Social life cycle assessment of solid waste management in Kathmandu City Nepal

Pradip Gautam

ParaCon Consult Private Limited, PO Box 13220, Kathmandu, Nepal

Pradip.gautam1@gmail.com

Abstract A social assessment was carried out under the framework of Social Life Cycle Assessment (SLCA) to assess the social components under current SWM practices in Kathmandu (KMC) Nepal. Stakeholders mainly the waste dependent workers, city inhabitants, city dwellers, municipality authorities were consulted in order to assess the attributes of human rights, working condition, health and safety, cultural heritage, decision making and socio-economic repercussions associated with the SWM of KMC. Traditionally, waste work has been assigned to the low caste groups living in residential segregation. The discrimination persists even in modern educated Nepali society where it has been declared illegal. Due to misconception, waste pickers are often regarded as beggars and suspected of being thieves. Reusable and recyclables from urban wastes are fulfilling the basic needs of many waste workers. Nearly 80% of their income is spent on food and water. Hundreds of people are directly employed by the KMC but thousands of other informal workers building their regular occupations upon wastes. They are compelled by the cost and scarcity for basic needs and try to retrieve items, which are discarded by the better-off society. Most of workers are unskilled and merely educated. They do not use safety mates and suffer from diseases. They are often indebted to scrap dealers who provide cash advances or lend bags, cycles, and tri-cycles for collecting recyclables. Waste workers are deprived of same services themselves because they live in slums, ignored by municipality and government. The perception of the waste workers reveals that they are in the lowest of the social order in urban areas where they work. Women and homeless children are most affected among others who are in this type of work. After having the social debate in SWM decision-making it has been concluded that success of any new initiative for SWM of KMC will largely depend upon more rational and humane processes of decision making that allow for progressive adaptation as social and environmental knowledge grows and people's need and values change.

1 Introduction

Kathmandu, the capital city of Nepal is currently suffering from the improper municipal solid waste (MSW) management. As solid waste management (SWM) is the responsibility of city authority, the tendency of them is to seek the solution by attributing SWM largely as an engineering function. In fact, waste generation is mostly related to social and economical aspects. People in search of a better life and higher standard of living, consume more and generate more wastes without themselves making any provision for its management. As a result, unmanaged MSW like indiscriminate dumping of waste on street, open public spaces, and river banks, clogging of urban drainage systems, contamination of water sources, proliferation of insects and rodents, direct exposure to clinical and industrial wastes, etc are posing a serious and continuing threat for the stakeholders. The scenario in Kathmandu is comparable with other least developed Asian Country Cities (for example see Alamgir et al 2005).

The main source of MSW is domestic; others include commercial (shopping centers, hotels, restaurants, and other recreation places), institutional (schools, colleges, universities, governmental and private offices), construction and demolition wastes and detritus from municipal services such as street sweeping and drain cleaning. Wastes from hospitals, clinics are often deposited with general municipal wastes. Industries located in and around urban areas discard parts of their waste materials at the local waste assembly points where they mix with other MSW.

When residents of this metro city are suffering from the inadequate or unavailable solid waste collection and disposal services, the informal sector is playing an important role in recycling of solid waste thus contributing to the environment and making their lives out of it. Owing to the slow progress in proper MSW management and growing frustrations among the city dwellers as reflected in the ICIMOD (2007), JICA (2005), government of Nepal through the ministry of local development (MoLD), solid waste management and resources mobilization center (SWMRMC) has invited the private sector for partly take over the waste management of KMC (www.swmrmc.gov.np). As municipal authority, generally prefer to have the techno-managerial solution to waste management undermining the social dimensions of waste dependent livelihoods. This study is particularly focused on the waste workers role in the selective life cycle stages of waste management.

Life Cycle Management creates an essence of awareness on the environmental protection, the risks of tradeoffs among possible impacts associated with products (both manufactured and consumed) and the need to move beyond the conventional engineered solutions to more holistic approach while developing methods to better understand and address key impacts along their life cycle.

It is believed that the Life Cycle Thinking helps planners in business and governments to develop a holistic view. It expands the traditional focus on the production site and manufacturing processes and incorporates various aspects over its entire life cycle from cradle to grave (UNEP 2009).

