

# Domestic Solid Waste Management in South Asian Countries – A Comparative Analysis

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## 1. Background

The South Asian region as a whole is experiencing rapid urban growth. Increasing population, urbanization, industrialization and changing consumption patterns are resulting in the generation of increasing amounts of solid waste and diversification of the type of the solid waste generated. Solid waste is the most visible environmental problem among many in urban areas. Increased solid waste generation creates more environmental problems in this region, as many cities are not able to manage it due to institutional, regulatory, financial, technical, and public participation shortcomings.

The environmental degradation caused by inadequate disposal of waste can be expressed by the contamination of surface and ground water through leachate, soil contamination through direct waste contact or leachate, air pollution by burning of wastes, spreading of diseases by different vectors like birds, insects and rodents, or uncontrolled release of methane by anaerobic decomposition of waste. The sustainability of the landfilling system has become a global challenge due to increased environmental concerns. Growing public opposition together with unavailability of land is one of the reasons why obtaining sites for new landfill is becoming increasingly difficult. Locating a landfill far away from the urban area can be adventitious from public opposition. Site is far away from the source of waste generation increases transfer costs and additional investments for the infrastructure of roads, hence intensifying the financial problems of the responsible authorities.

Common problems for Municipal Solid Waste (MSW) management in the region include institutional deficiencies, inadequate legislation and resource constraints. Long and short term plans are inadequate due to capital and human resource limitations. There is a need to practice integrated solid waste management approach such as: Incorporation of more environmental and economic friendly concepts of source separation; recovery of waste; legitimization of the informal systems; partial privatization and public participation. Although some governments have formulated policies for environmental protection, they were only implemented in the national capital cities. In rural areas, open dumping is still considered the most popular method of solid waste disposal.

## 2. Solid Waste Generation

In order to prepare a well-planned waste management system, it is essential to know the quantity of waste generated as well as different categories of the waste. Solid waste generation differs from place to place to a great extent; its production and composition are influenced by consumption pattern, climate, season, cultural practice, etc. Figure 1 shows the comparison of solid waste generated per-capita (kg/day) in different South Asian countries (Zurbrugg, 2002; UNEP, 2001a; WWF –Pakistan, 2001; AIT, 2004; UNEP, 2001b; UNEP, 2002; UNEP, 2003). It is observed that the per capita waste generation varies in a range from 0.3 to 0.9 kg/person/day.

