DOMESTIC WASTE MANAGEMENT OF DHAKA CITY FOR REUSE AND RECYCLE

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ABSTRACT

Reuse and recycle of domestic waste were studied in Dhaka City Corporation (DCC) from June to December 2015 based on the data set collected by questionnaire survey, interviews or observations. Waste management of Dhaka City is one of the most priority concerns of DCC. This research analyzed existing waste management options, strength, weakness and future opportunity of modern waste management of DCC. It focused on existing laws/acts/policy/rules and action plan regarding waste management of DCC as well as on the related legal provision of the central government of Bangladesh. It was revealed that there was no up-to-date laws/policy for effective waste management in DCC. The study identified a range of issues which need to give attention for effective waste management in future. It was found that DCC as a local government institution, not capable enough to manage its huge burden of waste. The findings from the literature and primary data analysis suggest building up collaboration of DCC with NGOs, private organization and other donor agencies. Recycle and reuse practice is the main priority subject of the modern waste management but the scenery was very poor in case of DCC. The deficit is partly due to the lack of legal framework and decentralization of waste management without having financial and capacity support. This study analyzes the key issues of domestic waste management like waste generation, waste characteristics, and impact of domestic waste disposal. Valuable suggestions are found from stakeholders involved in waste management and summarize those to develop an effective waste management strategy for DCC. It aims to provide a guideline for domestic waste management for DCC as well as other City Corporations and Municipalities of Bangladesh.
Key words: DCC, Domestic waste, Waste management, Recycle and reuse, Legal framework

1. Introduction

   The management system of domestic waste is one of the main environmental and economic concerns of the mega city Dhaka as well as the local government institution and also the concerns of the central government (Hai and Ali, 2005). The government of Bangladesh has an action plan which sets the target of zero waste in Dhaka city and considers re-use and recycling as the driving factors to achieve this target (DNCC, 2013). At present, the City is running with sky-scraping burden of wastes (Tania, 2014). An environmental friendly waste management strategy may not only ensure clean environment but also cost effectiveness for the residents. The waste generation of Dhaka city has an upward trend and the rate of increment is directly related to the rate of population growth and their consumption (Hai and Ali, 2005). In 2003, the annual waste generation was 2.6 million tones, in 2010 it was 3.02 million and the projected waste generation will be 5.52 million tons in 2021(Mukti, 2013). Disposal of waste is critical because it creates land pollution, water pollution and also air pollution depending on waste disposal and dumping systems (Hai and Ali, 2005). The waste management system of Dhaka City is not environment friendly. Due to improper waste management systems it has been experiencing various adverse effects such as occurrences of diseases, ground water contamination, surface water and air pollution (Hai and Ali, 2005). Separation of recyclable and reusable waste from total waste is another constraint for proper management system. Due to the lack of awareness and inadequate knowledge of the property of waste particle the desired outcome of separation of waste cannot be achieved. To minimize health and environmental hazards and also increase the waste value, the present waste management should be modified. In a study conducted by Mukti (2013) it is found that in most cases DCC collect waste only once a week, as a result segregated waste on road side causes environmental hazards. Optimum use of recyclable and reusable waste substance can increase waste value and decreased dumping volume. The 3Rs (Reduce, Reuse and Recycle) should be dealt with better management of waste and be interconnected (Department of Environment, 2010). By the effective use of reuse and recycle policy of waste management, the amount of waste can be minimized. Waste recycling suggests a commendable and environmentally sound process which reduces pollution (water, air, land), reduces the necessity of new natural resources, reduces GHG emission as well as plays a greater role in reducing global-warming (Tania, 2014). Recycling is a financial driver as it is a source of employment of man, women and children called waste picker (Yusuf and Reza, 2013). At present, the rate of waste collection of Dhaka City is about 43.5% of total generated waste (Waste Concern, 2005). Rahman and Ghazi (2011) found that average urban waste generation rate of DCC is 0.41 kg/per capita/per day and around 4700 tons of solid waste generates per day. There is no waste management strategy in Bangladesh and the management is done solely as an engineering responsibility (Department of Environment, 2010). So it is necessary to adopt a better guideline to improve present domestic waste management system to increase recycle and reuse waste materials. The aims of the study were: (1) to analyze the domestic waste generation trends and its characteristic of Dhaka City; (2) to evaluate the existing domestic waste management system; (3) to assess the impacts of disposal of domestic waste with special focus on reuse and recycle; and (4) to develop a guideline for increasing reuse and recycle of domestic waste in Dhaka City.