Life Cycle Approaches are currently reflecting the incorporation of life cycle thinking in decision making processes and encompass various tools to avoid burden shifting between impact categories, products, dimensions (social vs. economic vs. environmental).

Social Life Cycle Assessment (S-LCA) is a technique to evaluate social positive and negative impacts of products/services along the life cycle of a product/service (UNEP 2009). The birth of the SLCA was mainly due to the recognition that the enhancement of Environmental LCA alone could not achieve the agenda of sustainable development in developed and least developed economy. As per the task force for the developing guidelines for SLCA, the need for it was motivated by a consensus that 'the use of LCA is hampered in developing countries clearly due to lack of expertise, data etc., but also due to the inability of LCA to engage in developing countries key issues'.

2 Goal and scope definition

The goal of this study is to identify social hotspots in the current solid waste management (SWM) practices of Kathmandu metro city (KMC). The outcome of this study will be useful to the recent government initiative for the integrated SWM of KMC.

The study will be confined in the KMC. Data and other information are collected from literatures and informal interviews. There are three steps namely, generation and storage at source; collection; and disposal of wastes in the current waste management system of KMC. These steps are further elaborated in the figure 1.

This study is mainly focused on collection and disposal part of the municipal solid wastes management in Kathmandu city.

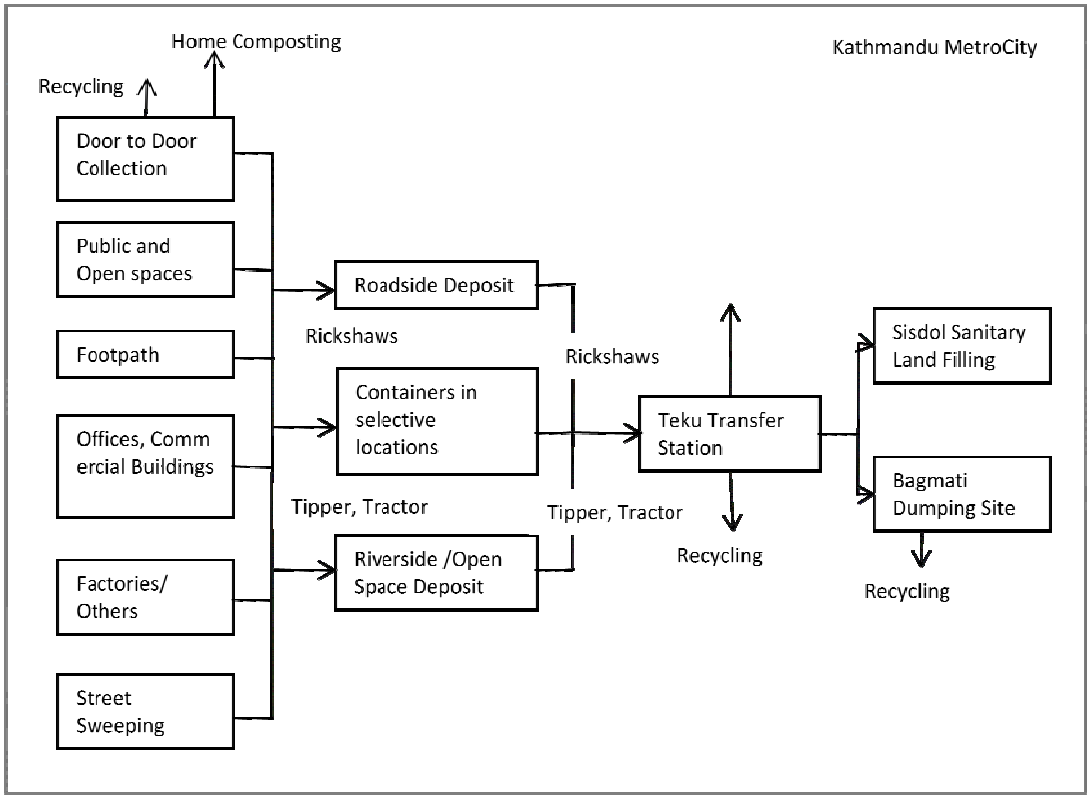

Fig 1: Municipal solid waste flow diagram of KMC

MSW is generally stored at the household in single bins made of plastic or metal of different shapes and sizes, or in polythene-bags or discarded containers. Further, wastes irrespective of type are generally deposited in community bins, street corners, riverbanks and open spaces, either by residents themselves or by waste workers from NGOs, CBOs, city authorities, institutions or private sectors from households. In general, the city authority collects waste from the secondary points (like roadside deposits, containers, and open space deposits) and deposits it at the designated disposal sites. Major portion of inorganic non-hazardous and slowly degradable organic wastes are recycled and reused, whether from the generation points, during collection, from secondary points and even from or at disposal sites. Composting, a common option for treatment and reuse of organic portions of MSW is done on a small scale by urban dwellers, NGOs, the private

sector and even Municipality. However, bulk of waste remain unmanaged thrown into open spaces, roadsides, riverbanks, drains etc. very small fraction of clinical wastes are incinerated and bulk of it follows the path of MSW.

Waste workers collect the household containers from the households and then empty the wastes into their rickshaw (tricycle container). Generally, the rickshaw has only a single compartment, so the waste is mixed after the collection of waste from HHs even if these were separated at source. In the absence of door-to-door collection system, the house dweller or their servant are responsible for carrying the waste to nearby local assembly points or community bins.