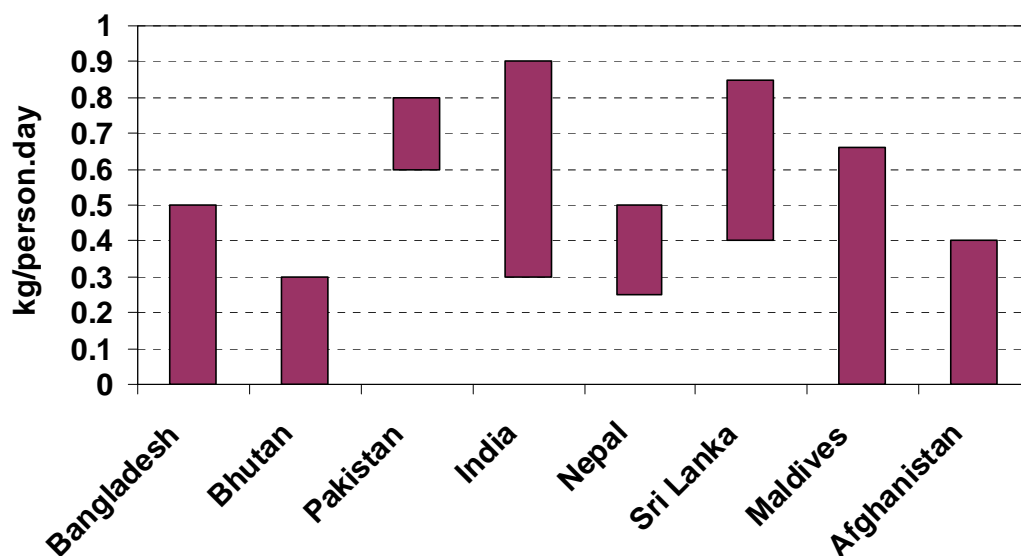


Figure1: Per capita solid waste generation in South Asian countries

Although South Asian countries and its urban areas have lower per capita waste generation rate compared to the cities of the developing countries, their quantum of waste is high owing to their higher levels of population density. According to the latest report prepared by UNEP (2005), the MSW generation in East Asia and Pacific region has been increasing at a rate of 3 – 7 % per year (as a result of population growth, changing consumption patterns and expansion of trade and industry in urban centres) and similar trend has been seen in the South Asian countries.

In general, solid waste generation and its composition in the developing Asian countries vary widely due to different cultural practices, living standards and climatic conditions (AIT, 2004). As for the case of Thimpu (Bhutan), it generates about 10 tons/day (UNEP 2001a) and Dhaka (Bangladesh) generates as high as 4,364 tons of waste daily (Iftekhhar *et al.*, 2005). Average daily solid waste generation in Kabul city (Afghanistan) is 1,080 tons out of which only 250 ton is collected (UNEP, 2003). In New Delhi (India) 3,880 tons of solid waste is generated each day of which only 2,420 tons is collected for disposal (UNEP, 2001c). In Karachi (Pakistan), everyday around 7,000 tons of mixed garbage is generated and its generation rate is increasing by 2.4% per year (WWF-Pakistan, 2001). In Kathmandu Metropolitan City (KMC), Nepal, daily garbage flow is 944 m<sup>3</sup>, approximately 300 tons (Manandhar, 2002) whereas, in Colombo (Sri Lanka) the MSW generation is 2,927 ton/day (AIT, 2004).

### 3. Solid Waste Composition

The composition of the waste, in general, differs from country to country on the economic level of countries as well as other factors such as geographical location, energy resources, climate, living standards and cultural habits. Most of the developing Asian countries have high percentage (50 to 80%) of organic matter in their waste stream with high moisture content making them unsuitable for incineration (AIT, 2004). Compositions of MSW in few South Asian countries/ cities are presented in Figure 2 (Zurbrugg, 2002; UNEP 2001c). It also reflects the heterogeneity of the waste stream. Over the years, many plastics and paper wastes had finds its way into the municipal waste stream due to the rapid economic expansion.

