Efficiency of Municipal Solid Waste Management Service Delivery System and Policy Issues in Debre Markos Town, North Western Ethiopia

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Municipal SWM problems are coming to the forefront of the global environmental agenda at an increasing frequency and becoming more pronounced in recent years, as a result of inadequate collection and disposal of wastes in cities, especially in developing countries. This study aimed to evaluate the efficiency of municipal solid waste management service delivery system and policy issues in Debre Markos town through field visit, discussions with residents and staffs of municipal administration. The Findings showed that, the municipality lacks institutional, financial and technical capacities. Solid waste collection and disposal services are inadequate and waste was disposed improperly which creates unhealthy environment. For effective solid waste management, there should be proper service delivery system with qualified personnel, modern vehicles and equipment. There should also be improvement of institutional structure and implementation of integrated MSWM involving private service providers and other stakeholders.

Key words: SWM, Institutional capacity, Efficiency and Effectiveness, Debre Markos

INTRODUCTION

The rapid urbanization that has been taking place during the 20th century virtually transformed the world into communities of cities and towns facing similar challenges of environmental issues in which most of the challenges have to be addressed at international level. Among those environmental issues; solid waste management is a critical one because as long as humans have been living in settled communities, solid waste generation has been an unavoidable and critical issue both in developed and developing nations (Smith, 2010). According to Kneeland and Knutson (2012), waste management is an all-encompassing term which describes several distinct processes. It includes the elimination or reduction of waste, recycling of waste material, the treatment and distraction of waste that is physically destroying, chemically detoxifying or otherwise rendering waste permanently harmless and disposing or depositing the material into the air, water or land.

In lower-income countries, such as Ethiopia, an estimated 30% - 50% solid waste produced in urban areas is left uncollected. Consequently, some viral and other infectious diseases are associated with the uncollected waste which also serves as breeding grounds for insects and mosquitoes. Uncollected waste often blocks drainage channels leading to urban floods. In addition, accumulated wastes provide the ever-present hazard of physical injury to people coming into its close contact, particularly children and scavengers (SWM manual, 2012). The urgent need to expand, improve and establish waste collection and management systems will have to be supported by institutional and legal reforms and changes in attitude. However, legal, institutional and administrative framework for the environmentally sound management of waste remains either lacking or inadequate despite considerable progress in formulation and adoption of waste

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management policies (Mohammed and Eyasu, 2017). For a waste management to be considered as well-organized, it is crucially important to actively involve the community, share information on waste separation and recycling, develop a culture that minimizes waste production, promote an efficient use of resources, establish a mutual dialogue among the urban dwellers and ensure popular participation in the urban transformation.

Currently, the responsibility of solid waste management is mainly carried out by municipal authorities. The involvement of private sector players is deemed insufficient (Meaza, 2016). It is characterized by waste collection from designated areas, transportation of waste and tipping waste into the open dump area. This management method comes with poor environmental quality mostly for communities living close to the dumping site. Subsequently, these communities have to deal with issues of environmental health with attendant impacts on economic productivity and development (Tadesse et al., 2014). It is against this backdrop that the present study evaluated the town of Debre Markos with special attention on efficiency of services provided by the municipal authorities. Specifically, the study assessed existing solid waste management practices and challenges as well as institutional arrangement and capacity of solid waste management. Also, it examined the efficiency of existing solid waste management service delivery system.

THEORETICAL UNDERPINNINGS

Concepts of municipal Solid Waste management

Solid waste means any garbage, refuse, sludge, and other discarded solid materials, including solid waste materials resulting from industrial, commercial, agricultural operations and from community activities (Berhanu, 2014). Municipal solid waste (MSW) - refers to materials discarded in urban areas for which municipalities are usually responsible for collection, transportation and final disposal. Municipal solid waste management is an activity of planning and implementation of solid waste management components such as collection, transfer, transportation, recycling, resource recovery, disposal of MSW under jurisdiction of local government (Solomon, 2011). Solid Waste management is an important responsibility and a core service municipality offers to their citizens. Especially; in contexts where national states undergo a transformation towards a more decentralized organization of public affairs, municipalities take responsibilities (Connective Cities, 2015).

