangement to manage solid waste and for management of solid waste activities. This includes recycling activities for which the Local Body can consult and coordinate with relevant industry.

Chapter 4 of the Act permits private sector participation in solid waste management. The permission to participate must be granted through a license by the relevant Local Body and must be awarded through a competitive tendering under open tender.

4.2. INVESTMENT BOARD ACT 2011

Articles 5 and 7 of the Investment Board Act stipulates the responsibilities of the Investment Board Nepal. Its duties include:

- Invite proposals from investors on competitive basis, evaluate proposals, negotiate, approve and enter into agreement for projects.

- To make available government land or to arrange for acquirement of land as per existing rules and regulations for the purposes of approved investments.

- Coordinate with various ministries government and local agencies for investment promotion.

Article 9 of the Investment Board Act 2011 specifies the priority investment sectors. It states that "irrespective of whatever stipulation made in existing laws," the investment required for implementation for various infrastructure projects including "Solid Waste Management and Treatment in urban areas" shall be mobilized in accordance with this Act.

5. CASE STUDIES

5.1. NATIONAL CASE STUDIES

GHORAHI MUNICIPALITY

Ghorahi Municipality is the only service provider for waste collection and disposal. The Municipality estimates that of the 15 tons of waste collected daily 12 tons goes to the Karaute Danda Sanitary Landfill site.

Collection System
Waste collection is performed daily, except Saturdays, though door-to-door collection. Waste collectors use compactor vehicles (modified cycle rickshaws similar to ones used in Kathmandu) for door-to-door collection. The Municipality also operates two larger vehicles – one truck and one tractor. Owing to the municipality's close proximity of the landfill site, waste collectors transfer waste directly to the landfill site. There is no transfer station.

Ghorahi Municipality has also mobilized compost bins and segregation bins. The Municipality sells these bins to households at a subsidized price (50%). Approximately, 200 households use compost bins and 1000 households use segregation bins. It is not mandatory for households to keep these bins. The use of bins has increased through community action. This has been done through public campaigning and also households in a neighborhood pooling in money to buy a common bin for the neighborhood.

Waste Disposal
Prior to the establishment of the Karaute Danda Landfill site waste was being dumped along the riverside of the Katuwa Khola. Complaints by locals led to the Municipality establishing the Karaute Danda Landfill site in 2005. The site is 7.5 km from Ghorahi city center.[1] Waste is unloaded into a steep pit. Once the pit is filled it is covered by dust and tree leaves.

Waste Composting and Recycling
Most composting is carried out at the household level. The Municipality has provided training to people from household who use composting bins.

There is no formal recycling system in Ghorahi. The municipality carries out some sorting of paper, glass, plastics and metal at the landfill site. Recyclable materials collected by Municipality workers are transported to scrap dealers in Chitwan and Nepalgunj. Some segregation of recyclable materials is done at the households. These are collected by independent scrap dealers. The Municipality is also promoting the segregation of plastics at source through the use of Suiro hooks.[2] A Suiro hook is used to hold a bunch of used plastic bags together before they are collected for recycling.

Replicable Best Practice
Ghorahi municipality has been good at community outreach. The public campaigns about sanitary waste management techniques have led to greater use of waste segregation bins, even at a cost for individual households and business that buy the segregation bins. In addition promoting the use of Suiro hooks to segregate plastic bags from other wastes. A Suiro hook is a simple contraption. Its use can easily be encouraged in other cities in Nepal.

---

1 Ghorahi profile UN HABITAT
2 ibrd

BIRATNAGAR SUB METROPOLITAN CITY

Biratnagar is the second largest city in Nepal and is also a major industrial hub. It is also the first municipality in Nepal to contract the private sector for solid waste management. Approximately 50 tons of solid waste is dumped everyday in Biratnagar.

Private sector participation in solid waste management in Biratnagar started in 1997-98. Prior to this public private partnership, the municipality provided solid waste management service which was proving ineffective. However, the first contractor – Americorp – ran into difficulties due to political instability and lack of clear government policy. A subsequent contract was signed with another company called Silt. Silt was operational until 2007. An important point that Silt established was that that effective partnership it had established with the city which helped it to pioneer the introduction of waste management charges for the households and local businesses.

Since 2007 Samajik Sudhar Tatha Batabaraniya Bikas Manch has taken over the contract for solid waste management. The contractor is responsible for collection, transportation and dumping of solid waste.

