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REVIEW ON PARTICIPATORY APPROACH OF SOLID WASTE MANAGEMENT WITH SPECIAL FOCUS ON LALITPUR METROPOLITAN CITY, NEPAL

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ABSTRACT

This study was conducted during the period of March 2017 to February 2018. Secondary literature survey and field observation were the techniques of data collection for this study. Nepal has Municipal Solid Waste (MSW) generation of 0.50 kg/capita/day and average rate of 91.3 to 182.5 kpc in municipalities. The developing countries like Nepal are facing this problem in many folds as compared to the developed ones. The worldwide estimation of MSW generated is 1.7–1.9 billion metric ton. But the waste generation rate differs from country to country. Despite various efforts contributed by governmental agencies in waste planning, they are not able to improve at far extent as assumed. However, these days, administration has explained insufficient participatory approach in decision making as one of the main reason for the failure of waste management plan. Participatory approach is not only limited to public involvement but also considers several agencies that initiates participation through various media and helps in upgrading standard.

1. INTRODUCTION

Developed and developing countries around the world are alarmed of the consequences of detrimental waste management system. The worldwide estimation of MSW generated is 1.7–1.9 billion metric ton (UNEP, 2010). The waste system not only deals with treating solid wastes but employs trash as valuable resources. Waste can be used as massive potential of energy; however the opportunity has to be implied properly and efficiently. The developed countries have demonstrated effective example of waste to wealth theory and the developing countries are struggling for the same (Thapa, 2017).

As so, Nepal has recently initiated several projects of waste exploitation of which pilot project by KMC (Kathmandu Metropolitan City) has successfully produced 14 KWs electricity by adapting methane plant (Chikanbanjar, 2017). Despite various efforts contributed by governmental agencies in waste planning, they are not able to improve at far extent as assumed. However these days, administration has explained insufficient participatory approach in decision making as one of the main reason for the failure of waste management plan (Squires, 2006). In fact, several wards of Lalitpur Metropolitan City (LMC) of Nepal had already started the practice of involving individual, local group and private sector in decision making that had helped to provide employment opportunities and waste minimization in Lalitpur ward.

1.1 MSW AND WASTE GENERATION

Municipal Solid Waste is defined as any of the discarded material by public collected and treated by or for municipalities (Organization for Economic Cooperation and Development (OECD, 2007a). According to the opinion number (12-97) of The Office Of The Attorney General, Tennessee (2012), MSW covers waste resulting from the activities of residents, yards and garden,

commercial and institutional buildings as well as street sweeping but excludes waste from private disposal treatment system, construction and demolition actions, municipal sewage networks and hazardous as well as infectious waste. The terms of municipal waste varies in national definition in developed and developing countries (OECD, 2007a). The United States refers Municipal Solid Waste as garbage or trash unlike Britain where the municipal waste is regarded as refuse or rubbish. The developing nation lacks technology and economy for segregating and treating MSW separately hence, can be classified as hazardous or non-hazardous waste. In developing nations, Municipal Solid Waste is generally defined as the waste produced in a municipality (Karak, Bhagat & Bhattacharyya, 2012). In contrast, Code 20 03 01 in the European Waste Catalog states MSW as mixed municipal waste which generates from different source and not only from municipalities (Scottish Environment Protection Agency, 2015).

The nations from Asia displayed waste generation as 0.2 to 1.7 kg per day (Visvanathan & Trankler, 2003). Among which China with large number of population i.e. 592.68 millions in 2006 signified 38% of population being urbanized and waste management being greatly affected (Karak et al., 2012). In addition, being extremely influenced with tourism, Maldives has the utmost MSW generation rate (905.2 kpc) in the developed Southeast Asian countries. At present, Sri Lanka has one of the highest urban MSW generation figures of 0.89 (kg/capita/day) among the low income developing countries (World Bank, 1997a). Karak et al. (2012) mentioned that the current waste scenario will worsen by 2021 with data of 6.21–9.13 million tons per year.

Nepal, one of the developing countries with low income source has MSW generation of 0.50 kg/capita/day and average rate of 91.3 to 182.5 kpc in municipalities (World Bank, 1997a). A study in 1991 illustrated that the total waste in about four decades (1952–1991) risen by factor of 3 and the average in between 2001 and 2002 increased by 20% (Karak et al., 2012). The per capita

generation of solid waste in 2007 was within the range of 73.0–328.5 kpc with the GDP of \$US5, 047. Solid Waste Management and Resource Mobilization Center (SWMRMC, 2004) conducted a survey in 2003 in all the 58 municipalities of Nepal to find an average of 91.3 kpc and discovered the rate differed in various stations from 92.2 to 255 (kpc). The developing countries in Asia (except Japan, South Korea, and Singapore) lack well planning and strict policy guidelines concerning waste management services which tends to destroy the efforts of municipal agencies for managing even lesser amount of waste.