Solid waste management (SWM) involves the collection, storage, transportation, processing, treatment, recycling and final disposal of waste. Systems need to be simple, affordable, and sustainable (financially, environmentally and socially) and should be equitable, providing collection services to poor as well as wealthy households. SWM therefore, requires adequate infrastructure provision and maintenance for all activities (J. Rouse, 2008 cited in Daniel et al., 2017).

Sources and Types of Municipal Solid Waste

MSW is generated by households, commercial and industrial premises, institutions such as schools, hospitals, care homes and prisons, and from public spaces such as streets, markets, slaughter houses, public toilets, bus stops, parks, and gardens (M. Coffey et al, 2010 cited in Mengist and Assegid, 2014). With respect to source from which solid waste emanates; (Connective Cities, 2015) categorized municipal solid waste as household (residential) refuse, institutional wastes, street sweepings, commercial area wastes as well as construction and demolition debris. In developing countries, MSW also contains various amounts of industrial wastes from small scale industries. Waste management issues are coming to the forefront of the global environmental agenda at an increasing frequency as population and consumption growth result in increasing quantities of waste. In the context of the above-mentioned challenge a New Paradigm for waste management has emerged, shifting attention to resources efficiency and minimization of environmental impacts throughout the life cycle of waste management from waste prevention to safe disposal. The primary objective of waste management is to give adequate protection to the general public and environment from harmful effects of wastes (Yohanis and Genemo, 2015).

Solid waste management in Ethiopia

Similar to cities to most developing countries provision of required services lags behind the need and development of settlements in urban areas of Ethiopia. Integrated infrastructure and housing development are not widely practiced. Provision of solid and liquid waste collection and disposal is low (most urban areas lack the service). In addition to this, deterioration of the immediate environment in the households and their surrounding is increasing. As solid waste generation increases with economic development and population growth, the amount in these urban areas will double within a similar time range. So, is the cost for solid waste management. Municipalities in Ethiopia have to be prepared for this challenge. Recently, most municipalities in Ethiopia have become aware of the negative consequences of poor sanitation. Accordingly, they have devised and adopted a system to collect and dispose solid waste. A survey of present status of the system in 15 randomly selected large (Dessie, Bahir Dar, Debre Zeit, Gondar, Mekele, Nazareth) and medium urban areas (Woldiya, Axum, Adigrat, Robe, Giambi, Adwa, Arbaminch, Wologaya Sodo, Debremarkos) shows that from the sample urban areas studied 13, i.e. 86.6 percent used open dump to dispose waste, while the rest used holes. Most of the other urban areas in Ethiopia are believed to use open dump for disposal. Open dumps pollute surface and ground water, soil and the natural environment as a whole (Yami, 1999).
In many of the cities in Ethiopia the municipality administration is responsible for waste collection. Though, there is a wide variation in performance in relation to waste collection in cities. It has become a common business practice to have household waste to be precollected by individuals who are organized through formal or informal association. The pre-collected waste is then transferred into containers which are then collected by municipalities. As there is very limited effort to recycle, reuse or recover the waste that is being generated; waste disposal has been the major mode of waste management practice. Some studies have shown that only 43% of waste is collected in the country are properly collected and disposed in open landfills. The remaining waste is indiscriminately disposed in drainage lines, open spaces, street sides or is informally burned (EPA/World Bank, 2004 cited in Yohanis and Genemo, 2015).

Integrated Solid Waste Management

Integrated Solid Waste Management (ISWM) takes an overall approach to creating sustainable systems that are economically affordable, socially acceptable and environmentally sound. An integrated solid waste management system involves the use of a range of different treatment methods (Berhanu, 2014).

![Figure 1. Integrated Solid Waste Management hierarchy diagram adapted from (Haile, 2016)](image)

ISWM is a comprehensive waste prevention, recycling, composting and disposal programme that considers how to prevent, recycle and manage waste in ways that most effectively protect human health and the environment (Mohammed and Eyasu, 2017).

MATERIALS AND METHODS

Study Area

Debre Markos; the capital of East Gojjam Administrative Zone is located in the north west of Addis Ababa, the capital city of the FDRE of Ethiopia, at a distance of 300 km and 265 km from Bahir Dar, the capital of Amhara Nation Regional State. It has latitude and longitude of 10°20'N 37°43'E and altitude of 2,446 meters above the sea level. According to CSA (2007), the population of the town was 85,597. The town has a total area of 6,160 ha. It has an average Annual Temperature of 18.5°c and Mean Annual Rainfall of 1,380 mm.