Collection System
Waste is collected from designated open collection points around the city. It covers almost 95% of the total urban area[3]. Door-to-door collection happens every morning using rickshaws. (Silt had previously used plastic containers but locals rejected these because of the bad odor omitted by the decomposing waste.

Waste management in industrial areas is the responsibility of and carried out by the industries themselves.

Transportation
Various vehicles are in operation for solid waste management in Biratnagar. Two tippers with a capacity of 3 tons each. Six tractors that have a capacity of 2 tons each. One excavator, one power tiller, 25 rickshaws and 3 handcarts are also used. These vehicles are used to transport the collected waste from collection sites to the dumping sites.

Waste Disposal
There are 3 dumping sites in operation for Biratnagar. Two sites are on lease, which are 6 km from the main market area. A third site is on the bank of Singe Khola which is 4 km from the main market area. There is no sanitary landfill site used for final dumping.

Waste Composting and Recycling
Recycling business in Biratnagar is doing very well. A major reason for this because the city is on the border with India. There is a larger market for recovered waste materials in India than in Nepal. About 30% of domestic and commercial waste is recycled daily. The table below provides approximate prices for different recovered waste materials.

Material	Price (NRs/kg)
Plastics	6
Metals	35
Paper	12
Glass	2

SOURCE: BSMC

One model composting plant for organic waste is operated by the Biratnagar Sub-Metropolitan City in Ward no. 1. It was a capacity of 4 tons per day. The compost is sold for NRs. 10 per kg.

Replicable Best Practices
Biratnagar is the first city in Nepal to effectively utilize a public private partnership model

3 Practical Action

in the city's solid waste management system. Although, the solid waste management system is not entirely a sustainable one and the public private partnership is limited to very specific aspects within the solid waste management system there are positive lessons to be taken away.

1. Highly specific use of private sector in solid waste management. The private sector participation in solid waste management in Biratnagar is limited to collection, transportation and dumping while BSMC is responsible for managing the dumping site, composting and recycling and all other activities related to solid waste management. Having clearly defined roles and responsibilities between public and private parties in a PPP is most important in a PPP contract.

2. User based fees for solid waste management. Samajik Sudhar Tatha Batabaraniya Bikas Manch directly charges users for its services. The charges range from NRs. 30 to NRs. 1500 depending of the customer's premises and the service provided. This is an indication that households and commercial entities are willing to pay for solid waste manage services if the service provided is effective.

Effective use of composting plant and recycling. Biratnagar's use of composting plant and sale compost can be a model of other cities looking for sustainable methods of managing solid waste.

5.2. NGOS AND INFORMAL SECTOR

In Nepal various NGOs are making significant contributions towards solid waste management. The NGOs mainly work on door-to-door collection and recycling. The successful NGOs are financially self-sustaining through the fees they charge for their service coving their operating costs. However, underlying problem persists. Final disposal of non-recyclable waste is still a major problem for these NGOs in many cities around Nepal. Also, lack of legislative support from the government has hindered the expansion of the effective solid waste management activities many NGOs are performing.

NEPAL POLLUTION CONTROL & ENVIRONMENT MANAGEMENT CENTER (NEPCEMAC)

Established in 1997, NEPCEMAC has been operating in parts of Kathmandu metropolitan city, Lalitpur sub-metropolitan city, Biratnagar sub-metropolitan city, Itahari municipality and Triyuga municipality. NEPCEMAC perform door-to-door collection and promote household composting. All non-recyclable waste is dumped at locations designated by the respective municipalities. For example, in Lalitpur sub-metropolitan city some waste dumped at the banks of Bagmati River while in Kathmandu it uses its own vehicle to transport waste to Sisdol landfill site.

NEPCEMAC charges a fee to households and commercial enterprises for using their services. The revenue generated from fee collection is almost entirely used to cover the operational cost of the NGO's solid waste management activities. In addition to improving the solid waste management system NEPCMAC is also helping the urban poor with creating jobs for them and providing them with income.

One major problem NEPCEMAC has encountered is encouraging the citizens to reduce waste and segregating recyclable and non-recyclables at source. Even with the distribution of red and green colored bins to households for waste segregation NEPCEMAC has observed that households largely put out only mixed waste.

URBAN ENVIRONMENTAL MANAGEMENT SOCIETY (UEMS)

UEMS was established in 2002 and has been involved in composting activities. It operated in Lalitpur sub-metropolitan city. UEMS involved communities in its solid waste management activities through awareness campaigns, training, orientation, and education. The community mobilization aspect is key to UEMS solid waste management model.