2. Materials and Methods

2.1 Data Collection

Several methodical procedures have been applied based on the predetermined aims and objectives to achieve the purposes of the research. The study considered to analyze the domestic waste of Dhaka City Corporation (DCC). The primary methods of this study consisted of two parts: literature review and data collection. In order to understand the existing waste management system of DCC an extensive literature review has been carried out. Among others, some specific sources with respect to the existing rules and regulations have been considered. Two types of data were used for analysis; primary and secondary.

Primary data were obtained from asking questions through questionnaire, interviews or observations. As an effective method Questionnaire was considered for both quantitative and qualitative information from people. The questionnaire comprises with eight main factors consisting of 26 questions. Initially total one hundred and five questionnaires were sent to respective respondents by email. Both structured and open ended questionnaire were used to collect data.

Gill (et al, 2008) explained that there are three main types of interview: structured, semi- structured and open-ended or unstructured. There are two main methods of interview: face to face and telephone (Walliman, 2005). MSN messenger interviews and E-mail interview also be considered in type.   He also stated that face to face interview may be conducted through various situations such as: at home, at works even at travelling and respondent may be general public, experts, specific segment of a society and so on. For the purpose of qualitative analysis face to face interview and telephonic interview were also practiced for this research. Face to face interview ware structured, flexible, and adjustable (Szolnokin and Hoffmann, 2013). They also explained that face to face interview are generally based on personal interaction and it may be restricted within the survey atmosphere. Face to face interview may be biased and time consuming also.

Email questionnaire, telephone survey and face-to-face interview and informal discussion have been followed with the key respondents, such as, senior official of Dhaka North and Dhaka south City Corporation, senior official of local government and rural development ministry, mid level officer of DCC who are responsible for the waste management sector, NGO representative, environmental activist and a large number of household occupants during the study period. The study also uses secondary data from published books, magazines, newspapers, reports, statutes, enactments, project documents from DCC, information will be used to gather previous and current articles, journals, online news paper. Internet sources can be one of the most important research tools to collect secondary data (Shodhaganga, 2012). So, for the present research several authentic websites can be visit to collect data related to waste management system in DCC, Bangladesh as well as waste management of others developing and developed countries.   Effective and relevant information will be used to gather previous and current articles, journals, online news paper, waste management related web page in the world especially from Bangladesh and UK. The web portal of DCC and LGRD ministry, government of Bangladesh will be helpful for current data and other information.

The total process of data collection including questionnaire formulation, distribution among respondents and collection of filled up questionnaire required almost eight weeks. Proper concentration has been given to choose the respondent to issues the questionnaire in order to get a qualitative and quantitative feedback of the respondents. Respondents were asked to give their opinion to what extent they agree with the given statements according to 5 point Likert scale where rank 5 represent that the respondents are strongly agree with the statement and rank 1 represent the strongly disagree. In the same way rank 4, 3 and 2 represent agree, neither agree nor disagree and disagree respectively. Effective communications with respondent were maintained in order to increase the responses rate.

The survey questionnaire along with a forwarding letter was emailed among the selected respondents to evaluate the identified statement by ranking and also by putting comments and/or suggestions. The forwarding letter briefly explained the objectives and significance of the participation of the participant. At the end of the questionnaire, respondents were requested to provide an overall remark or suggestions (if have) regarding integrated waste management systems.

2.2 Data analysis

Statistical analyses were done by SPSS software (version 16.5) and hierarchy analytical process. One-way ANOVA (Analysis of Variance) tests were used at 95% confidence level.