3 Waste Recycling

Generally, recycling is carried out in three phases of waste management. In the first phase, source separation occurs where the generators separate refuse of higher market value (e.g., papers and paper products, bottles, fresh containers, plastic items, tin, glass, metal, old clothes, shoes, etc) for sale to street hawkers. Hawkers buy recyclables and reusable from home to home and sell them to the small recycling shops nearby. In the second phase, the poor, women and children of slum dwellers collect different items typically of lower market value, from on-site storage bins/containers, and open storage spaces. The items include broken glass, cans, cardboard, waste papers, rags, plastic items, metals, and miscellaneous commercial waste discarded by the affluent households. The final phase is the recovery of the reusable and recyclable materials from the transfer stations and dumping sites. Waste workers salvage recyclable wastes, mainly when the vehicles are unloading at the dumping sites with all the associated safety risks. The reclaimed materials are passed on to small reusable/scrap material shops which are more than 600 in numbers, where the intermediate processing such as washing, drying and sorting out are carried out on a viable scale, before they are sold onto wholesale market. Finally all reclaimed materials are supplied to appropriate processing factories (partly in Nepal for example iron and steel industries, plastics, beer factories and bulk of it to bordering towns of India) for reuse as raw materials. Estimated 116 tonnes of recyclable materials counting 84% of the total are exported from the Kathmandu Valley (Nippon Koei & Yachiyo Engineering 2005), excluding bottles, animal feathers and waste oil from automobiles. Rests, 16% of recyclable materials are recycled within the Valley.

Under the same study (Nippon Koei & Yachiyo Engineering 2005) it was mentioned that 70% of the recyclable paper collected is recycled in Nepal and the remaining 30% is exported to India. Similarly, 70% of collected bottles are reused in Nepal and the rest goes to India. In metal, particularly iron, 50% is used in Nepal by iron industries such as Ashok Iron Industry and Jagdamba Iron Industry. The remaining iron scraps are also exported to India. Meanwhile, 85% of aluminum and copper scraps are used in Nepal and the remaining only exported to India. All 100% of the collected motor batteries are exported to India. In plastic recyclable materials, 30% of collected material is utilized in Nepal, while the remaining 70% is exported to India.

4 Stakeholder analysis

In this section, the current views of the main stakeholders are presented. These views are primarily based on interpretations of literatures, and informal interviews. As KMC intends to adopt the integrated solid waste management (ISWM) approach, it is crucial that Kathmandu Metro-City administration try to identify and to understand the views and needs of particular actors relevant for the city.

Stakeholder analysis is a systematic approach where effort is put mainly in collecting information about groups or individuals who are or who will be affected by decisions, categorizing that information, and explaining the possible conflicts that may exist between important groups and areas where tradeoff may be possible.

