

Solid Waste Management Efficiency in Kabul City

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Abstract - Kabul city faces to serious problem in the management of solid waste, which does not comply with environmental standards. This research is a mixed methods integrating both quantitative and qualitative, was used to evaluate the efficiency of solid waste management in Kabul city. The residential houses in 7 and 10 districts of Kabul city are regarded as representative areas, which form the basis of this research. Based on the determination of sample size, 380 and 375 residential units were considered, but in district 10, about 77 questionnaires were left undistributed. Besides, field visits for further confirmation were conducted. Results showed, the majority of respondents expressed that the functioning and management of wastes by the municipality is ineffective and also the provided services are insufficient. More than 72% of respondents pointed out that the municipality is lack of public awareness and there is no a source reduction's program within the municipality. More than 56% of respondents said that the people join in waste management. In addition, they pointed out that lack of experts and skilled workers, lack of standardized vehicles and proper roads in the unplanned and slopes areas for collection and delivery of services and also lack of public concerns to the environment are the factors limits effective solid waste management in Kabul city. Based on the findings, it is suggested that a strategic plan with short-term and long-term goals with flexibility property and ability to up-to-date should be prepared as regarded of current state of the country.

Key words: Collection, Compost, Integrated Solid Waste Management, Landfill, Recycling, Solid Waste, Source Reduction.

1. Introduction

Population growth, urbanization and economic development have resulted in changing consumption pattern and led to a rapid increase in waste volumes and types of waste. MSW generation rates are influenced by economic development, the degree of industrialization, public habits, and local climate. Generally, the higher the economic development and rate of urbanization, the greater the amount of solid waste produced. Income level and urbanization are highly correlated and as disposable incomes and living standards increase, consumption of goods and services correspondingly increases, as does the amount of waste generated. Urban residents produce about twice as much waste as their rural counterparts. Solid waste management has become a major environmental problem confronting urban areas all over the world [1].

In developing countries in particular, the waste produced by burgeoning cities is overwhelming local authorities and national governments alike [2][3] as accumulations of waste outstrip its control. Municipalities are spending significant resources to address this problem, but the overall situation is far from satisfactory and rapid and haphazard urban growth is making the problem worse.

MSW encompasses residential, industrial, commercial, institutional, municipal, and construction and demolition waste [4]. Such MSW is considered a problem that having impacts on the environment and the public health if not properly managed.

Municipal solid waste management (MSWM) is the management process of solid waste - generation, collection, transportation, recovery, and disposal in the best applicable or suitable manner (policy and technology) to ensure that public health, socioeconomic, aesthetic and environmental values are not jeopardized [5]. The other definition is, a solid waste management system is an interrelated system of appropriate technologies and mechanisms involved in the generation, collection, storage, processing, transfer or transport and disposal of solid waste designed to reduce waste at the lowest possible cost [6]. This should also minimize risk to the health of the people and the environment as a whole.

In urban areas of most developing and least developed countries generated MSW is at best collected and dumped in arbitrary dump sites that mostly lack the appropriate norms. Such disposal requires collecting, transport and dumping into the nearest open space area. In other countries MSW is dumped into water bodies and wetland and part of the waste is burned to reduce its volume. Such practices have their adverse environmental impacts ranging from polluting the natural resources and the ecology to the creation of health problems which might turn into long-term public health problems [7].

Kabul is also faced to same problem like other least developed countries in the case of MSWM. The amount of solid waste produced in Kabul city is 653557ton/year or 1790 ton/day [8][9]. Collection and proper sanitary disposal of this quantity of solid waste would cost close to 20million US\$ per year, which equates to nearly 41% of the municipal revenue [8]. Based on [10], the specific gravity of the waste is 413 ± 52 Kg/m³ and the amount per capita/day is (0.31-0.43) Kg. Organic matter forms about 70% of overall the waste produced in Kabul city. According to World Bank (2005) as noted in Afghanistan national policy, the amount waste produced per day is 2000 ton which composed of 57% organic matter, 15% plastics and papers and 28% metals, glasses and other materials. Based on UN-habitats, Lacks in strategies, skills and capacities in municipality to respond caused about 70% is remained uncollected and thus accumulate inside/backyard, streams, rivers and open spaces. If this large amount of solid waste is properly regulated and managed, it will definitely play a significant role in protecting the environment, the public health and growth of economy.