3. Results and Discussions

A total of 62 completed questionnaires were received from 105 which were summarized in Fig. 1. The response rate was 59.00%. 11 questionnaires were not considered due to poor information provided by the respondents. Out of 51 respondents 21 were administrator/manager, 6 were policy maker and engineer, facilitator/trainer, waste management service provider and others were 7, 4, 3 and 10 respectively. Among them 11 had 0 to 5, 13 had 6 to10, 22 had more than 10 years experience and 5 had not mentioned their work experience.
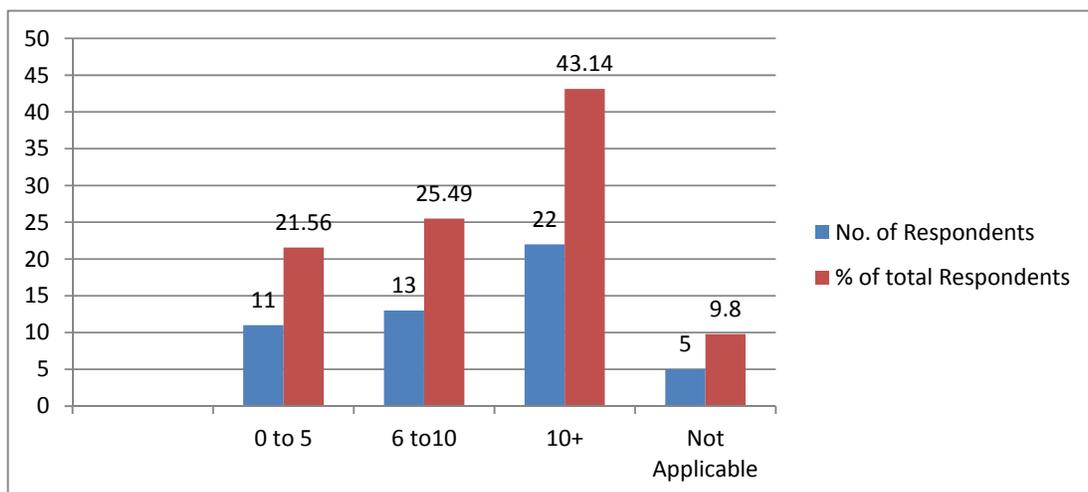

Figure-1: Respondents experience in terms of number and percentage

The respondents were categorized in terms of their professions (Figure 2). 21 respondents (41%) were administrator/ manager. Engineer, policy maker and facilitator were 7, 6 and 5 respectively.
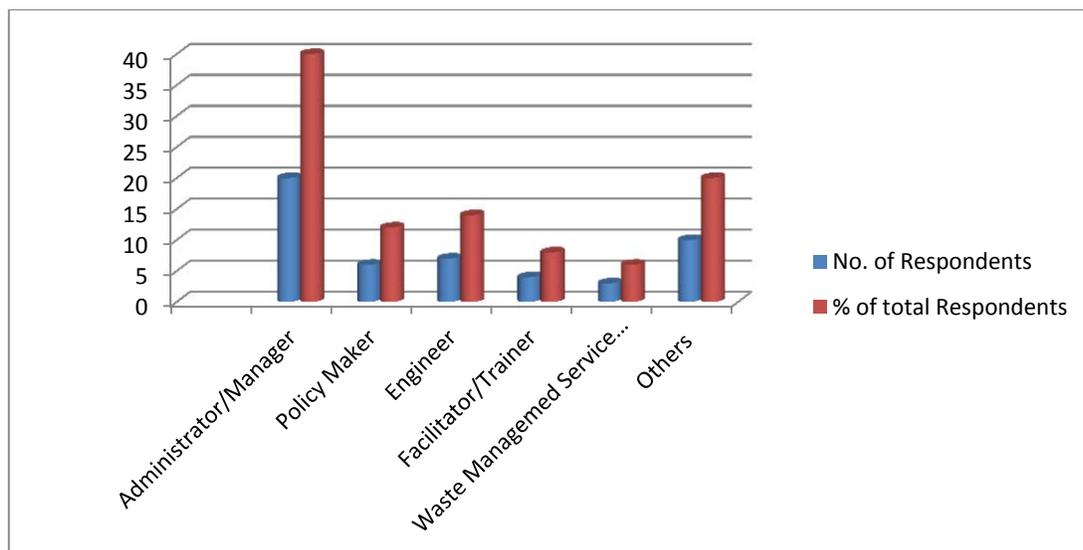

Figure-2: Number of respondents in terms of profession

The data assembled from the filled up questionnaire and telephonic interview were categorized (Table 1) so that it is possible to rank and presented in a tabular form and graphical manner where regarding suitability.