Participating households segregate organic waste and put it in compost bins which can hold up to 50 kg. Households sell compost to UEMS at a NPR 6 per kg. UEMS refines and repacks the compost and sells it to local flower nurseries and other customers for NPR 10 – 12 per kg.

UEMS faces organizational problems because if insufficient staff and financial limitations. Nevertheless, UEMS has expanded awareness of composting and recycling. By paying households to by their organic waste it has encouraged these household to segregate waste at source.

THE WOMEN'S ENVIRONMENT PRESERVATION COMMITTEE (WEPCO)

WEPCO has been operating since 1992 in Lalitpur. Its main objective is to work with local communities and to empower women to manage solid waste issues in their neighborhoods. They provide training on composting, vemicomposting, paper recycling, leadership, capacity building and gender issues.

Waste collection is done through daily door-to-door collection. WEPCO has distributed red and green bins for paper and plastic collection. Its 'Give Plastic and Take Compost' campaign has generated awareness of organic and inorganic waste reduction and segregation. After collection waste is dumped at a transfer point. WEPCO also operates a paper recycling plant and a composting plant.

WEPCO operates on a self-sustaining business model. The revenue it generates from recycling and composting activities cover its operational costs. Similar to the structural problems faced by other NGOs the poor institutional set-up of government organizations and lack of adequate legislative support curtails its activities and expansion plans.

5.3. INTERNATIONAL CASE STUDIES

BELO HORIZONTE, BRAZIL

The current integrated solid waste management system in Belo Horizonte uses both the resources of the city government and also the various associations of informal solid waste workers. The Public Cleansing Agency (SLU), an arm of the city government, is responsible for solid waste management. It operates vehicles and transports the waste from around the city. Curbside collection is done by the city's formal workers who collect the recyclables. There are over a 150 drop-off sites in public places around the city where citizens can separate recyclables into containers. City trucks collect the recycling containers. Door-to-door collection recyclables are performed by pushcarts at small business and by larger vehicles from industry.

After collection the waste is taken to warehouses operated by cooperatives and associations of informal solid waste workers. At the warehouses waste is segregated and sold by the association members. These associations are integrated into the SWM system through formal agreements with the city government to operated the warehouses for recycling.

Key Lessons
The integration of the informal workers in the SWM system has had an added important social consequence above creating an effective recycling system. It has provided a formal mechanical of income generation for the urban poor. By allowing recycling activities to take place in warehouses away from the public eye in the streets, it has allowed some degree of social integration for the urban poor.

It is important to understand that the successful integration of the informal workers into the formal SWM framework was because of the recognition by the city authorities of the important environmental and economic contribution made by the informal waste pickers. In addition to this, some other important policy aspects include:

- Infrastructure was provided to associations/cooperatives such as construction of recycling warehouses for sorting.

- Formal agreements between city government and different associations cooperatives. This was recognition on part of the authorities of the important environmental and economic contribution by waste pickers.

- Technical assistance and capacity building programs.

- Environmental outreach campaigns carried out by the city government.

- The creation of a stakeholder forum (Municipal Waste and Citizenship Forum) with representatives from associations, city government and NGOs.

TIMARPUR-OKHLA SOLID WASTE MANAGEMENT PROJECT

This project was initiated in 2007 by the Municipal Corporation of Delhi (MCD) and the New Delhi Municipal Corporation (NDMC). The project developed a 16 MW Waste to Energy facility. The PPP operated on a Build Own Operate Transfer (BOOT) basis. The total cost of the project was estimated at INR 1.75 billion but later escalated to INR 2 billion. After the bidding process the project was awarded to Jindal Urban Infrastructure Limited (JUIL).

The Delhi Power Company and NDMC provided the land on lease and also signed the main concession agreement with JUIL. JUIL is the 100% equity owner of the special purpose vehicle, Timarpur Okhla Waste Management Company Ltd. (TOWMC) which will implement the project. Commercial banks provided the loans to JUIL to implement the project. NDMC and DMC supplied the waste at zero cost to TOWMC while the Delhi Jal Board also supplied sewage.

TOWMC had two outputs from the project – electricity and organic fertilizer. Both were sold on to customers. In there case of electricity TOWMC had signed a Power Purchase Agreement (PPA) for 25 years with BSES Rajdhani Power Limited for 50% of the electricity generated, while the remaining 50% was sold through open access. The project was CDM certified so also earned carbon credits, which provided another revenue stream.