Increasing the efficiency of solid waste management system in Kabul city requires reducing waste generation at source, increasing public awareness, private sector participation and NGOs in urban waste management, and applying new technologies in this management system. Therefore, it is necessary to evaluate the current management of solid waste by assessing the effectiveness of the solid waste by completing the questionnaire and determining the best methods for solid waste management in Kabul city from the majority sense and propose to the responsible organizations in order to replace the conventional methods or to continue the current methods. The purpose of this study is to review the current status of Kabul solid waste management in order to establish a sustainable waste management system for solid waste. To achieve this goal, various factors that influence solid waste management, such as the economic, social and technical factors are seemed necessary, was evaluated.

2. Materials and Methods

2.1 Study area

Kabul is the capital and the largest city in Afghanistan and is one of the rapidly growing cities in Asia. It is located between latitude 34°, 35' and 33" N and longitudes 69°, 16' and 67" E with 1800 m ASL. The total area of this province is 4525 km² which form 0.069 percent of the whole country. Kabul city area in 22 of its districts is 1008.7 Km². The 19 district is the largest with an area of 130 Km² and the 1st district is the smallest with 4.5 km² area. There are both formal and informal settlements in Kabul city. The informal houses form about 76% while the rest is the formal settlements. The representatives' districts for the purpose of this research have bolded in below map (Figure 1).

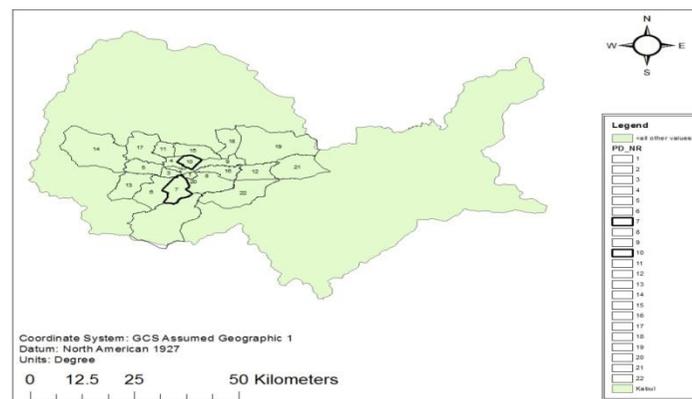


Figure -1: Kabul map, representatives districts bolded

2.2 Sources of information

The body of information collected included both secondary and empirical data. Secondary data were elicited from a critical literature review of scholarly articles on solid waste management. The set of empirical data was generated through field work using questionnaires survey, face to face semi-structured interviews, and on-site visits of households, communal container collection sites, dumpsites, and landfill sites. This body of primary data was supplemented with information obtained from field observations. The structured and unstructured were used so as to get the responses from respondents.

2.3 Sampling techniques and data analysis

This is a mixed method research containing both quantitative and qualitative was done for evaluating the efficiency of solid waste management in Kabul city. District 7 and 10 was chosen as representatives areas which form the bases of this research. Selected samples were residential units which 1 person/each individual house selected. So, the rest of places like public institutions, hospitals national/international NGOs were not considered in designing of the research.

Residential units in the mentioned districts were selected based on the socio-economic of inhabitants and the planned and unplanned character of the regions. Chosen age bracket was over 20 years which forms 65 percent of the city population. The questionnaires were administered to a representative sample of house-holds selected from the population of households inventoried in the districts 7 and 10.

After sample size determination, the study population in district 7 involved 380 households and in district involved 375 households randomly selected from a total number of 40,000 households and 16752 respectively. In district 10, about 77 questionnaires were left undistributed due to the residential buildings ownership by NGOs. The sample of households was selected randomly (simple and systematic. The concept of household in this study was referred to as a person/each individual house was considered to engage in the filling of the questionnaire.

The confidence level considered 95% and the level of precision $\pm 5\%$. The data acquired from the study were analyzed with MS-Excel and the Statistical Package for the Social Sciences (SPSS) software version 21.0.