Table-1: Respondent's Responses with Ranking

Sl. No	Considering Factor/Factors	Respondent number with Ranking					
		Strongly disagree (1)	Disagree (2)	Neither agree or disagree(3)	Agree (4)	Strongly Agree(5)	Remarks
1.	Existing Policy/ Laws/ Strategy						
	a) Present waste management status of DCC is satisfactory.	15	19	14	3	0	
	b) Existing legislations (Acts/Rules/Regulations/policy paper/ strategy etc) are sufficient enough in waste management	6	19	21	5	0	
	c) New policy/ strategy are required for effective waste management	0	2	3	25	21	
2.	Promotion of waste minimization						
	a) Knowledge of household community is essential in reuse and recycle of domestic waste.	0	0	2	21	28	
	b) Need based training and desimination of information in awareness building is crucially important	0	1	5	22	23	
	c) proper utilization of DCC budget can play important role in waste minimization	1	2	5	29	14	
	d) Sectoral allocation of more funding is needed	0	2	8	32	9	
	e) Additional logistics are required	2	0	3	29	17	
3.	Promotion of Bin						
	a)Initiation of size and number of covered bin in waste collection	0	1	2	17	31	
	b) Separate collection bin is necessary for effective waste treatment.	1	0	3	14	33	
	c) Waste preservation in secondary collection carriage	0	4	9	24	14	
4.	Community Based Waste Collection Systems						
	a) DCC is capable enough to handle the existing burden of waste.	13	20	7	9	2	

	b) Community based waste collection system may be incorporated	0	1	7	26	17	
	c) Household community may pay for waste collection.	1	1	11	25	13	
	d)Introduction of 'polluter pay' principle in waste management	1	4	9	21	16	
	e) Slum and floating people waste can be incorporated under DCC management.	0	0	6	19	26	
5.	Optimization of Reusable and Recyclable management						
	a)Allocated DCC budget can optimize in recycle and reuse practice	2	3	10	31	7	
	b) Cost effective and environment friendly system is needed for optimization of recyclable and reuseable waste management.	0	0	1	16	34	
	c) Promotion of potential market for reuse and recycle products in optimization.	0	0	6	22	23	
	d) Composting of non-reuseable and non-recyclable waste	0	4	9	12	26	
6.	Landfill management						
	a)Minimization of waste landfill.	0	1	13	22	15	
	b)Waste carrier transportation system from carriage (Secondary storage point) to landfill demands environmentally safe	0	6	4	21	20	
7	Impacts of disposal of domestic waste in relation to reuse and recycle						
	a) Minimization of environmental hazards	2	2	2	21	24	
	b)Lessen health related problems	2	1	3	28	17	
	c) Decline air, water and soil pollution	2	1	3	24	21	
8.	Establishment of partnership with NGOs and other development organization.	0	1	3	21	26	

In order to determine the level of agreed and disagreed opinion of the respondent in the questionnaire of the waste management issues of Dhaka City Corporation of Bangladesh and its hierarchy position, the mean value of every issues was determined. To determine the mean value a simple calculation was done which was shown in table 2.

Table-2: Sample Mean Value Calculation

Sl. No.	Considering Issues	No. of Responses with Ranking Point(in bracket)					Mean
		Strongly disagree (1)	Disagree (2)	Neither agree or disagree(3)	Agree (4)	Strongly Agree(5)	
1	Present waste management status of DCC is satisfactory	15	19	14	3	0	

$$Mean = \frac{15 \times 1 + 19 \times 2 + 14 \times 3 + 3 \times 4 + 0 \times 5}{15 + 19 + 14 + 3 + 0} = 2.098$$

The mean value of other issues were determined by using Microsoft Excel and then presented in a tabular with rearranging according to ranking and their overall hierarchy position (Table-3).

Table-3: Mean value of issues with overall hierarchy position

SL. No.	Considering Issue/Issues	Mean	Hierarchy position	Remarks
1.	Cost effective and environment friendly system is needed for optimization of recyclable and reuseable waste management	4.65	1	
2.	Initiation of size and number of covered bin in waste collection	4.53	2	
3.	Separate collection bin is necessary for effective waste treatment.	4.53	2	
4.	Knowledge of household community is essential in reuse and recycle of domestic waste.	4.51	3	
5.	Establishment of partnership with NGOs and other development organization.	4.41	4	
6.	Slum and floating people waste can be incorporated under DCC management.	4.39	5	
7.	Promotion of potential market for reuse and recycle products in optimization.	4.33	6	
8.	New policy/ strategy are required for effective waste management	4.27	7	
9.	Minimization of environmental hazards	4.24	8	
10.	Decline air, water and soil pollution	4.2	9	