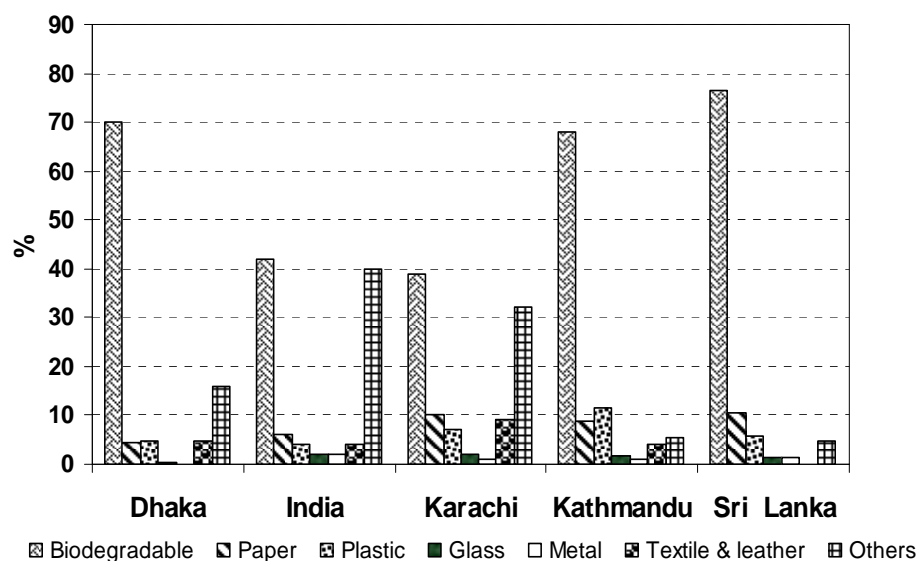


Figure 2: Composition of MSW in South Asia countries

### 4. Solid Waste Management

Capital cities of almost all South Asian countries are challenged by urbanization and industrialization trends, population increase and consequent rise in waste. These cities therefore face major problems relating to public health and environmental pollution. Poor government policy and response, lack of political will, lack of appropriate economic and human resources, and weak local institutions result in poor waste management (especially in large cities). Although municipalities are increasingly involved in managing the solid waste, lack of resources, institutional and infrastructure facilities are hindering the efforts. Box 1 describes the existing status of solid waste management conducted in Indian Metro cities and state capitals after the inception of Municipal Solid Wastes (Management and Handling) Rules.

#### 4.1 Collection and Transport

Significant amount of the solid waste generated in urban centers of South Asian countries are not collected/ attended and either burned openly in the streets or end up in rivers, creeks,

marshy areas and empty lots thereby posing a serious threat to public health. In developing countries, municipal solid waste management costs consume 20-50% of municipal revenues, collection service levels remain low with only 50- 70 % of residents receiving service and most disposal being unsafe (Cointreau, 1994). For instance, Kathmandu spends 38% of the municipal budget on MSW management; 93% of this is spent on sweeping, collection, transfer and transport (Glawe *et al.*,2005).

#### Box 1: Solid Waste Management Indian Metro Cities and State Capitals

The CPCB in collaboration with National Environmental Engineering Research Institute (NEERI), Nagpur has undertaken a detailed survey of 59 cities in the country to assess the existing status of solid waste management in these cities. Objective of the survey was to assess the compliance status of 59 cities with Municipal Solid Wastes (Management and Handling) Rules, 2000 and initiatives taken for improving solid waste management practices. The 59 cities selected for study cover 35 metro cities. It has been observed that initiatives for collection of waste from house-to-house and waste segregation has been undertaken in only seven cities, privatization of transportation of waste has been done in 11 cities and waste processing facilities have been set up in 15 cities. Ten waste processing facilities are based on composting; one of these composting facilities has provision for energy recovery also, four are based on vermin-compositing, and one facility employs pelletisation and energy recovery technology.

Source: MoEF –India

The collection rate varies from city to city and sometimes within different sections of one urban area. Collection rate vary from 10-90 % of the total municipal waste generated. Collection facilities are either inadequate or inefficient in almost all of the cities. In low income or squatter settlements, garbage collection is often non-existence as these settlements falls outside official service areas (UNEP, 2001c). Figure 3 depicts the collection efficiency of various capital cities in South Asia (UNEP, 2003; DoE, 2004; UNEP, 2001a; AIT, 2004; UNEP, 2001b; WWF-Pakistan, 2001).