1.2 COMPARISION OF COMPOSITION OF MSW

Substantial classification of waste is essential for each country to develop proper management plans and techniques for successful operation. The categories of the waste determine the methods and techniques to be adopted for the waste handing before its disposal. The MSW comprises of organic waste, plastics, paper, glass or ceramics, metals and others (Karak et al., 2012). The composition is shown in Table 1.

Table 1: Composition of Solid Waste in Developing Countries

Country	Compostable	Paper	Plastic	Glass	Metal	Others
Nepal	80	7	2.5	3	0.5	7
Bangladesh	84.37	5.68	1.74	3.19	3.19	1.83
Myanmar	80	4	2	0	0	14
India	41.8	5.7	3.9	2.1	1.9	44.6
Lao PDR	54.3	3.3	7.8	8.5	3.8	22.3
China	35.8	3.7	3.8	2	0.3	54.4
Sri Lanka	76.4	10.6	5.7	1.3	1.3	4.7

Indonesia	70.2	10.6	8.7	1.7	1.8	7
Philippines	41.6	19.5	13.8	2.5	4.8	17.8
Thailand	48.6	14.6	13.9	5.1	3.6	14.2
Malaysia	43.2	23.7	11.2	3.2	4.2	14.5
Hong Kong	37.2	21.6	15.7	3.9	3.9	17.7
Singapore	44.4	28.3	11.8	4.1	4.1	6.6
Japan	22	45	9	7	6	11

Source: Hoornweg and Thomas, 1999

The study conducted from 1983 to 1985 in Germany stated composition of organic waste as 27% of total waste. The adoption of bag system (wastes separated in different bins) throughout the country decreased to 14% presently (OECD, 2007a). In general, MSW typically include larger amounts of organic and paper waste as compared to the fraction of plastics, glass and metals.

Many municipalities of Turkey contains high amount of organic MSW (43–64%). Similarly, large percentage of organic waste was discovered in European countries as (OECD, 2007a) Austria (35% in 2004), Belgium (41% in 1995 and 39% in 2003), Bulgaria (41% in 1990), Cyprus (39% in 2005), Denmark (29% in 2003), Greece (47% in 2001), Lithuania (36% in 2010), Poland, Spain with predicted figure of 70.5% in 2016 and Moldova with 68.5% in 2003. Malaysia includes organic waste (51%), paper (15%), plastics (14%), glass (3%), metals (4%) and other (13%) which clearly shows the largest percentage of waste (Karak et al., 2012). In addition, organic composition of solid waste in Asia appears to be higher in comparison to other waste as well.

However, the informal rag pickers and intensive waste collection centers have contributed in the declination of paper, glass and plastic wastes (Visvanathan & Trankler, 2003). In the same way,

the MSW production in Kathmandu Valley of Nepal is changing its pattern from the last year. It is due to the rising trend in paper and plastics products (packaged food, etc.) as the effect of progressing urbanization. Thus, quantity of biodegradable waste is more noticeable in low income developing countries. In fact the higher composition of the organic waste in various countries overlooks mass of other MSW.

1.3 HISTORY OF WASTE MANAGEMENT IN NEPAL

The management of municipal solid waste in Nepal started only after 1980 with the establishment of Solid Waste Management Resource Recovery Mobilization Centre (SWMRMC, 2004). Before 1970, the municipal wastes were handled locally as the large amount of waste was organic in nature (Gotame, 2012). Most of the houses in the cities usually had a common courtyard which was used as dumping spot for waste. Approximately, all organic nature waste was used as fertilizers in farmland and inorganic waste was used for other purpose. People managed to have land and used the waste as compost. When the waste was large in amount, it was the duty of adjacent household to dispose it off (McAllister, 2015). With the start of waste management offices and work division to staffs, people no longer felt that waste management was their responsibility and ignored the practice of managing waste themselves (Nyachhyon, 2006).

The research from the University of Stuttgart outlined the lack of aid and practices in management of MSW which led to establishment of bilateral agreement between the Nepal and German government in the form of The Solid Waste Management and Resource Mobilization Committee (SWMRMC, 2004). It mainly aided three main cities of Kathmandu Valley- Kathmandu, Lalitpur and Bhaktapur with the financial support of GTZ (Deutsche Gesellschaft für Technische

Zusammenarbeit). It founded separate institution for waste collection and established Compost Resource Recovery Centers at Teku in 1985 and sanitary landfill site at Gokarna in 1986.