Key Lessons
The project did not require grants from the government for meeting its capital or operation expenditure. The loans acquired from commercial banks covered the capital costs of the project while the revenue from the sale of electricity and organic fertilizer and income from carbon credits financed the operational costs and debt service of the project.

TOWMC is a classic project financed PPP model. There are multiple stakeholders who

are bound together through legally enforceable contracts. In the case of the Timarpur-Okhla Integrated Waste Management Project the following are the key agreements while allow the project to function properly:

- Concession and land on lease for 25 years provided by Delhi Power Company and NDMC to JUIL. The concession agreement allows for the project to sell its output directly to consumers.

- Loan agreements with commercial banks.

- Agreement with NDMC, MCD and Delhi Jal Board to supply waste and sewage to the project. This is extremely important because waste and sewage is the fuel to generate the project's output.

- 25 years PPA agreement with BSES Rajdhani Power. This provides a guaranteed revenue stream for 50% of the power output for the duration of the project.

TOMPKINS COUNTY, NEW YORK, USA

Tompkins County's current SWM system is a modern and effective system which is very efficient in its use of available resources. Since the development of a materials recovery facility and transfer station, The Tompkins County Recycling and Solid Waste Center (TCSWC), it is highly modernized system where the resource management and financial drivers dominate policy and practice.

Recyclable waste is source separated and separately collected door-to-door throughout the county by the county authority. The separate recycling collection is funded through a US$ 56 annual fee paid by all businesses and households. Solid waste collection is performed by private entity (except in some parts of the county where the local authority collects it). In rural areas of the county, many households take waste to the depot themselves because the universal recycling collection reduces total waste by more than half. Residents pay a fee per bag to dispose of their non-recyclable waste. Other PPPs are also in operation to collect food waste from restaurants and institutions which composts approximately 2000 tons per year.

Non-recyclable waste and residuals from recycling activities are "exported" to a private sanitary landfill site in the next county for a fee.

Key Lessons

The most important feature of the Tompkins County SWM system is that it is self-sustaining. Even with modest population of about 100000 people the county's SWM system is independent of the county budget. This is made possible with the fees that are charged to households and businesses for waste disposal, annual disposal fees and revenue from sale of recyclable.

Administrative autonomy and financial independence are important drivers for making it a self-sustaining system. Autonomy in decision-making has allowed TCSWC to invest in know knowledge and human resources and to provide advisory services to businesses and communities which in turn has generated revenue for TCSWC.

PPPs have been established for different activities and in different areas within the SWM system. The activities and responsibilities of each private entity are predefined in the contract. This allows for clarity in the differentiation of activities between all stakeholders and also imposes accountability to make a holistic and effective SWM system.

6. CONCLUSION

It is evident that KMC's solid waste management system is largely ineffective and unsustainable. There is no official practice of recycling. The urban poor operate as scavengers and perform most recycling activities. Without any formal mechanism for recycling, more than necessary waste is being disposed off at Sisdol landfill site. This will only lead to the Sisdol landfill site being exhausted sooner. Furthermore, the informal recycling that is taking place is benefitting industries outside of Nepal because most of the reusable waste that is scavenged is sold in India. The use of public waste containers and bins around Kathmandu metropolitan city is also limited. As a consequence it is common to find waste on street sides waiting to be collected by the municipality.

These issues in Kathmandu's solid waste management system yearn for a modernized, efficient and effective system. However, in implementing a modernized solid waste management system it is important to recognize the needs and the context of the city. As such, the national and international case studies surveyed present solid waste management systems that have strengths that can be replicated for Kathmandu metropolitan city. The lessons that can be learnt from these case studies are important in implementing a holistic solid waste management system.

At source segregation of waste should be encouraged by KMC as prescribed by law. KMC should be able to use the example of effective community action in Ghorahi to promote at source segregation amongst the citizens of Kathmandu. KMC has been ineffective in recycling waste, which in contrast, is being performed well by NGOs and even in Biratnagar sub-metropolitan city.

The international case studies focus on the best practices of incorporating the private sector into a city's solid waste management system. In the context of Kathmandu, perhaps the lessons from Belo Horizonte is most relevant. Kathmandu already has many informal workers working on solid waste management. Incorporating them within the formal solid waste management system would allow KMC to regulate their activities while also creating jobs and income generating activities for the urban poor.