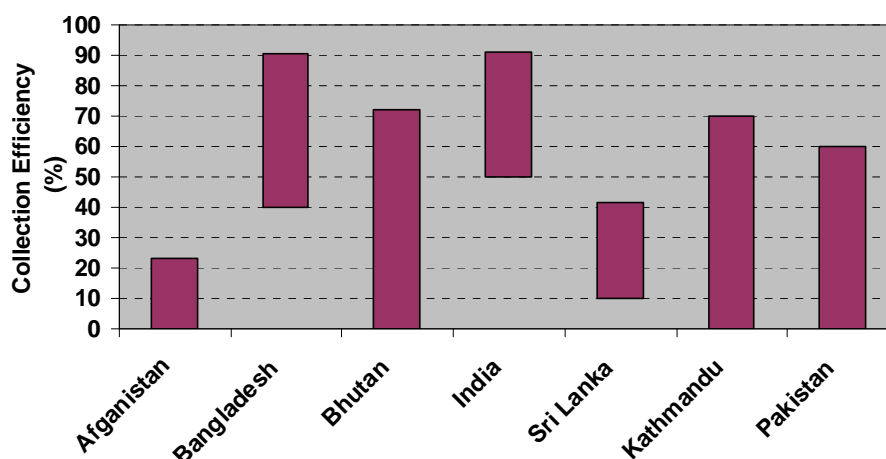


Figure 3: Comparison of Collection Efficiencies

## 4.2 Processing and Disposal of MSW

According to AIT (2004), final disposal in most of the economically developing countries is usually a matter of transporting the collected waste to the nearest available open space and

discharging them. Open dumping is predominant except for the developed countries. Composting is not carried out to the capacity that can be achieved though almost half of the MSW can be reduced thus. Other forms of disposal like animal feeding, ploughing into soil, open burning and dumping in water bodies or wetlands contribute to environmental hazards. Waste burning is practiced to reduce its volume and minimize the attraction of animals and vermin. Despite the degradation of valuable land resources and the creation of long-term environmental and human health problems, uncontrolled disposal systems are still prevalent in most of the developing countries (ISWA & UNEP 2002). Sanitary landfilling or engineered landfilling of MSW is often misinterpreted in the developing countries, especially when it comes to covering a dumpsite by soil. Financial and institutional constraints are one of the main reasons for inadequate waste disposal. Introduction of SWM user fees cover only the collection and transportation costs leaving practically no resources for safe disposal of the waste. Generally, when aesthetic values are in question most people are willing to pay for the removal of refuse from their immediate environment but are not concerned with its ultimate disposal. Figure 4 reflects the disposal methods of municipal solid waste practiced before 2000 in some South Asian countries. Significant changes have been made over the past few years, especially in the field of composting organic wastes in countries like Bangladesh, Sri Lanka and India.

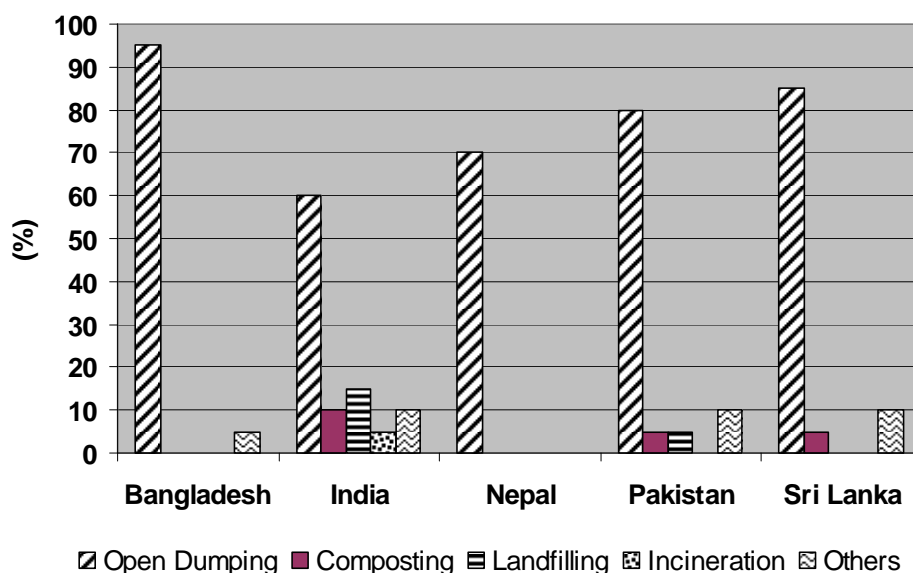


Figure 4: MSW disposal methods practiced in some SA countries  
Source UN, 2000

#### 4.2.1 Open Dumping

In most of the cities of South Asia, open dumping is the most preferred method for the final disposal of solid waste. Even though, government and municipalities are already working to develop the sanitary landfill sites in few urban areas, open dumping still remains the cheapest and most effective solution to get rid of the mounting garbage. New sanitary landfill is often too distantly located compared to the open dumpsites within municipal limits. The sites far away from the source of waste generation increases transfer costs and additional investments for the infrastructure of roads, hence intensifying the financial problems of the responsible



authorities making the longer collection and hauling time. These open dumpsites in the course of time (Figure 5) become haven for scavengers (animals and man alike).