Mainly two dimensions of workforce “formal” and “informal” are involved in the waste management of KMC. Formal is associated with the public bureaucracies or private sector corporations and registered businesses with an organized labour force governed by the labour laws, with capital investment and modern technology. Whereas, informal is associated with unregistered, unregulated, or ccasual activities, individual and family enterprise, small scale and low capital input, local materials and labour intensive techniques (Furedy 1990).

It was learned that the informal sector is central to the functioning of Kathmandu city’s waste management. Informal waste workers are in large number than formal ones and owing to the difficulty of getting the distinguised data for each groups,

the term 'waste workers' has been used to represent all the workers associated with waste management.
Broadly, four categories of stakeholders are identified. These are Workers, Local Community, Society, and Value chain actors. Further, these categories are presented in groups of stakeholders. They are presented in the table 1. Interests and importance to the waste management varies among the stakeholders. Most of them might not recognize immediately the full importance of waste management to their livelihoods and welfare. Others have narrow interests or fluctuating ones. Assuming their direct roles in the waste management, these are the core stakeholders in the context of SWM in KMC. The key groups of stakeholders within these categories are explained in the subsequent paragraphs.

4.1 Kathmandu metropolitan city (KMC) office and SWMRMC officials

Solid waste management and resource mobilization center (SWMRMC) is an apex body under the ministry of local development (MoLD), government of Nepal to formulate the policy and provide technical support associated with the waste management in all 58 municipalities of Nepal. After the promulgation of local self-governance act, all municipalities are authorized to plan, manage their wastes, and collect the levy to do so.

Officials either from the Kathmandu metrocity (KMC) or from SWMRMC are concerned with collecting and disposing of wastes to minimize health hazards and nuisances. Their wish is to distance people from wastes, by using machines to reduce waste handling, by restricting people's access to wastes, and by locating dumpsites as far as economical from city settlments. They do not deploy the instruments to address waste reduction processes, nor do they encourage waste reuse and recycling directly. They force the public to cooperate, to obey regulations on waste disposal, but they rarely encourage people to express their needs and perceptions.

4.2 People living in slums and squatter settlements

Poor people are much more likely to see wastes as resources that may be used as substitutes for regular market goods than are the better off. They are not distanced from wastes and generally accept a degree of intimacy with their wastes that

would be burdensome or toxic to others. They have little awareness of the specific hazards associated with accumulated solid wastes. Poor families find the requirements that they have to meet in order to benefit from municipal waste removal services burdensome; they lack the time and resources to conform too much of what the municipal authorities expect. They rarely can articulate ideas about their living environments, or to learn essentials that would make waste management ideas sensible to them.

4.3 Higher income families and middle class residents

Well-off householders share the prevailing view of their garbage as a nuisance and potential hazard that first servants, and then the city authorities must deal with. Their preoccupations are with the regularity and general convenience of waste collection. They hardly recognize that consumption of modem consumerism and packaging has augmented waste problems, although middle-aged people will remember, when prompted, the careful, conserving habits of earlier days.

Middle class people in KMC as in other municipalities of Nepal do view wastes as resources, and engage in source separation, if they can recoup some of their housekeeping expenses by selling wastes to itinerant collectors, but there are limits to how much inconvenience they will put up with for small returns from this saving and trading.

4.4 Poor people whose livelihoods depend on wastes

Children particularly street children, families at or near dump sites, itinerant collectors or ‘rag pickers’ and workers in cottage industries are among those poor people residing in the marginal areas mostly along the corridors of Bagmati River and its tributaries. For them, wastes are vital resources, and the hazards associated with handling and transforming wastes can hardly be taken into account. They have important knowledge about the nature of wastes in the city, and the actual and potential ways in which resources can be saved and recycled. In spite of severe financial and technical constraints, they apply this knowledge to earn a living. Even when they earn much more than formal sector workers, social prejudice and lack of education usually prevent them from improving their living conditions (Furedy 1990).

4.5 Waste-selling intermediaries and waste-using manufacturers

Waste sellers recognize the value of wastes. However, they may be unconcerned about the savings to society at large or to the municipality (which thus has less waste to dispose of) from this recycling. Mostly they depend upon informal workers to retrieve, deliver, sort and process wastes and these workers have no bargaining power to press for improved wages and working conditions. The commercial exploiters of wastes will be reluctant to make improvements for the benefit of workers or the immediate environment. Nevertheless, it is essential to understand their views and bring them into solid waste planning.