Similarly, public participation approach was introduced by SWMRC with communal containers, mass media campaigns, local radio and television station and the Flying Squad -three-wheeled vehicles that broadcasted the significance of waste management habits. Although with these best efforts mere change in waste disposal behavior was observed among the people. After the shutdown of both the facilities in Teku and Gokarna due to the opposition from the locals, Shova Bhagawati served as temporary dumping site for one and a half year till 1995. This resulted in dumping of waste along the side of Bagmati by the local office ([Gotame, 2012](#)).

There was no specific, systematic or comprehensive plan for waste management till 1996. Ministry of Local Development, Pulchowk has enacted [Solid Waste Management National Policy 2053 \(1996\)](#) where Katmandu has included the policy of conducting public awareness promotion campaign in order to gather huge public participation to minimize the generation of the solid wastes. With the realization of importance of public participation in [SWM \(1997 to 2001\)](#), NGOs and private sector were emphasized to participate in waste management. Also, composting and its strict implementation were stressed. Similarly, 'Polluters Pay Principle' was introduced in [Tenth Periodic Plan \(2002-2007\)](#). In 2005; another landfill site was initiated in Sisdol, Okharpauwa with large capacity of waste disposal which is completely occupied presently ([Singh et. al., 2015](#)).

The Nepal Government passed an Act of Solid Waste Management in 2011 (Government of Nepal, 2011). The major objectives of the act were to maintain sanitary environment by diminishing negative impacts of litter on health of public and environment. The act regulates municipal authorities to formulate necessary plans to segregate MSW at source. They have been authorized

for the total management process of infrastructure for assortment till treatment of MSW. However, scenario is different as lack of SWM baseline information along with functional elements data has ended up in difficulties for preparing management plans to local bodies. The SWM and Resource Mobilization Center had made an attempt of collecting SWM information for 58 municipalities in 2003 ([SWM in Nepal: Policy, 2013](#)).

The attempt of updating the statistics was ineffective due to inconsistent technical methods and mainly other public services gets higher demand in Nepal, the findings of the study was irregular ([Thapa & Murayama, 2010](#)) ([CBS, 1997](#)) states no more than 17 % of the city area has proper waste collection system. The waste has started to be a problem now. In the past, people were even practicing the process of recycling metal box. But now, the urbanization and changing of people eating habits has increased the waste (mostly wrappers of food items).

1.4 WASTE MANAGEMENT PRACTICES

MSW Management is environmental issue as well as sociopolitical problem. [Nyachhyon \(2006\)](#) defined waste management as not only about waste disposal but even the collection and transfer of waste to disposal site. It mainly involves process of production minimization, involving the communities, regarding waste as economic resource and ultimately considering safety of human health and surroundings. Municipal Solid Waste Management mainly comprises of storage and collection, transportation, treatment and disposal system.

Each component has its own role to play for the efficient and effective waste planning. The collection section forms a trend of proper storage of waste among public for easy access of collection of garbage from sources. The main function of transportation sector in MWM is to convey waste to the transfer stations and then to disposal sites. Generally, developed countries are

observed performing treatment of waste before disposal although the developing countries lack this facilities. The final section is disposal system which follow practice of incineration, landfill, composting and waste prevention (reduce, reuse, recycle and recovery) (**Barbalace, 2003**).

Dumping/Sanitary Landfill: Traditionally, landfill plays significant role in final disposal of wastes. However, availability of land for waste disposal is very limited in larger towns or cities. Indiscriminate dumping method has increased rate of environmental degradation in urban area. Oftentimes social, economic, environmental and technical constraints have to be considered to operate the waste management system effectively. **Barbalace (2003)** states that people living around the landfills have to heavily pay for their health. The dumping sites are unsafe as they are not covered and factors such as flies, rodents, odor, and vectors are common in dumping sites. The disposal sites are mainly located in low-lying areas, environmentally sensitive areas such as wetlands, water bodies or forest edge. They do not often have fences, soil covers and liners and are greater threat to groundwater and public health.

Burning: Similarly, burning is also considered as one of the health destructive method of waste disposal system. **Barbalace (2003)** states that case study in India found that waste was burned in many areas where the policy was not strictly implemented. Similarly, Nepal and Burkina Faso have the same conditions with 12% and 25% of the total MSW burning which emits toxic gas such as dioxins and furans (**McKay, 2002**). Although burning trash is illegal, thousands of people burn waste where garbage collection services are not available and they have no choice for disposal.

Recycling and Waste Prevention: Major part of world either incinerate or landfill Municipal Solid Waste for SWM. Nevertheless, large amount of organic waste in MSW can be used for alternative method as composting. **Barles (2005)** mentioned that there is nothing any actual scrap

in industry; everything must either be used for agriculture or for industrial purpose itself. By the late 18th century, the farmers had realized that food residues and also, human and animal excreta could be used as fertilizers. Hence, greater attention has to be given to source separation (organic and inorganic) along with composting and anaerobic digestion associated with biogas production. Though, the wastes that reach to the disposal site consist of greater amount of organic waste in both the developed and developing countries ([Karak et al., 2012](#)).