Regardless of questionnaire surveys and interviews, field visits of recycling companies as well as steel and plastics fabricates, their discharge of untreated wastewater to the environment and lack of preventive measure and job safety of plastics and steelmaking workers, situation of storage points and community bins, dumping sits and the situation of worker and scavengers were conducted.

3. Results and discussions

3.1 Demographic and Social Characteristics of Respondents

The results as tabulated in Table 1 indicate that the majority of the household respondents were males 90% as against 10% of females. It was an indication that more males participated in effective Solid Waste Management in Kabul Municipality than females. Kerama, (2012)[11] has cited from Rekha and Gaonkar (2009) that women in most developing countries have a low social and economic status and thus their participation in effective Solid Waste Management in Kakamega Municipality was hampered. However, this finding is consistent with the mentioned research but this result points to the following facts in Kabul city: 1, man deals more than women in social related work in Afghanistan; 2, Also, there were face to face semi interview with the people that is why in religious country like Afghanistan the women are not ready to do interview with man.

Table -1: Profile of respondents.

Variable Respondents %	
Gender	
Male	90
Female	10
Age group	
21-30	40.0
31-40	31.8

41-50	12.5
>50	11.4
Nonresponses	3.9
<17	0.4

Education

Others (Certificates)	44.5
Diploma	16.8
Bachelor's degree	29
Masters	5
PhD	

No of family members

2-4	11.2
4-6	33.3
>6	41.5
No.R	14

Moreover, the data contained in Table 1 further indicate that the overwhelming majority 71.8% of respondents were in the age bracket of (21-40) years; this indicates that majority of respondents have what it takes in terms of energy and perseverance to play a proactive role in issues relating to participatory solid waste management projects in Kabul city. Also, it reveals that Afghanistan is youngest country within the world. As tabulated in Table 1, the respondents were asked to indicate whether educational level of respondents determined effective SWM. Based on results in Table 2, these findings agreed with the findings of Babayemi and Dauda (2009), [12] with increasing in education level the level of people awareness about effectiveness SWM have increased. This was a further prove that education levels of the respondents played a vital role on effective Solid Waste Management in Kabul city. As showed in Table 1, the majority of respondents' family members were more than 6, as stated in demographic statistic is the mean in family member in Kabul city is about (6-9). Based on Sankoh et al (2013) regardless of others factors mean numbers in families also affect solid waste generation and composition.

Table -2: Cross Tabulation Results between Educational Level and effective SWM

	Responses	Others Certificate %	Diploma %	Bachelor's Degree%	Masters %
Effective SWM	Strongly agree	3.0	1.9	2.9	0.4
	agree	20	4.1	10.5	1.0

disagree	18.1	9.5	11.9	2.3
Strongly disagree	4.9	3.7	5.1	0.6

3.2 Respondents’ Knowledge and Perceptions of the Environmental Issues and Solid Waste Management

The respondents were asked to express that today the world environment is facing to many problems like population growth, resource scarcity, soil erosion, acid rains, ozone depletion, air and water pollutions, global warming and climate change, how these problems are important with them.

That the majority of them high to very high 75% as shown in Table 3 responded these are important to them. The results indicate that environmental issue is not a novel as well as for Afghan people but are the facts no one deny it. The results in Table 3 shows, that the majority of respondents 77% are aware of the pollution and disease associated with solid waste, its management and the means that they obtained such information were the more personal observation/experiences and next followed by mass media. The results indicate that mass media has affluent on increasing public awareness in Afghanistan as well as in Kabul city. The data contained in Table 3 also showed that majority of respondents 69.8% developed a perception that it was the sole responsibility of the Kabul Municipality to manage waste and maintain the urban environment clean. It followed by next that the respondents expressed that the public and every individual should take part in SWM and keeping clean the environment because it is hard task to the municipality alone.