*Sri Lanka (AIT, 2004)*



*India (AIT, 2004)*



*Bangladesh (Waste concern)*



*Pakistan (URC)*

Figure 5: Open dumpsites – ‘Haven for scavengers’

#### 4.2.2 Composting and Recycling

Composting is the second preferred method of solid waste, mainly due to the high percentage of organic material in the waste composition. There are some small-scale composting plants in Dhaka, which has shown more success such as windrow composting, however composting in bigger scale is not that popular in the whole region. The main reason why centralized composting plants are not functioning effectively includes high operating and maintenance costs, incomplete separation, and lack of effective marketing.

Increased urbanization, lack of space, and a cultural shift toward disposable plastics have all decreased household waste segregation. Many municipalities in India are experimenting with educational campaigns and hiring workers to conduct door-to-door collection of segregated recyclables (Damodaran, 2003). In many islands of Maldives organic wastes are composted at home backyards and non-biodegradable waste (such as plastics) is dumped near the beach or buried in a few islands. Burning of combustible waste at designated areas is also widely practice. Even being the typically used method for final disposal, the overall condition of landfill is still unsatisfactory.

Recycling is widely practiced by the informal sector "waste pickers" or by the solid waste management staff themselves for extra income. Collection of recyclable waste is done in several steps such as households (door to door collection), transfer stations and even in the disposal sites. Such work is done in a very labor-intensive and unsafe way, and for very low

incomes. Recovered and recyclable products then enter a chain of dealers, or processing before they are finally sold to manufacturing enterprises. The main items that are recycled include soft and hard plastics, glass, steel, paper, cardboard, aluminium and alloys etc. In Bhutan, around 20% of the collected wastes are sent for recycling. Whereas, most of the recyclable wastes collected in Nepal and Bhutan are sent to India, due to insufficient recycling factories in the countries.

### **4.3 Waste Management and 3Rs concept**

In South Asian countries, the promotion of 3R in the Domestic Solid Waste Management over- emphasises “Recycle and Reuse”, and less focus is given to “Reduction”. It is also interesting to note that due to the low purchasing capacity in the developing countries the market is overflowing with low quality and cheap products creating more waste after its short useful life.

Prior to formalising the 3Rs concept in the waste management hierarchy, few financial and economic issues need to be addressed and resolved.

- Is there any budget allocated for 3Rs activities such as awareness, motivation etc?
- How 3R can be used to meet the budget and expenditure of local governments?
- How to link the 3R financing and environmental benefits?

As for Japan, 3R activities are promoted under the concept of “Sound Material-Cycle Society”. Both treatment and 3R technology are well developed and implemented as part of the solid waste management program. Several cities and towns get together and constitute one wide area over which an efficient 3R system is planned and implemented. An integrated system with various facilities for the 3Rs, such as biomass utilization, recycling, waste power plants, asbestos treatment and so on, are formulated under close collaboration among cities and towns.

## **5. Legal, Social and Financial Issues**

Due to the similarity in economical and infrastructural development, South Asian countries are facing more or less similar legal, social and financial problems in terms of solid waste management. Considering the necessity of environmental issues in the country’s development, government and municipalities are working hard to extend environmental legislation. Responsible organization for the management of solid waste and current situation of legislation in South Asian countries is presented in Table 1.