11.	Composting of non-reuseable and non-recyclable waste	4.18	10	
12.	Additional logistics are required	4.16	11	
13.	Community based waste collection system may be incorporated	4.16	11	
14.	Need based training and desimination of information in awareness building is crucially important	13	12	
15.	Lessen health related problems	4.12	13	
16.	Waste carrier transportation system from carriage (Secondary storage point) to landfill demands environmentally safe	4.08	14	
17.	proper utilization of DCC budget can play important role in waste minimization	4.04	15	
18.	Minimization of waste landfill.	4	16	
19.	Sectoral allocation of more funding is needed	3.94	17	
20.	Waste preservation in secondary collection carriage	3.94	17	
21.	Household community may pay for waste collection.	3.94	17	
22.	Introduction of 'polluter pay' principle in waste management	3.92	18	
23.	Allocated DCC budget can optimize in recycle and reuse practice	3.72	19	
24.	Existing legislations (Acts/Rules/Regulations/policy paper/ strategy etc) are sufficient enough in waste management	2.49	20	
25.	DCC is capable enough to handle the existing burden of waste.	2.35	21	
26.	Present waste management status of DCC is satisfactory.	2.09	22	

The study has determined 26 causes which are categorized into 8 main issues in waste management of DCC in Bangladesh. All the issues are directly and/or indirectly related with the concept of waste management system but their level of significance does vary. The perception of the respondent also does vary from one issue to other issues. According to the mean value analysis (Figure3), it is found that the mean value of the issues- Cost effective and environment friendly system is needed for optimization of recyclable and reuseable waste management. Initiation of size and number of covered bin in waste collection,4.53; Separate collection bin is necessary for effective waste treatment,4.53; Knowledge of

household community is essential in reuse and recycle of domestic waste, 4.51; Establishment of partnership with NGOs and other development organization, 4.41 which clearly recognized that those issues are most important. On the other hand respondents strongly disagree with the statement, i.e. Present waste management status is satisfactory; its mean value is 2. Similarly the respondent also strongly disagree the statements which are: DCC is capable enough to handle the existing burden of waste, contain mean value, 2.35 and the statement regarding existing legislation,i.e. Existing legislations (Acts/Rules/Regulations/policy paper/ strategy etc) are sufficient enough in waste management, containing mean value 2.49.
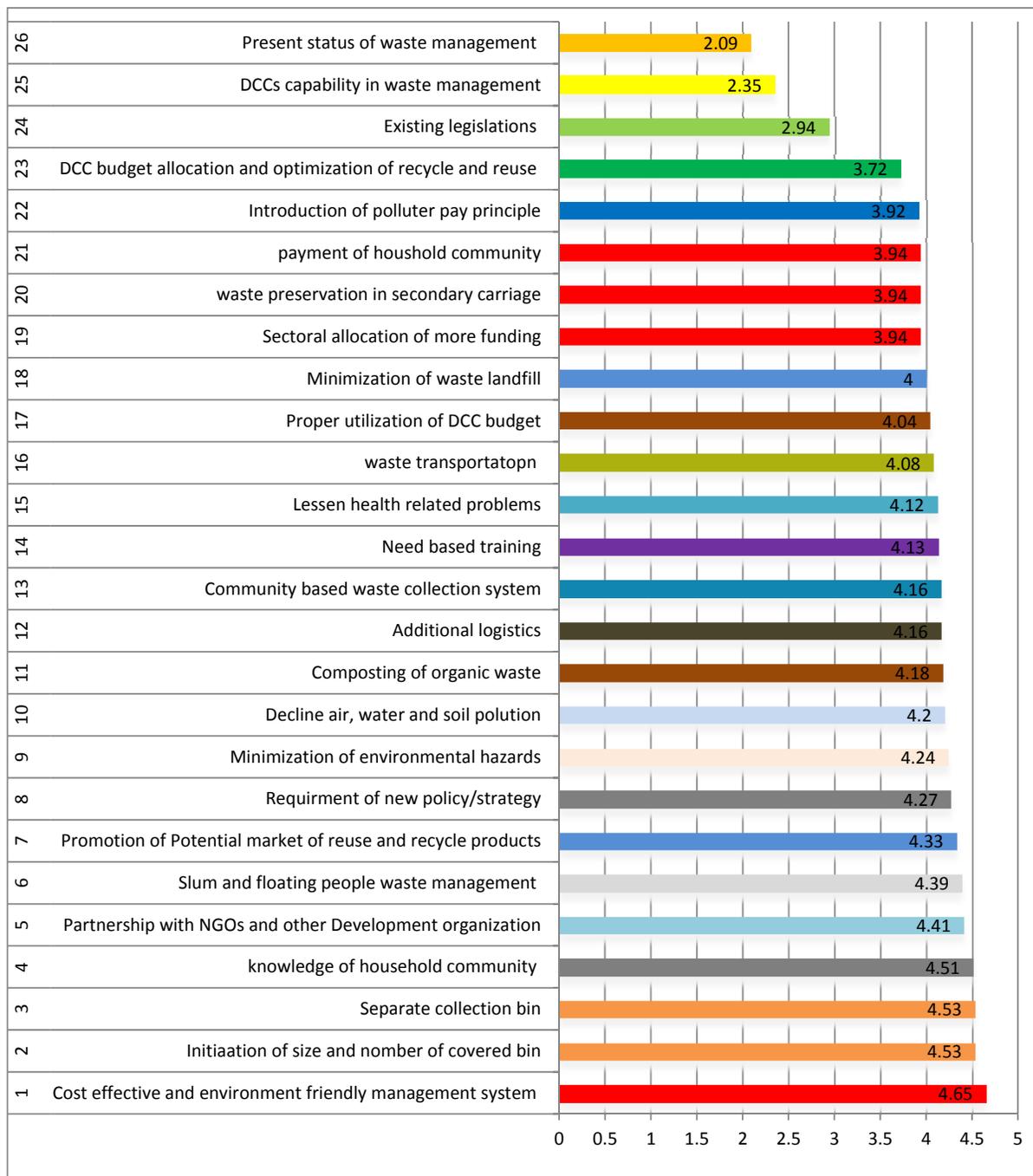
#	Issue	Mean
26	Present status of waste management	2.09
25	DCCs capability in waste management	2.35
24	Existing legislations	2.94
23	DCC budget allocation and optimization of recycle and reuse	3.72
22	Introduction of polluter pay principle	3.92
21	payment of houshold community	3.94
20	waste preservation in secondary carriage	3.94
19	Sectoral allocation of more funding	3.94
18	Minimization of waste landfill	4
17	Proper utilization of DCC budget	4.04
16	waste transportatopn	4.08
15	Lessen health related problems	4.12
14	Need based training	4.13
13	Community based waste collection system	4.16
12	Additional logistics	4.16
11	Composting of organic waste	4.18
10	Decline air, water and soil polution	4.2
9	Minimization of environmental hazards	4.24
8	Requirment of new policy/strategy	4.27
7	Promotion of Potential market of reuse and recycle products	4.33
6	Slum and floating people waste management	4.39
5	Partnership with NGOs and other Development organization	4.41
4	knowledge of household community	4.51
3	Separate collection bin	4.53
2	Initiaation of size and number of covered bin	4.53
1	Cost effective and environment friendly management system	4.65