2. PARTICIPATORY APPROACH

In particular, collection of solid waste in various countries has been the sole responsibility of the municipalities. But due to limited resources and organizational capacity, the authorities lack in well-organized waste collection and disposal service availability for average of 50% of residents in urban areas of developing countries ([Parizeau, Maclaren and Chanthy, 2006](#)). Government budgets are limited and only the disposal part of the waste management system is related with the cost ([McBean, Rosso and Rovers, 2005](#)). As new landfill is proposed it is found that residents refuse to agree with the plan of landfill sites close to their territory and involve in protest.

As to say, municipalities counter more trouble in the disposal process but are compelled to effectively provide services which reveal that proficient organization in waste planning cannot be achieved only by involvement of municipal authority. However, the government has already realized that only change in attitude of people will assist in efficient waste management system. For this the municipalities has initiated formal and informal participatory approach involving coordination of local people and communities, private and governmental CBOs, NGOs and INGOs that are prioritizing reduction and recycling at source. The main bodies of the waste management system are: National Level (Local Development Ministry is concerned with supervision of

municipalities and VDCs), Municipality and ward office (Municipalities work with less interference of Governmental agencies. Municipalities and Ward offices have duty of all public development activities), Sectoral Agencies (Solid Waste Management & Resource Mobilization Centre acts as a sectoral agency in Nepal that works for upgrading of sanitation), NGOs (more than 2700 of NGOs has been registered in Nepal with only 5 or 6 actively involving in SWM) and Donor Agencies (UNICEF, German Agency for Technical Cooperation (GTZ), UNDP and the World Bank that offered economical and technical support in Nepal).

2.1 COMMUNITY PARTICIPATION

The first and foremost technique of waste supervision is avoiding creating waste at the first place itself. This requires higher public involvement which ensures a clean and healthy environment (Amasuomo, Tuoyo, & Hasnain, 2015). Proper waste management administration policy and Governmental organization serviceability such as urban development law, health, engineering, geography and economics has to be brought together for effectual waste management system. Private sector operators as actors add valuable contributions to the SWM sector (Ahmed and Ali, 2004). They reviewed community participation as *active contribution of the local people for making decision concerning development projects or implementation*.

Gotame (2012) states public participation as the process to extend the capacity of community to contribute to the development and assume responsibility for one's health and welfare. Community participation is key to successful management than any other service as they are the one who have to decide on what and how much to produce. Furthermore community participation is a continuous maintenance system for waste management (Anschütz 1996, cited in Gotame, 2012). For an example, community has the work of garbage to be stored in bag or bin, dry and wet waste to be

separated, etc. Community-based management projects are carried out by the community's members and are only concerned with collection of garbage. However, it is the responsibility of municipality to carry waste to dumping site.

Hoorweg and Thomas (1999) view participation to ensure that the world development projects are accessible to the needy people in most proficient or benefited manner. Nabegu and Mustapha (2014) state three major issues concerned with solid waste in Kano metropolis. First is when individuals ignore the pollution and do not consider how much waste they produce. Second is individuals pay less amount of prices in comparison to how much they produce. Actually polluters pay policy has to be implemented for the additional waste generated. And the third is association of poor waste management with negativity. For an example, In Kano metropolis, religious and cultural beliefs state that the disease and death are believed to be caused by God and fate, however it has not been proved so far (**Nabegu & Mustapha, 2014**). **Gotame (2012)** concludes that participation topic turned out to be 'tyranny' (unjust exercise of power) which has harmed those who were in need to be empowered. Participation fails to identify varying attitude of individuals, impact upon their preference and neglect the potentials links among participatory processes and subordination; although it has an essential part in imperishable development.

2.1.2 NGOs

The non-governmental organization (NGO) was introduced in 1945 when UN felt the requirement to set the difference between governmental and private agencies (**Gotame, 2012**). NGOs basically have self-governing and governmental interference free characteristics which states non-violent and non-profit making as well as must not represent any political party or criminal group.

NGOs practice various programs and plans for garbage reduction by implementing a range of educational programs for generating consciousness between societies, composting the degradable waste and selling the recyclable material and training people about the dry and wet waste with their segregation process (Kansal, 2002). Many NGOs have even provided support to informal actors (rag pickers) to provide them with facilities, organize the man help in reducing role of the private sectors. Also, the informal actors as rag pickers who are involved indirectly in solid waste management add to proficient organization.