Table -3: Respondents’ perceptions of the Environmental Issues/Solid Waste management

Variable Respondents %	
The importance of Environmental issues	
Very high	61
High	14
Undecided	7.6
Less	6.7
Very less	10.4
Nonresponses	0.2
Level of awareness from the waste related pollution, health risk/its management	
Aware (yes)	77
Not aware (No)	23
Means by which information on solid waste/its management was obtained	
Journal papers/Newspaper/magazines/books	17.5

Mass media	25
Personal observation/ experiences	31.7
Others (municipalit)	0.4
All options	2.0
Nonresponses	23.5
Respondents' perception on who is responsible for managing waste	
Kabul Municipality (KM)	69.8
Afghanistan National Environmental protection Agency (NEPA)	6
Citizens	10.8
NGOs	3.2
KM/Citizens	8.2
All options	1.9
Respondents' perception on recycling	
Not aware	55.7
Used in other countries	22.7
Awareness has given about its importance	9.1
Used at home	8.2
Nonresponses	4.3

The lack of awareness on solid waste recycling by a good majority of the respondents 55.7% as shown in Table 3 could be attributed to the inability of the Municipality to carry out adequate public awareness and education. This situation could have serious adverse effects on solid waste management system and activities in the area, as the inadequate knowledge of the residents thereof and the lack or little participation of the people therein could render the underlying objectives of these activities unachievable.

3.3 Technical, economic, social, institutional and legal Factors and effective SWM

The results in Table 4 pointed out that the municipality was not functioning efficient in waste collection, disposal and its management: if we look at the options disagree to strongly disagree, both forms major responds about 50%;

Table -4: Technical, economic, social, institutional and legal Factors and effective SWM

No.Q	Variables	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Nonresponses
1	Municipality is functioning efficient in collection, dispose/SWM	8.8	34.8	3.9	39.5	10.4	2.6
2	Municipality has enough equipment and personnel involved in SWM	5.4	20.9	13	38.4	18.4	3.9
3	Municipality's personals have adequate qualifications and skills	4	19.2	8.4	45.8	19.4	3.2
4	Municipality's workers have weak activities	35	45.8	3.9	9.9	2.2	3.2
5	Right now, the municipality bins used for storage of shops and other public uses	9.5	18.0	21.0	32.0	12.7	6.7
6	Is there sufficient of funds from government allocated to municipality for MSWM?	6.1	16.2	17.5	36	9.9	14
7	Municipality lacks public awareness on SWM	37.2	35.4	10.9	8.4	3.9	4
8	Municipality lacks source reduction policy and in public participation	23.6	32.2	21	11.2	3.2	8.8
9	There is no garbage's dispose approaches that is why the people throw into unreasonable places over the streets/streams	26.4	32.4	11.5	15.8	2.8	11
10	There is deep rooted corruption in municipality that makes it hard to implement environmental laws	36.3	35.4	10.4	5.8	1.1	10.9

Municipality has enough equipment and personnel involved in SWM: disagree to strongly disagree about 57%; Municipality's personals have adequate qualifications and skills: disagree to strongly disagree 65.2%; Municipality's workers have weak activities: strongly agree to agree 80.8%; Right now, the municipality bins used for storage of shops and other public uses: a good number of respondents 44.7% were strongly agree to agree; Is there sufficient of funds from government allocated to municipality for MSWM?: a good number of respondents about 46% were strongly agree to agree. The study findings disclosed that economic factors in terms MSWM, budget allocated from government to

municipality were inadequate to promote effective Solid Waste Management in Kabul city; Municipality lacks public awareness on SWM: the majority of respondents strongly agree to agree forms 72.6%; Municipality lacks source reduction policy and in public participation: a good number of respondents about 55.8% were strongly agree to agree; There is no garbage’s dispose approaches that is why the people throw into unreasonable places over the streets/streams: the majority of respondents strongly agree to agree forms 58.8%; There is deep rooted corruption in municipality that makes it hard to implement environmental laws: the majority of respondents strongly agree to agree forms 71.7%; MSW should be teach in schools (subject)/universities(1-2 lectur): the majority of respondents strongly agree to agree forms 88.2%.