Figure-3: Mean value of issues and their position of hierarchy

28 respondents were put their opinion on three options, some of them two and also few of them put their opinion only one option. It was found that 23 respondents have put their opinion on formulating new waste management strategy, 24 of them on promotion of bin and its size, number and frequency and 20 respondents gave their valuable suggestion regarding integrated waste management system which were summarized as follows:

a) Formulation of new waste management strategy: Most of the respondents suggested incorporating people's awareness program about waste management. They also gave same importance on new strategy formulation. They have suggested following the developed countries waste management strategies. The opinions include participation of stakeholders including households, businessmen, community organizations, NGOs and the government's institutions in the implementation process. Partnerships between these actors will lay the basis for waste awareness campaigns, recycling initiatives, and compliance monitoring, amongst others. Responses gave importance on strict Law enforcements and proper monitoring activities. As Bangladesh is mainly an agricultural country, it has huge demand of organic fertilizer and in this perspective respondents were suggested to convert organic waste into organic fertilizer. They emphasized that there must have a provision of arranging series of workshops/ seminar to exchange opinion of all possible stakeholders. Coherent strategic policy need to be formulated and this strategy must be supported not only by the environmental laws and regulations of Bangladesh but also by the international laws and treaties. Opinions put importance on engaging and affordable mix of appropriate technical options to Reduce, Reuse and Recycle Waste.

b) Promotion of bin (Size, number and frequency): Almost all of the respondents emphasized on the supply of different colored waste bin to the household community by DCC. The opinions regarding size and number of bin per family and its frequency varied. But majority suggested two collection bins i.e. recyclable and non-recyclable and the frequency would be 2 to 3times per week. Others proposed that size and number of bin should be decided based on the volume of waste generation. City Corporation should have the provision to encourage community to play supportive role in bin maintenance as well as waste collection.

c) Overall suggestions in integrated waste management system: Responses proposed to establish sufficient number of recycle plants (if possible, council wise) and the policy must have the provision of those plants. Every respondent put emphasized on segregation of waste at the household level and in case of failure may be imposed fine. They relate waste management with establishment of sewerage treatment plant for the sack of better environment. Allocation of budget and empowerment of City Corporation authority also have got importance. Respondents suggested introducing Science Technology and Innovation for waste management.