Public awareness and public participation is a major step in effective implementation of the solid waste management system. Therefore, co-operation from the citizens is a vital aspect in managing solid wastes of a city. Habits and attitudes of inhabitants of a city largely affect waste management system. Hence, social aspect can not be separated from the overall waste management system. Therefore, environmental education from schools to develop the awareness of the general public becomes important.

Country	Responsible Organization	Current Situation
Afghanistan	Ministry of Irrigation, Water resources and Environment and Afghan Assistance Coordination Authority	No environmental legislation Started to develop legislation since 2000
Bangladesh	Ministry of Environment and Forest	No separate policy or handling rules for solid waste Preparing a comprehensive solid waste management handling rules
Bhutan	Municipalities	Fails to enforce the law
India	Municipal governments	Municipal Solid Wastes (Management and Handling) Rules, 2000 Non-biodegradable Garbage (Control) Ordinance, 2006
Maldives	Ministry of Home Affair	n/a
Nepal	Municipalities	Local Self Governance Act, 1999 (Fails to implement national policy, Improving the waste management facilities and educating people)
Pakistan	City government and town municipal administration	NEP-National Environmental Policy, 2005
Sri Lanka	Local Authorities	NSSWM -National Strategy for Solid Waste Management

Table 1: Responsible Organization and Current situation of MSW in South Asian Countries  
n/a - not available

Financial issues are the main problem for the developing countries to carry out any kind of development programs. International organizations and donors such as United Nations Development Programme (UNDP), Asian Development Bank (ADB), Japan International Cooperation Agency (JICA), German government, etc. are helping the local governments for establishing an environmentally sustainable solid waste collection and disposal system.

## 6. Role of Stakeholders

To achieve sustainability in waste management, it is important to look at the roles, interests and power structures prevalent in waste management. Experience in several countries has shown that cooperation and coordination between the different stakeholder groups like city council, provincial government, service users, NGOS, CBOS, the private sector (formal and informal), and donor agencies, will ultimately lead to increase sustainability of the waste management system, such as changes in behavior and sharing of financial responsibilities. On the other hand, ignoring certain activities or groups will result in decreased sustainability of the system, for example in the form of negative public health effects or increased unemployment (Nyachhyon, 2004).

### 6.1 Community based organizations (CBOs)

The community based organization is an essential element in ensuring the effectiveness of the solid waste management project in developing countries and increasing the likelihood of its



sustainability. One such example of a successful scheme is the Community based pilot project in solid waste management in Khulna city in Bangladesh (WSP-SA, 2000). Interestingly, in most of the South Asian countries, woman plays an important role in many community based organizations (See box 2). They are responsible for house-keeping and its immediate environment clean. The women have their hand in the MSWM from household management to administrative works. They have shown active participation in various MSWM concerns including educational activities and workshops besides playing an important role in their own community.

**Box 2: Women CBO in Sri Lanka**

Initiated by Arthacharya Foundation in Galle and Hikkaduwa, the women CBO programme was based on the introduction of source separation scheme involving sorting of recyclable materials into four categories: plastics/polythene, paper/cardboard, glass and organic waste. Under each women CBO, approximately 5 – 7 households are divided into small groups. The CBO initially provides each group with a metal barrel (200-liter capacity) free of charge for composting the sorted organic waste. The survey data showed that about 3930 kg/month of compost was produced during 2001 of which about 50% was used in the home gardens and the rest was sold. The average selling price of the compost was between Rs 10 – 25/kg (US \$ 0.1 - 0.25) depending on the location and the quality of compost.

Source: AIT, 2004

## **6.2 Private sector participation**

Private sector has played an important role in municipal solid waste management of the countries mentioned in the paper. Specially, in the capital city of Nepal private sector is participating more in door-to-door collection, street sweeping and waste transfer. Due to the involvement of the private sector, collecting garbage is found to be more efficient and in addition to this burden on Kathmandu Municipal Corporation (KMC) is reduced both in financial and in terms of human resources. Approximately 50% of the people surveyed replied that services provided by the private sector were more effective. Therefore, KMC is gearing towards the involvement of the private sector in all aspects of solid waste management.