The data contained in Table 5 shows that majority of respondents 78% said solid waste collection frequency is not enough by municipality and much volume remained uncollected in the places; 75.8% respondents said there is no waste collection every day by municipality; Does community participate in SWM?: the majority of respondents were agreed with public participation in SWM but they said there is no encouragements and policies for public participation to upgrade this purpose; 43.4% of respondents said there is no enough dumpsite after waste collection by municipality; Do you have bin? If no, how you dispose?: majority of respondents 72.8% said yes but they proposed increasing in the number of bins as well as in the hills and unplanned areas. Also, they said there are uncovered waste containers placed for disposing of their waste. This is an environmentally unfriendly manner which causes specially spread of diseases; Do you separate waste before disposing into bin?: the majority of respondents 73.7% said they do not separate their waste because there is no policies from government side to encourage them; Do you transfer your garbage to bins near to collection site every day?: the majority of respondents 66.1% had their wastes conveyed to the collection sites themselves or by their children but they expressed that most people occasionally dumped the wastes at unauthorized places or at the foot of skips rather than in-side; is there any prevention, charges/punishments from government for illegal garbage disposing in residential area, unreasonable places and near to houses?: the majority of respondents 75.8% pointed out there is no prevention charges/punishments from government for illegal dumping at unauthorized places, on roads, into streams, rivers, etc., that is why the people act irresponsible.

Table -5: Technical, social, institutional and legal Factors and effective SWM

Variables	Yes	No	Don't know	others	Nonresponses
SW collection frequency by municipality is enough?	12.3	78.0	5.8	1.3	2.6
Waste is collected by municipality every day?	16.8	75.8	4.0	0.7	2.6
Does community participate in SWM?	56.6	37.4	3.5	0.3	2.0
Are there dumpsites after waste collections by Municipality? If yes, where are?	15.8	43.4	32.6	0	8.2
Do you have bin? If no, how you dispose?	72.8	16.0	1.8	1.3	8.0

Do you separate waste before disposing into bin?	11.4	73.7	7.8	1.5	5.6
Do you transfer your garbage to bins near to collection site every day?	66.1	24.9	3.2	2.0	3.7
Is there any prevention, charges/punishments from government for illegal garbage disposing in residential area, unreasonable places and near to houses?	12.3	75.8	10.2	0.2	1.5

3.4 Field visits

Field visits of the situation of storage points, community bins, illegal and open dumping, weak preventive measures of scavengers and workers of solid waste management and recycle companies further confirm the results obtained by reviewing the published paper, questionnaire survey and interviews of this research. As seen the workers in steel and plastic object making companies were not safely employed and have not taken preventive measures. Besides, the wastewater produced by mentioned companies discharged to the environment as well as into streams and river without treatment. The photos of field visits not attached here.

4. Conclusions and Recommendations

Most respondents were not agreeing on the effectiveness of the municipality's role in collecting, transporting and disposing of waste. 78% of them said that the municipality's functioning was inadequate. The respondents have complained that in unplanned areas such as district 7 and hills especially where there are no suitable roads for transport are deprived of waste management services provide by municipality. However, in planned areas with high-income such as district 10, according to respondents, households paid (150-300) Afg/months to private sectors for their garbage to collect and transfer. Most respondents considered the municipality lack in public awareness and in public participation programs in waste management, if so they are ready to cooperate. The role of mass media in informing citizens are took second place after their study and their personal experiences. More than 75% of the respondents stated that there is no control, penalty, or punishment for environmental offenders and those who dispose of their waste in inappropriate areas. Also, this has been practically seen in field observations. According field survey, unofficial workers in recycling were mostly children and youngsters who have not paid any attention to the health hazards of waste. Plastics and steelmaking workers are also at high risk due to their lack of job security. Also, wastewater from Kabul's manufacturing plants is being discharged without being treated to the environment. On the basis of the results of the research the followings are suggested for an improvement of waste management in the Kabul city:

- Continuous reduction of municipal solid waste production and prevention of its production at source.
- Separation of hazardous waste from households wastes.
- Implementing a comprehensive waste management system in compliance with the management hierarchy.

- Education campaigns on solid waste management and public awareness in reducing production, separation and recycling of waste.
- Privatizations of parts or whole waste and monitoring their functioning by the municipality
- Waste separation of recyclable materials and composting of organic waste should be encouraged and also the economic market for this purpose should be supported.
- Increasing the number of rubbish and container containers on roads, alleys, highways, parks and other public and private places in the city.
- Coverage of solid waste management services at the household level and the easy access of people to such services.
- Increase the efficiency of municipal solid waste collection, waste collection sites, containers and increasing the collection frequency and timely collection.
- Suitable dumpsites and sanitary landfills
- Existing waste management regulations and their enforcement should be reviewed and amended as soon as possible.
- Economic instruments such as polluters pay principals and services users are also important in waste management process should be introduced.

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