Five out of five face to face respondents were pointed out that waste management is one of the main duties of the City Corporation. They mentioned that considering the waste generation trends and existing management system of DCC, an effective waste management system is needed to ensure healthy and safety environment. One of the respondents gave emphasized on the impact of waste disposal uttering various pollution and diseases problems. He also suggested increasing recycling to minimize the waste. He further suggested that to optimize recycling practices, an integrated effort should be needed from source segregation to product marketing. Three out of five respondents were gave attention in awareness building of local people. All of them are agreed to increase technical support and logistics relating to integrated waste management. The respondents were asked to put the opinion of increasing collection volume of waste by DCC. All of them were suggested to build up awareness of the citizens and to provide different collection

bin. Two of the respondents were responded to encourage private sector and NGOs in collection and recycling sectors. They also put attention on print and electronic media involvement in awareness program. One of the respondents was proposed to go on with 'Sister City Concept' with the cities of developed countries and another respondent put emphasized on strict enforcement of laws.

Four out of five telephonic respondents were self employed. Another one was employed by a managing committee of a local mosque. Out of five respondents 2 were waste collectors who collect waste from household and carrying through their own van and stored it to the nearest secondary storage bin provided by DCC. Other three respondents were waste separator, they separates recyclable and reusable wastes from secondary storage point and sold it to the nearest shop (local name –vangari shop). They learn their knowledge from work experiences with no academic knowledge or training. Waste collectors are getting payment from household members and waste separators earn money by selling their recyclable product. They have no authority and even no monitoring. They have earned TK. 1200 to TK. 3500 per months which is very poor considering the market price. All of them were engaged these jobs in part time basis. According to the respondent responses, waste collectors are not facing any diseases problem but waste separators are facing problems of odours, skin diseases, stomach diseases, etc.

4. **Conclusion and Recommendations**

Waste management is one of the major concerns of Dhaka City Corporation in Bangladesh. This study clearly represents the waste generation trends and waste characteristics and also the impacts of disposal of waste in DCC. Existing management system were evaluated by literature review and also by respondents opinions who were participated in this research by answering questionnaire, taking part of telephonic and face to face interview. All the study showed that less than 50% of wastes were generally managed by 25% of DCC's budget. It is a great anxiety of 10 million residents of Dhaka City. A number of challenged were identified during the study whose solution could be improved the sustainable waste management service of DCC. These challenged were started from waste generation and continued during the whole process of disposal. The existing laws/policy/ strategy are not suitable enough for an effective waste management of DCC. Traditional methods of waste management are not capable of managing the burden of waste. To improve the management system a number of pilot projects are running in DCC with the help of some donor agency, Climate Change Trust Fund and other development partners but those were facing lot of challenges because of various constraints.

An extensive study of the objectives identified a number of issues which have significant impact in waste management of DCC. Analysis of those issues with responses of questionnaires respondents; face to face interview and telephonic interview have set the priority of importance of those issues. From the findings, identified most priorities challenges for DCC's are: establishment of cost effective and environment friendly management system for optimization of recyclable and reusable practices, well organized collection system by initiating separate collection bin and building awareness among City dwellers. Literature showed that a number of pilot project were near to fail due to the lake of awareness of household residents and also waste collectors. In this respect respondent were put emphasized on need based training and desimination of information in awareness building of residents and other stakeholders. They were also suggested to engage more NGOs and other development partners to improve the waste collection services. Slum and floating people's waste management were identified as other significant challenges for DCC.