Accordingly Rathi (2006, cited in Gotame, 2012) stated, Mumbai India has initiated 'Advanced Locality Management (ALM)' community participation in waste management where NGOs and community based organizations are working together. This community approach has an objective of providing waste facilities to civilians from the base level and help people in segregation, composting and selling the recyclables materials. Municipal Corporation of Greater Mumbai (MCGM) has been associating with it to carry out different educational programs and establish composting pits with total number of 360 ALM bodies and 283 composting institute.

2.1.3 PUBLIC-PRIVATE PARTNERSHIP

Nyachhyon (2006) refers Public-Private Partnership (PPP) as an agreement among the governmental agencies and the private sector for providing basic services to the civil societies. It basically aims to offer sustainability, environmental awareness, social responsibility and public accountability along with private sector (Community-Based Organization, Non-Governmental Organization and research groups). Through these partnerships managerial efficiency, technological knowledge, entrepreneurship, financial access, job generation, environmental awareness and local knowledge under mutually favorable circumstances can even be gained.

4Rs principle are being encouraged (Reduce, reuse, recycle, recover) among the local community in India to recover from deteriorating circumstances (Kansal, 2002). Also, waste management programs in Nepal are involving participants in educational trainings and environmental plan (Gotame, 2012). In Ghorahi, Nepal participation by the local residents is able to sum up good example in waste management where they are able to introduce a scheme of sanitary dumping site at Karauti Danda themselves by spending their own capital resources. They are using it for producing compost, bee-keeping and selling reusable items. Moreover, some inhabitants have started showing concern in the waste topics and have started participating in educational as well as vocational programs. Waste management programs as Suiro Abhiyan in different parts of Nepal have been implemented (Luitel, 2008). Similarly policies have been formulated based on ‘Polluters Pay Principle’. Accordingly, Table 2 shows the plans and programs conducted in Nepal.

Table 2: Plans and Programs conducted in Nepal

Initiated Activities in Nepal (Name of the Programme)	Donors and Partners	Municipal Vision
SWM in Bhaktapur (2003)	CBO, GTZ, NGO, Nepal Government	Traditional but sanitary city.
SWM in Tribhuvan Nagar (2005)	Nepal Government, NGO, TLO, UNDP-RUPP, GTZ – UDLE	Safe and healthy community area
SWM in Bharatpur municipality (1999)	Private sector, Practical Action Nepal, Lumanti	SWM by PPP
SWM in Biratnagar (1997)	CBO, NGO, UNDP and Private sector	Improving waste management capacity with private agencies association
SWM in Hetauda (2002)	CBO, GTZ-UDLE, NGO, UNDP, UEIP, UN Habitat	Developing Hetauda city as healthy area with private agencies partnership.

Source: Luitel, 2008

To state, The Clean Cities Foundation in Warangal, India initiated Participatory Approach in 2012 (Source segregation and door-door collection service among the people) for Improving Solid Waste Management with association of Andhra Pradesh Pollution Control Board (APPCB) and Andhra Pradesh Industrial & Technical Consultancy Organization (APITC) (Ahluwalia & Patel, 2018). The approach was introduced as competition on intensive waste management activities conducted between participating team and the winning team was rewarded with funds. Through this program, it was clearly observed that segregation of waste enhanced assortment efficiency of waste and reduced waste by 30-40 percent. Thus, Warangal municipality was able to address the real problems and improve the capability of the workers as well as management.

3. LALITPUR METROPOLITAN CITY

Lalitpur Metropolitan City is popularly known as Patan which is one of the traditional oldest cities of Kathmandu Valley. It is considered to have remarkable history to be regarded as century's ancient existing civilization of people and rising improvement of city. Since old ages, Lalitpur has conserved fine arts and architecture, especially metal and wood workers. In fact, UNESCO has enlisted Patan Durbar Square (Lalitpur) as a World Heritage Site as the city of superior arts (Department of Archaeology, Nepal, 2007). It has ancient houses design with narrow and complex streets. The old houses have joint family with average size of 7-8 persons. Though newly established area has concrete and institutional and commercial buildings, the old house still practice the rent system. The major occupation of the locals was farming which is changing recently with literacy rate of 70.9% (Manandhar & Shrestha, 2006).

LMC covers an area of 24.94 square km and is positioned at south-east which is about 5 kilometers from Kathmandu. According to Nepal population Report 2016, population density (person per sq

km) of LMC is 1216 and average annual growth rate (2001-2011) is 3.26. It has total population of 2, 54,308 of which 1, 30,556 are male and 1, 23,752 are female (CBS, 2011). It has total of 62,893 household in its 29 wards. Recently, LMC is gaining integral position in Kathmandu, capital of Nepal. Table 3 comprises commercial and institutional services.