4.6 Local manufacturers, suppliers, advertisers

These yet are not aware of how their products design policies, modes of manufacturing, and packaging contribute to solid waste problems. They will see themselves constrained by competition, regionally and nationally, from making innovations (e.g. clean, waste-free processes) that will reduce waste generation. Strong consumer demand for environmentally friendly products might begin to influence their thinking.

4.7 Nominated CEO or elected city mayor

After the democracy came into this country, elected members of city administrations do not generally take a lead in integrating environmental concerns into urban policies. If city clean ups or environmental issues have publicity value, their backing can be relied on, at least for a time. Key figures like mayors or chief executive officers can be very influential who can have an impact on thinking about the status of city cleaners. Outstanding leaders could be important in local attitudinal changes and could influence routines of waste collection and disposal.

4.8 Non-governmental organizations

A number of non-governmental groups are active in KMC. Two types of groups have interest or influence in SWM: one is groups working directly with waste

pickers; the other one is environmental groups. The groups working for the welfare of waste pickers are those that are concerned about street children (who usually live by waste retrieval) like CWIN Nepal and those aiding community developments of picker communities at dumps or in squatter areas. For the most part, they are preoccupied with helping particular individuals and families to gain the education and skills necessary to move out of waste picking into safer and better work. These groups have a knowledge of attitudes and behaviors both among the waste workers and people who interact with them.

Environmental NGOs are less interested in solid wastes. They think that other topics such as hazardous wastes and global/regional environmental deterioration should have priority. They may even think that the solutions for solid waste problems are simply those of more efficient municipal service and appropriate disposal designs. They are less aware of the fact that accumulating wastes are the consequence of excessive resource exploitation, inappropriate products, excessive consumerism, and environmental thoughtlessness.

4.9 Environmental educators

Environmental educators in Kathmandu have not taken a broad view of wastes from a societal perspective, integrating waste reduction, reuse and recycling into their policy recommendations. (Recommendations for recycling are based on highly mechanized, imported techniques rather than community recovery/ recycling). They are mainly occupied with the curriculum for schools, they have tended to suggest awareness raising through anti-litter campaigns. Now, though, with more professionals taking an interest in global environmental problems, including resource depletion, there is the possibility of interesting a much wider group of educators in the basics of waste reduction, recycling and residue management.

5 Inventory analysis

Inventroy indicators were used to idnetify the condiiton of the solid waste management (SWM) in KMC. Inventory indicators provide the most direct evidence of the condition or result they are measuring (UNEP/SETAC 2009). Key inventory indicators along with their characterstics such as type and units are provided under each indicators.

5.1 Freedom of association and collective bargaining

Independent garbage cleaners union of Nepal (IGCUN) was founded in June 1990. It is an affiliate of general federations of Nepalese trade unions (GEFONT) and received the affiliateion with the IGEM in August 2003 (GEFUNT). About 1000 KMC waste workers are affiliated with the IGUCN but none of the informal waste workers is included in the IGUCN. It is also estimated that more than 2,500 informal waste workers are working in the City (Nippon Koei & Yachiyo Engineering 2005) without affiliation with formal unions. Most of cycle hawkers and small scrap shops are registered with the Nepal Recycle Producer Association (NEREPA), an association of buyers of recyclable materials in the Kathmandu Valley. Government of Nepal (GoN) has already ratified ILO core conventions (www.ilo.org). Due to work inexperience, reluctance and barriers to strikes, there is little collective bargaining in practice. It will take a long time to bring in the informal waste management sector within the umbrella of current union IGCUN becaue only 10% of the workers from formal economy are in a position to collective bargaining agreements in the country (www.ilo.org).

5.2 Child labour

Data revealed that 34% of children aged between 5 to 14 years in the country are engaged in child labour (CBS 2008). Among them 30% of total are male child and 33% of total are female child. According to one ILO Report, 963child labours are engaged in the rag picking (CDPS/ILO 2001) and this number is further estimated to be 1000 in the year 2000 by the (CWIN 2000).