 Importance of increasing recycles and reuse practice of waste management was supported by literature review and also by respondent's opinions. For accelerating the recycling and reuse practices respondents

were proposed to establish council wise new recycling plant and promotion of potential market for recycling products. To minimize the waste as well as to minimize the landfill demand, respondents were suggested to compost organic waste into organic fertilizer. Several literature studies showed that some composting plants are already running under pilot projects in DCC but in those projects DCC's involvements were negligible. Respondent were strongly agreed with the issue i.e. composting of organic waste into organic fertilizer, which reflect the demand of literature review's findings. Several researchers suggested introducing 'polluter pay' principle and they strongly recommended that household community should pay for waste collection. In this context, the respondent's opinions and the analysis of questionnaire did not support this statement strongly. In contrary, they suggested to increase DCC budget in the waste management sectors. Almost all the respondents suggested formulating a new strategy for effective waste management for DCC. They suggested that it is necessary to take initiative to develop waste management practices and overall effective sustainable policy selected by DCC require coordinated involvement of various stakeholders including citizens, businessman, community organization, NGOs and state authorities.

After clearly judge the detailed literature review, findings from the analysis of questionnaire, respondent's suggestions and opinions, the rankings of issues and their hierarchy positioned, the study suggested the following recommendations for formulating the new waste management strategy of DCC for effective waste management. These recommendations may also give the opportunity of further research of municipal waste management as well as waste management of Bangladesh.

1. Waste generation and separation of waste in household level: The findings of the study suggested segregating the waste at the household level. Some pilot projects were already running to promote source separation but there were no legal framework, no monitoring and supervision. As a result expected outcome were far behind. The policy may include provisions to promote source segregation at household level which might me increased the recycling waste. Household also may be encouraged to produce minimum waste by reuse practicing. Policy should have the provision to scale up such successful projects.

2. Stakeholder's awareness: This study showed that building awareness among stakeholders (household residents, NGOs, businessman, government body, service providers) is one of the most important initiatives for effective waste management. This awareness may change the behavior of waste practices and also change the consumption pattern. This study suggests that waste management at personal level may be introduced from primary education level under social science subject. Print and electronic media and also social media can play an important role in this context. Strategy should have the provisions of awareness building through mass media.

3. Optimization of recyclable and reusable waste: The rate of recycling waste is very poor in DCC. This study suggested increasing the percentage of recycling volume. This may be possible to build up awareness among stakeholders such as household's community, NGOs, businessman and others. The policy should have the provision of need based training of service provider of DCC and also other staff of NGOs and also waste collectors and waste pickers (Tokai). Though one NGO has set up a recycling training centre but it is not sufficient enough to train up all the member of staffs. Proposed policy must have the provision to address the training issue and also the provision of allocation of financial supports for this issue. The policy must have clear cut provision so that private investors can encourage investing this sector.

4. Partnership with NGOs, Private sectors and other developed partners: Study showed that DCC is not capable enough to handle all the burden of waste with their logistics and financial supports. Finding of this research suggested increasing the recyclable and reusable waste by involving other partners like NGOs,

private sectors and development partners. Private sectors may be given the opportunity of   soft loan, text exemption, and easy access for getting land from government to establish new recycling plant / recycling facilities to promote private sectors investment.

5. Introduction of innovation and new technology in waste management practices: Science technology and Innovation need to be introduced in waste management practices. In Bangladesh innovation team are working at every local government unit to central government unit. Innovation can introduce new technological advancement in waste management sectors. Not only DCC but also central government may have the provision to allocate necessary logistics in innovation sectors. An advisory panel may be formed with professionals having enough academic and professional knowledge in waste management under ministry of environment and forest.

6. Promotion of Composting of organic waste into organic fertilizer: Bangladesh is an agricultural country. There is a huge demand on organic fertilizer. The study showed that more than 80% of domestic waste is organic in nature and it is possible to convert this waste into organic fertilizer. Already few pilot projects are running in divisional level with the management of non-government organization. DCC as well as central government should have the provision to promote this technology for effective composting. Study showed that an international school at Baridhara, Dhaka established an in-house rooftop plant for composting their own organic waste. Ministry of education can apply this innovation in many other schools to promote 3R practices.

7. Promotion of informal sector: This study found that the informal sectors are playing important supportive acts in waste collection and separation of recycling waste at initial level. Most of them were self employed and few were employed by local community, NGOs and private sectors. This study showed that they have no academic experiences in composition of waste. They have done their job on the basis of practical experiences and local knowledge. As a result they faced various health hazards like skin disease, stomach diseases, etc. The working environment may be improved by giving them a short term training regarding waste composition and also health and safety. Strategy may be incorporated the informal sector under this provision.

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