Table 3: Commercial, Industrial and Institutional facilities

SN	Institutional/Commercial services	Number
1	Educational institutes	212
2	Health organizations	38
3	Governmental offices	49
4	International Institutions/ Organizations	14
5	Banks	19
6	Major Hotels	13
7	Others	19
	Total	364

Source: SWMTSC, 2012

3.1 MSW AND WASTE GENERATION

Likewise, household size and average household waste is 4.84 and 0.90 Kg/day respectively. The sum of only household waste of the municipality is 42.15 tons/day which is higher than the commercial and institutional representation of 36.80 tons/day. The average per capita MSW is 371.82g/capita/day and only 5.35 tons/day represent other waste (Asian Development Bank, 2013) (Figure 1). The involvement of 211 number of employee has assisted in Waste Management

in LMC. The number of vehicles used for the waste management is 2 tractors, 16 tippers, 5 dumper placers and 2 loaders.

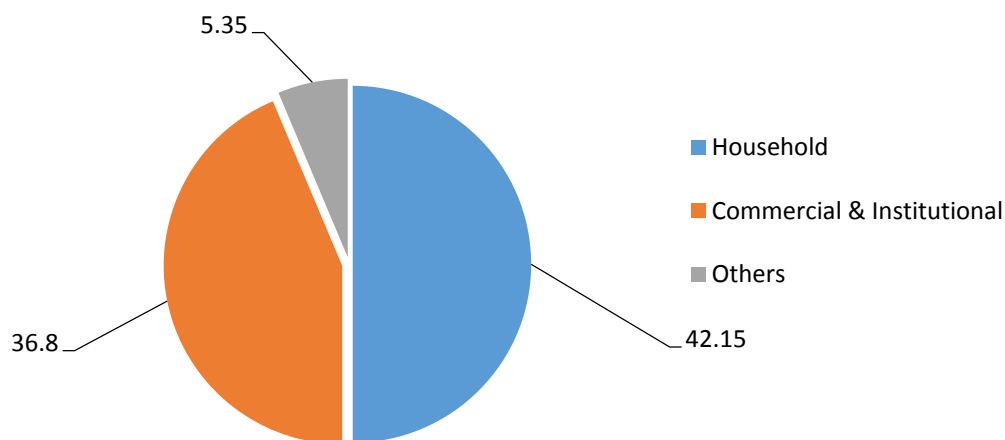


Figure 1: Solid waste from different sources in LMC (Source: ADB, 2013)

3.1.2 COMPOSITION OF MSW

ADB (2013) illustrated the organic waste as maximum composition of municipal waste from residential area with 77.97% and the textile and other waste as least constituents of waste composition with 4.35%. However, recyclables such as plastics and paper consist of only 17.69% of total composition of municipal waste (Table 4).

Table 4: Household waste composition in LMC

Composition of household waste	Percentage
Organic	77.94%
Recyclables (paper, plastics, etc.)	17.69 %
Textile and other	4.35 %.

Source: ADB Report, 2013

3.1.3 WASTE MANAGEMENT PRACTICES

Lalitpur Metropolitan City with the old settlement has narrow streets which are not easily accessible to the waste collection vehicles. The area is deprived of proper drainage facilities resulting in improper disposal of solid and human waste. Due to the presence of old garbage accumulation system called Sagals locals practices of open piling household wastes is still followed. Though in the past, the waste handling and disposal was not a problem as most of the waste composed of organic constituents who were efficiently utilized as agricultural compost and fed to animals. The lower caste groups were considered to be waste pickers and barely accepted in society. But these days, in one hand advancement in urbanization had led waste management system in critical conditions while in other hand society of any caste reflects concern regarding environmental waste. The old settlement residents are found further concerned about waste management than the new settlements ([Kathmandu Regulatory Study Team](#)).

Similarly, the traditional waste management system was time consuming and unhygienic that included shorthanded broom and bamboo baskets as tools to sweep streets and carry waste on their back. Nevertheless, this system has been upgraded to modern waste collection and transportation facilities that use improved brooms for sweeping and carts, tractors and trucks to collect and transport waste to sites. The collection is directly provided in 11 wards while remaining 18 wards is facilitated by private sectors without written agreement and regulation of tariffs. The institutional, commercials and hospitals waste are separately collected by LMC with individual written agreements though the waste from clinics is mixed and untreated from the municipal waste. The waste collection is container based door-door collection and is done through roadside pickup.

Some communities are seen practicing unhygienic composting method which includes digging of pit, throwing waste without any further process and turning waste manually for maturation.

Related for Lalitpur Metropolitan City, the entire house unit litter is 84.30 tons/day (ADB report, 2013) with total waste collection of 60 tons/day. It does not have designated composting and recovery centers therefore; most of the waste collected is drive to disposal site at Okharpauwa. All the three major municipalities of Kathmandu Valley are seen disposing its waste to Okharpauwa, Nepal which explains that it will sooner be out of service. Hence, the extensive waste collection is being limited by LMC by mainly focusing on source segregation and waste minimization in partnership with different organizations.