## **6.3 Non-governmental organizations (NGOs)**

NGOs operate between the private and governmental realms. They are motivated primarily by humanitarian and developmental concerns. NGOs may help increase the capacity of people or community groups to play an active role in local SWM by contributing to:

- people's awareness of waste management problems;
- organizational capacity and formation of CBOs;
- provide channels of communication between CBOs and government authorities;
- championing of CBO's voice in municipal planning and implementation processes;
- transfer of technical know-how of locally active CBOs.

NGOs may also provide important support to informal sector waste workers and enterprises assisting them to organize themselves to improve their working conditions and facilities,

increase their earnings and extend their access to essential social services such as health care and schooling for children. Whilst privatization basically involves the transfer of management responsibility and ownership from the public to the private sector and has proved to be a powerful means of improving the efficiency of some waste management services such as collection, haulage and disposal. Operating in various forms of partnership with the public sector, they may provide capital, management and organizational capacity, labor and technical skills (UN, 2000). This semi-formal private sector includes a wide range of enterprises varying from informal micro-enterprises to large business establishments, other CBOs and local enterprises. In recent years (AIT, 2004), Sri Lanka has gained a noticeable participation by the CBOs, NGOs and local enterprises in promoting MSWM and increasing public awareness in resource recycling and waste minimization. In Nepal, non-governmental organization “Zero Waste Nepal” is currently working towards community based solid waste management. Zero Waste Nepal is trying to develop new attitude and behaviour of the people towards handling waste and converting the existing “Throw Away” culture to “Zero Waste” culture. Also in Nepal, the Women's Environment Preservation Committee (WEPCO) in Lalitpur, started a pilot project supported by DANIDA with waste reduction as its main objective. The group is working for source segregation and composting servicing 500 households with primary collection. The sweepers sort out the recyclables and sell them to waste traders while the organic waste is composted. The organization sells 1200-1500 kg of compost monthly (UNSCO report). Similarly, in Bangladesh, NGOs like Waste Concern, Prodipan, Environmental and Geographic Information Systems (EGIS) are coming up with strategies to manage the solid waste properly. Prodipan is working from collection of solid waste to composting and runs a small scale incineration plant (WSP-SA, 2000). A local NGO, Pakistan Environment Welfare and Recycling Program (PEWARP), Tetra Park and Shehri are actively involved in Solid waste management in Pakistan (Government of Pakistan, 2005).

## 7. Recommendations

### *Technical Aspects:*

The adoption and transfer of the technologies from the developed countries without adapting them to the local or regional perspective would be fallacious on the part of the developing countries. Therefore, the technical aspects for a sustainable SWM would have to take into account the following points for planning and implementation of strategies.

- Provision of facilities for primary collection of waste from curbside/community bins and adequate storage facilities in the urban areas based on the population density.
- Transportation of waste from the community storage facilities at regular intervals and improvement in the waste collection fleet.
- Transfer stations (at optimal distances from residential areas) should be constructed wherever necessary with provision for weighbridges.
- There must be a separate SWM system for hospitals, health care establishments and industries to prevent the infectious and hazardous wastes from entering the municipal waste stream.

### *Management Aspects:*

Sustainable SWM would call for the strengthening of the management sector which has to go hand in hand with technical planning. In most developing countries, overstaffed management

due to politically motivated appointments result in absenteeism and hence the working efficiency decreases while at the same time there is a squeeze in resource allocation for technical aspects that get neglected. The effectiveness can only be achieved by a strong management that takes into consideration the following aspects.