5.3 Income source & fair salary

From an informal survey, it is found that the waste pickers earn Rs.15, 000- Rs.22, 500 (approx. $225 to $300). This amount is found to be above the regular minimum salary of the government employee. Nevertheless, social barriers while translating their earnings into improved standards of living (Furedy, 1990) usually inhibit waste workers.

5.4 Working hours

There are two shifts (six hours in the morning and six hours in the evening mainly for street sweeping) of work to the formal waste workers assigned by the Kathmandu Metro City (KMC) but there are no fixed hours of work among the informal waste workers. For informal waste workers, their earnings are associated with the amount of recyclables they can collect and to collect more they have to work for long. Working hours range between seven to nine hours and they usually start from early morning. Usually informal waste workers work in a group of four to five and collect the valuable waste items.

5.5 Forced labour

Workers are bonded/indebted by the debts from the local scrap collectors and dealers. They usually provide some advance and many times tools like rickshaw (tricycle), bicycle, to carry recyclables.

5.6 Equal opportunities/Discrimination

5.6.1 Traditional groups

Like in many other Asian cities, traditionally, only a special caste (i.e. Pode or Chyame) was involved in waste management activities in Kathmandu. In the past, these people collected the waste from settlements using primitive tools such as buffalo ribs to lift the waste and shoulder baskets (Kharpan) to carry the wastes (Thapa and Devkota 1999). The wastes collected were dumped on nearby riverbanks or in open fields. Still, majority of formal waste workers come from this caste group in the KMC. They usually live in residential segregation and are subject to other forms of discrimination. This discrimination, subtle or unsubtle, persists even in well-educated society of Kathmandu where it has been declared illegal.

5.6.2 Social order

Many of the waste workers are migrants from the nearby villages of Kathmandu valley. Except to those traditional waste workers, others have been found to place

themselves very low in the social order. Many of those waste workers who came to Kathmandu with a hope to get into the mainstream of urban society are hesitant to tell their fellow villagers about their job in the city. Further to this, waste pickers are sometimes regarded as tramps, vagrants and commonly suspected of being thieves.

5.6.3 Women and children

As a common practice among the informal and poor households throughout the country, women are usually the main providers or organizers of daily household needs; they collect fuel as well as prepare food and fetch water. Among the waste collecting and sale of reuse dependent families, women's work is closely linked to the nature and availability of wastes (Furedy 1990). It was observed that the large numbers of the waste workers particularly among street and dump pickers are women and children.

5.7 Health and safety

Waste workers are the most vulnerable for the infectious diseases including the hepatitis, tuberculosis, asthma, and skin infections among others. The irony is that the children involved in this job are particularly vulnerable to respiratory problems and parasitic infestations. There is no direct support from concerned authority to the waste workers, no provision of health checkups, no awareness campaigns, thus no motivation to the waste workers for behavioral change, and adaptation of the safety measures.

5.8 Social benefits/social security

Nepal does not have a social welfare system for all of its citizens. Those who are unable to afford to buy what they need mostly rely on the second hand gifts or access to the waste material discarded from the other rich communities. Resources to these families from waste range from housing, clothing, fuel, work and sometimes even food. It is rare that statistics record show how many people depend on urban wastes, but it is not that difficult to understand in a nation where the poor families spent nearly 70-80% of their earnings to feed themselves.

Tab.1: Inventory table (adapted from UNEP/SETAC 2009)

Stakeholder categories	Stakeholder Groups	Impact categories	Sub-categories
1.Workers	Poor people whose livelihoods depend on retrieving or recycling wastes People living in slums and squatter settlements including street children	Human rights	(a) Freedom of association and collective bargaining (b) Child labour (c) Income/fair salary (d) Working hours (e) Forced labour Equal opportunities/Discrimination (f) Health and safety (g) Social benefits/social security
2.Local community	Affluent and middle income class residents Local manufacturer, suppliers and advertisers	Working conditions	Access to material resources Access to immaterial resources Delocalization and Migration Cultural heritage Safe and healthy living conditions Respect of indigenous rights Community engagement Local employment Secure living conditions
Society	Members of non-governmental organizations concerned with welfare of the urban poor,environment, citizens' rights and safety Environmental educators	Health and safety	Public commitments to sustainability issues Contribution to economic development Prevention & mitigation of armed conflicts Technology development corruption
Consumers		Cultural heritage	Health and safety Feedback mechanism Consumer privacy Transparency End of life responsibility
Value chain	KMC officials and	Governance	Fair competition

actors	SWMRMC officials and their field staff Nominated CEOs/elected city mayors, officials Waste-trading intermediaries and business people depending upon wastes as feedstock for manufacturing	Socio-economic repercussions	Promoting social responsibility Supplier relationships Respect of intellectual property rights