The communities are involving in source segregation programs organized by individual, communal and municipal groups. About 70% of municipal areas practice source segregation with ward 22 and 13 being ahead of other wards. Although the waste segregated at source are again mixed in the collection vehicle due to lack of proper collection system. After implementation of source segregated waste management practice, prevention of burning and disposal of waste in open areas in SWM Act 2011, the authorities have initiated sending separate vehicles for collection of segregated waste. The total waste generation has lessen by 15% and collection efficiency of Lalitpur district has approximately risen to 82% (**91% for 22 wards, COWI, 2015**) in 2015.

3.1.4 PARTICIPATORY APPROACH

Participatory approach is not only limited to public involvement but also considers several agencies that initiates participation through various media and helps in upgrading standard. These numerous agencies have initiated different projects which involved participation of public and communities with different sector and improved waste practices. The LMC itself has set off organization called Social Welfare Division which supervises different awareness and training

programs related to waste management focusing mainly to women groups. The agencies that are making an effort of contributing necessary roles in the society are described as below:-

3.2 PRIVATE SECTOR

The largest private organizations in LMC are Sirjansil, WEPCO and NEPCEMAC which are involved in waste awareness educational program at ward level. Even though the numbers of private operators are limited for SWM, the involvement of these organizations has contributed a lot in participation and waste reduction. Solid Waste Management Service Improvement Plan (SWM-SIP) of Lalitpur in 2016 stated that these agencies are collecting 35% of total household waste of LMC and providing street sweeping facilities in their area. Also, they are performing door to door collection and transporting waste in their own transfer station where they perform composting and recycling services. Besides they have their own recover and recycle facilities and pilot projects of which WEPCO (*Women Environment Preservation Committee*) and NEPCEMAC (*Nepal Pollution Control; Environment Management Centre*) has 200 and 1,200 household waste segregation plan in Lalitpur and Kathmandu and recycle 19 MT/day of waste. As based on municipal progress report, 3 MT of compost is produced and 4 MT of recyclables is sorted from biodegradable waste in LMC with an objective of fulfilling each 40% recovery of organic waste and recyclable by 2018 in the Strategic Plan without mechanical material recovery facility (MRF) **(OBA, 2016)**.

3.2.1 COMMUNITY PARTICIPATION

Community participation is considered as vital phase in waste management. According to The GEF Small Grants Program, a well-known organization WEPCO (*Women Environment Protection Committee*) was established by a group of women from Lalitpur in 1990. It mainly aided the waste

treatment burden of the municipality by nearly reducing 962.9 tons of waste annually which is equivalent to nearly two days waste of Kathmandu Valley. This community-based project initiates collection of paper from commercial institutions as well as recycling 912.5 tons of waste and manages 0.5 tons waste at source level. Apart from this, the project has been successful in biogas production, organizing Eco Clubs in 47 schools of Lalitpur area and establishing finance cooperative that mobilizes 123,924USD. Thus, contribution of stakeholders (students, private sector (through green circle) and households) and managing 2.5 tons of waste per day has result the organization to earn nearly US\$25,756 per annum.

CEAPRED (Center for Environment and Agriculture Policy, Research, Education and Development) of Lalitpur established in April of 1990 has the similar responsibility for the group of women to promote prevention and facilitate the recycling process of their own waste. It has developed as one of the strongest women's recycling centers in four year time period and the governmental administration is foreseen only as partner for waste management.

However, the main focus of NEPCEMAC (Nepal Pollution control and Environment Management Centre) established in April 1997 is to reduce and control pollution originated due to solid waste though it even participate in waste collection and cleaning of various area. It has been a year that it is conducting activities like environmental conservation and managing waste with community participation ([Ghimire, 2009/2010](#)).

Furthermore, CRC (Community Recycling Centre) is an organization that considers management of inorganic waste as well. It initiated youth club named as KMC Youth Corner Club to start recycling centre for plastic waste as milk pouch, oil plastic pouch, plastic bags and bottles. The staff of CRC mentioned that it has greatly helped in reduction of plastics waste as community

people reuse the plastic bags to either get discount by selling plastics to vegetable sellers or to carry vegetables in them.

3.2.2 PUBLIC-PRIVATE PARTNERSHIP

Since 2006, before OBA Project intervention, every household level was distributed with 4700 segregation bins and 4700 compost bins. At current situation European Union (EU) funded project in Ward 22 is supporting Lalitpur for source segregation and waste minimization. It is aiming to include pilot rooftop gardening and equip 12,500 household with segregation and compost bins. About 60% and 70% of 2500 households are successful in practicing household level composting and source segregation respectively. After successful partnership of government and PPP in generation of energy from waste in Kathmandu Metropolitan City (KMC), Government of Nepal has decided to precede the similar project in Lalitpur and Kirtipur with involvement of Public Private Partnership (PPP).