The cases of Tomkins County and New Delhi/Delhi highlight the benefits of PPP and the importance of structuring the project properly to accrue full benefits. Tomkins County uses different private sector entities for different tasks within the solid waste management system. Having separate agreements that define the roles and responsibilities with each private entity is important to run a functional PPP. Without properly defined roles the partnership can be inefficient or even be ineffective which may impose costs to the system. Similarly, the Timarpur-Okhla Solid Waste Management project has multiple agreements with different parties. The efficient operation of the project is due to clearly defined roles and responsibilities in the agreements between the parties. The effective use of private entity within a solid waste management system is already in operation in Birtanagar. Once again the success of the partnership is because of the specific role of the private entity within the greater solid waste management system.

The other important take away from the Tomkins County and Timarpur-Okhla Solid Waste Management projects is the financial independence of the projects. Both projects are financially self-sustaining though the revenues they generate. This is one of the greatest benefits of PPPs – it alleviates the budgets of governments and public bodies.

7. RECOMMENDATIONS

Transparency of information and coordination between relevant departments. Under the Investment Board Act 2011 the Investment Board Nepal has the authority to tender and award solid waste management projects. However, the Solid Waste Management Act 2011 imposes responsibility on Local Bodies for solid waste management. If Investment Board Nepal initiates a tender and awards a contract for solid waste management for Kathmandu, there should be, from the beginning, consultation and coordination with KMC. This is especially important because at the end of the PPP agreement the handover of the project will be made to KMC.

- If other government agencies are involved directly or indirectly with activities relating to solid waste management Investment Board Nepal must exercise its authority to coordinate. For example, waste-to-energy project is initiated Investment Board Nepal should coordinate and assist in negating Power Purchase Agreement between project company and Nepal Electricity Board.

Formally include informal workers and NGOs already participating in solid waste management. The work that is being performed by NGOs have aided the solid waste management efforts of KMC. In addition, informal workers are the ones who have been performing most of the recycling activities. When implementing a modern solid waste management system it will be important to incorporate these NGOs and informal works. This can have added social benefits. Especially in the case of informal workers who are the urban poor, excluding them from the activity through which they derive their livelihood can lead to great social exclusion and alienation.

KMC must initiate a public awareness campaign for recycling and aggressively promote at-source segregation. Promoting at-source segregation is demanded by law – Solid Waste Management Act 2001 Chapter 2 Article 6. KMC can take heed and learn from the community outreach activities of NGOs and also Ghorahi municipality. Recycling will reduce waste being dumped in Sisdol landfill site and in turn extend its life.

KMC should identify relevant industries and coordinate recycling activities. As prescribed by the Solid Waste Management Act 2011 KMC as the authoritative Local Body for Kathmandu should initiate contact with industries to promote recycling.

Attract private investments for solid waste management services and implement PPPs. A large chunk of KMC's budget is used for providing solid waste management services for the city. Initiating PPPs and involving the private sector in solid waste management will reduce the financial burden on KMC. To initiate PPP the following issues should be taken into consideration:

- Should there be multiple PPPs at different stages of the solid waste management system? Or should there be a single PPP agreement for the lifecycle of solid waste management system from collection to disposal.

- Technical considerations. When tendering for proposals KMC should state their requirements in broad terms. The technical parameters should not be too narrow so as to leave enough room to encourage innovative solutions from the bidding parties.

- All rights and obligation and roles of all party to a PPP agreement must be defined clearly in the PPP agreement. This should include consequences for non-performance. This is to ensure efficient operation of the project.

REFERENCES

Anderzén, C., Blees, V., *Solid Waste Management in the city of Kathmandu, Nepal: Evaluation of Växjö Risk Assessment Model applied on Gokarna Landfill Site*

Practival Action Nepal, 2008, *Best Practices in Solid Waste Management of Nepalese Cities*

Gotame, M., 2012, *Community Participation in Solid Waste Management in Kathmandu*

Government of Nepal, 2011, *Investment Board Act 2011*

Government of Nepal, 2011, *Solid Waste Management Act 2011*

JICA, Ministry of Local Development Government of Nepal, 2005, *Action Plan on Solid Waste Management Kathmandu Metropolitan City*

Asian Development Bank, 2010, *Nepal: Preparing the Secondary Towns Integrated Urban Environmental Improvement Project*, Biratnagar Final Report