6 Interpretation and conclusion

This study was aimed to identify the social hotspots associated with the current waste management system in the KMC. Identification of social hotspots is one of benefits of doing SLCA. The methodology for SLCA was adapted from the UNEP/SETAC (2009). However, the study could not fully adapt to the framework and guidelines. It is because the published guidelines mainly focussed for a product but not to the other sector like management system. The inventory data could only be found for the workers.

Waste workers are not organised in an association. Their freedom of association and collective bargaining is hindered due to various factors among which ignorance by affluent society is . Although they are the 'living machines' helping to keep the Kathmandu city clean but they are treated as beggars and suspected of being thieves. Their contribution in mainiainting the city aesthetics and over all environment is very high. The perception of the waste workers reveals that they are in the lowest of the social order in urban areas where they work. Women and homeless children are most affected among others who are in this type of work.

Management officials fear that the public participation in waste management would be counter-productive for waste management. They want to have a better capacity for regulation and enforcement, hoping that the threat of stiff penalties will bring general public compliance. They are inclined to favour mechanized schemes to manage the waste.
When the Solid Waste Management (SWM) problems are deeply rooted in the complex socio-cultural, economic and political factors, looking only to the technical and managerial solutions are not sufficient.

7 References

[1] Alamgir, M., McDonald, C., Roehl, K.E. & Ahsan, A. (2005). Integrated Management and Safe Disposal of Municipal Solid Waste in Least Developed Asian Countries. Department of Civil Engineering, Khulna University of Engineering & Technology (KUET), Bangladesh.

[2] CBS (2008). Report on the Nepal Labour Force Survey. Central Bureau of Statistics, National Planning Commission Secretariat, Government of Nepal, UNDP, ILO, Kathmandu Nepal. http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-kathmandu/documents/publication/wcms_118294.pdf (Accessed 2/4/2011)

[3] CDPS/ILO (2001). Nepal Situation of Child Rag pickers: A Rapid Assessment. Central Department of Population Studies (CDPS), Tribhuvan University, Kathmandu, Nepal International Labour Organization International Programme on the Elimination of Child Labour (IPEC) November 2001, Geneva

[4] CWIN, (2000). Annual Report of the CWIN Socialization Centre. Child Workers in Nepal Concerned Center (CWIN) Kathmandu.

[5] Furedy, Christine (1990)."Social Aspects of Waste Recovery in Asian Cities." Environmental Sanitation Reviews series, No. 30. Bangkok: Environmental Sanitation Information Centre, 1990, pp. 2-52.

[6] http://www.ilo.org/dyn/natlex/country_profiles.ratifications?p_lang=en&p_country=NPL (Accessed 2/4/2011)

[7] ICIMOD (2007) Kathmandu Valley Environment Outlook. ICIMOD, Kathmandu Nepal

[8] Nippon Koei & Yachiyo Engineering (2005): The study on the Solid Waste Management for The Kathmandu Valley, CKV study report, Japan International Cooperation Agency (JICA) assistance to Nepal.

[9] Thapa, G.B.; Devkota, S.R. (1999) Managing Solid Waste in Metro Kathmandu. Studies in Regional Environmental Planning, ACRD Monograph 1, School of Environment Resources and Development. Bangkok: Asian Institute of Technology

[10] UNEP/SETAC (2009). Guidelines for Social Life Cycle Assessment of Products. UNEP-SETAC Life-Cycle Initiative, France.

[11] UNEP/SETAC Life Cycle Initiative (2010). Methodological Sheets for 31 Sub-Categories of Impact for a Social LCA of products. Online http://www.estis.net/sites/lcinit/default.asp?site=lcinit&page_id=A8992620-AAAD-4B81-9BAC-A72AEA281CB9