3.2.3NGOs

The role of NGOs and INGOs is acquiring higher value in spreading information about the waste minimization process in Lalitpur area. There was vast increment in number of NGOs since 2003/4 till 2012/13 with data of 35 and 78 respectively. Also, total number of INGOs in Lalitpur was 3 in 2012/13 (Social Welfare Council) yet these organizations rarely work for waste management (SWMTSC, 2016). Some of the waste management programs organized by agencies in Patan are:

Urban Waste Expertise Program (UWEP): UWEP is a program funded and initiated by Netherlands Directorate General of International Cooperation and WASTE respectively. Integrated Pilot Project (IPP) was conducted in Subahal Tole of Lalitpur with aim of improving living and

environmental conditions especially urban waste issues of locals. It acts as small enterprises to integrate urban and municipal services (**Patan Conservation and Development Program, 1996**).

UDLE/GTZ: The German international cooperation GTZ (Gesellschaft für Technische Zusammenarbeit) has been one of the main donors in waste management activities in Nepal. It has initiated waste planning participation programs in communities by mainly focusing women group and involving them in *Self-Help Group (SHG)* (**Dangi, Schoenberger & Boland, 2015**).

Urban Basic Services (UBS): It runs under Ministry of Local Development (MLD) with an assistance of UNICEF. Although the main objective of this program is to raise the living condition of poor urban people, it even contributes in waste management in some way. It mainly helps in strengthening and building capacity of poor communities through participatory approach. It initiated program regarding degrading environment of urban area in LMC which presented good impact in society (**Presern, 1990**).

Metropolitan Environment Improvement Program (MEIP): MEIP conducting tole improvement program under fund provided by World Bank. The major objectives of this program are similar to IPP of Subahal tole which performs awareness and improvement of environment in Teta Tole, Lalitpur. It has been successful to change attitude and behavior of people towards disposal of waste (**Patan Conservation and Development Program, 1996**).

Micro Enterprise Development for Women: It established “Khumbeshwar School” in 1983 that developed economic condition of women and sanitary habits of Poday communities who were considered as sweeper (**Patan Conservation and Development Program, 1996**).

The NGOs have been successful to minimize waste in source level and actively involve public into participation and upgrade the condition of waste services by frequently conducting different

programs that include street and Sagal cleaning, waste collection, recycling, motivation approach in school, trainings, field exposure/ visit and Sanitation awareness **(Tuladhar & Bania, 1997)**.

Similarly, community meetings were organized, signboard containing waste awareness message “Waste is strictly prohibited” were placed and available media was used for audio-visual and cultural programs for the people who were not fully aware of health and sanitation relationship. NGOs have effectively implemented waste planning by recovery and recycling market of about 8,000 informal workers including women groups of communities, Mobilizer, scrap dealers (115 number in Lalitpur) and many more **(PRISM Project/Practical Action and EU, 2014; Gotame, 2012)**. In addition an authorized local NGO named Multipurpose Community Development Service Nepal (MCDs) conducts various projects of which EDEN (Entire Development for Environment and Nature) made first attempt to build environment for people to participate in the management of waste in Buddhajyoti and Chamati of Lalitpur **(Gotame, 2012)**. Program named ‘Chelibeti’ was organized for girls to improve knowledge on society and environment. In fact, due to the tremendous achievement in waste management participation in Subahal, Lalitpur (ward 8) by IPP project, this program has been started in communities of 24 other wards of LMC which states advantage of participation of various sectors **(SWMTSC, 2016)**.

4. CONCLUSION

The role and participation of the public is important to the success of any endeavor, especially municipal solid waste management that affects the environment, economy and human health. Public perception of the risks and resource potential can change attitude very quickly and make the waste management process not only successful but also sustainable. However, the rag pickers contributing in SWM must be given positive feelings and respect in the society so that they do not hide their identity even with the government.

The work that should be done to develop certain tactics to clean the large amount of garbage and to maintain the dumping site in each district with involvement of public participation can be given by: reduction, segregation of waste generated at its source and its accumulation that include street sweeping, composting and recycling, awareness campaigns, education and participation, efficient waste collection and final disposal. Despite above, tendency of listening to public, community meetings and consultation seminars has to be developed for upgrading trust and extending initiatives. Also new mechanisms of dialogue participation among public, including Federal, State and Local government has found to be effective in waste planning. Thus, confirming that participation of several governmental and non-governmental agencies is responsible for enhancement of waste management services in one way or other.

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