- An executable master plan and implementation plans for MSWM at the provincial level or the state level in accordance with the strategy for national environmental quality would help the management;
- Application of Polluter Pays Principle to all waste generators, especially in urban areas including governmental and non-governmental agencies, private sectors and commercial enterprises;
- Application of the 3R concepts, product stewardship, cleaner production and specification in the selection of packaging materials to the manufacturers.
- Continuous monitoring and record keeping of MSW aspects with the development of a systematic information system that can be comparable, utilizable and updated;
- Appointment of responsible governmental agencies that can regulate and supervise MSWM activities of both local government and private operators so as to reduce the environmental impacts;
- Providing of organizational support for encouraging the involvement of private sector operators, NGOs and CBOs; and
- The informal sector needs to be formalized.

#### *Financial aspects:*

- There should be transparency and coordination amongst the staff regarding the operation and maintenance costs at each level of waste handling so that the expenses are rational;
- The levying of waste collection and disposal fees should be based on waste generation rates and according to the economic standard of the area, whilst considering the nature of the waste wherever necessary. However, these fees should not be levied solely to meet the financial lacunae for management and the equipment demand;
- The larger generators should be charged on excessive waste generation which could be prevented with cleaner production principles;
- There should be provisions for subsidies (grant, soft loan, etc.) from government to local authorities, including the private sector, NGOs and CBOs;
- Tax exemption for importing recycling technology and reduced tax benefits from those industries using waste and scraps as raw materials;
- A fund or trust for promoting 3R needs to be developed instead of a micro credit program in the informal sector; and
- Transformation of 3R into financial terms or economic value is needed.

#### *Legislative aspects*

Legislation and its effective enforcement is a key to sustainability for which the framework requires to be established. The related aspects are given hereunder:

- Set up of appropriate pollution discharge standards for solid waste disposal facilities such as effluent and emission standards either based on World Health Organization (WHO) norms or related to the national standards for pollution control;

- Declare all solid waste disposal facilities as pollution sources, which if done should be strictly enforced such that discharges should be regulated in pursuant to the established standards;
- Develop regulations and related laws to set up mechanisms for implementing 3R concepts – Reduce, Reuse and Recycle;
- Regulate an appropriate SWM system for the mass-transportation terminals;
- Declare a no-development buffer zone within 500 meters from the boundary of all processing and disposal sites; and
- The joint involvement of the Ministry of Finance, city planning offices and the Ministry of Environment to develop infrastructure plans on promotion of 3R is needed.

### *Supportive aspects*

Municipal bodies could have the required technology, financial resources, management structure and a framework of legislation for effective SWM. However, its implementation cannot be effectual unless the supportive aspects are mobilized to work hand-in-hand with the system. This can be achieved if the system can:

- Encourage private sector involvement for waste collection, hauling and disposal as both short term and long term contractors since efficiency is found to increase with their involvement;
- Promote public education program, trainings and workshops, revise school curriculum by introducing the 3R concepts in general and SWM in particular, and reinforce social values for all children and citizens in the society;
- Initiate education and training program in fostering technical and administrative capabilities to local government and private personnel;
- Encourage waste separation and recycling program at sources - households, commercial centers, institutions and factories by employing segregation strategy that would fit the appropriate waste collection and disposal practices;
- Encourage research and development projects for suitable technology in coping with the mounting MSW management problems and enhance management efficiency through established academic and research institutes; and
- The coordination between stakeholders is important.

## **8. Conclusion**

The management of Municipal Solid Wastes (MSW) in South Asian cities still have many problems. The current regulation system is not perfect and the existing management system and the collection facilities do not fit the present requirements. Municipal solid wastes are still collected without separation at the source, treatment facilities are limited and the collected wastes are mostly dumped haphazardly in open areas. Government, NGOs, CBOs and private sectors are working hard in this field but still much needs to be done. The main management strategies to remedy this should include amendment of current laws and regulations, improve current management systems and introduce classified collections. The effective implementation of these strategies will help to solve the environmental pollution problems to a large extent. It is also important to observe that there are possibilities for research implementation and collaboration among developing countries having similar climatic and solid waste characteristics.

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