Methods of the Study

The study uses qualitative and quantitative methods. Data was collected from municipal reports, structural questionnaire from sample MSW generators (residents, commercials, institutions and Municipal Street), staffs of municipal administration and enterprises which give a service on solid waste collection. Also, the study employed filed observation with checklist, group discussion and interview for officials. Secondary data was collected through reading and interpretation of documents, publications, annual performance reports and other related materials from city municipality. Finally, data were analyzed by qualitative and quantitative methods.

RESULTS AND DISCUSSION

Existing SWM practices and problems in municipality service delivery

Solid waste Storage facilities

This functional element of MSWM constitutes an activity that is carried out both by solid waste generators and managers of a town. It encompasses an action of storing solid waste in a certain kind of material or equipment as soon as it is generated and safe control of it until it is permanently disposed. Accordingly, studying solid waste storage facilities and their handling has significant impact for betterment of municipal solid waste management activity (Solomon, 2011). The primary solid waste storage often used by study area residents includes sacks, baskets, plastic bags, tanks and waste piles. Secondary storage facilities are solid waste containers used to store solid waste generated from households at a common or central point from where collection vehicles can pick the waste and transport to final disposal site. These facilities are provided by the municipality. The number of storage facilities does not commensurate with the amount of waste generated, the secondary solid waste storage facilities come under the vagaries of the weather (rainfall and sunshine) exposing the residents who live close by to diseases.

Separation, Reuse and recycling

At household level plastic materials, glass and bottles are considered as valuable and usually sorted out for reuse and some recyclable materials are sold to local collectors. Due to shortage of facility, lack of knowledge and financial problems MSEs have no recycling mechanism of solid waste. Recyclable waste collection in the city is performed by the informal sector. The role of municipality in recycling is absent and it mainly focused on collection, storage, transportation and disposal of solid waste.
Solid waste Collection and transportation

Waste collection is generally considered to be the most important component of any waste management system because it was the most expensive and visible part of the system. Therefore, properly designed and executed waste collection systems can be resulted in significant reduction in environmental and public health risks (Massreshaw, 2017).

Primary Collection of Waste: waste is collected by micro and small enterprises having formal agreement with the municipality to collect waste from households or business establishments and dump them in designated containers. Currently, there are 9 MSEs organized to deliver solid waste collection service to residents. They collect waste once from households and twice from institutes and commercial centers in a week. The MSEs use facilities such as baskets, card boxes, barrels, plastic bags, pushed carts and used garbage bins for street users. The MSEs have no appropriate storage containers to store and collect wastes. The site is exposed to animals like dogs and cats which scatter the waste in to the surrounding area.

Secondary Collection of Waste: is a system of transporting solid wastes from containers to final open dumping site. Trucks collect wastes every day from commercial centers and residential households. Currently the waste collection system faces the challenges of poor infrastructure, lack of trucks, lack of containers and lack of properly designed collection route system. Containers are not protected from rainfall and sunshine which makes the garbage to decompose. Also, due to poor road conditions, transportation becomes another problem especially, during rainy season which causes frequent breakdown of the trucks.

Street sweeping Activity

The street sweepers clean roads everyday using brooms and store waste in sack and placed in transfer stations. There are 40 workers that work and paid on the daily workers basis and the existing employees are not able to cover all streets and most of the street sweeping takes place around the center of the town. There is inadequate number of dust bins and the awareness of the people to use these bins is very low.

Solid waste Disposal

Waste management is also dependent on safe and reliable disposal system. This system can be effectively achieved when disposal site is on accessible landfill, closed and protected from animals and which has no bad smell to the community (UN-Habitat, 2013). Currently the town has two disposal sites; the modern disposal site; located 6 kms away from the town and covering about a surface area of 3.25 hectares. But it is not functional due to human and
technical constraints. The one which is presently used is the open disposal site which is located 4.5 kms away from the center of the town having a surface area of about 150mx200m. It is a type of crude open dumping which is bounded by farming and residential areas without any protection for man and animals (Figure 3).

**Institutional Arrangement and the mandate of the Solid Waste municipality**

Recent studies showed that, many of the municipalities in developing countries do not have clearly defined line of authority that is well established within this institution. As such; Debre Markos town solid waste management system is organized under the municipality as one work process called Plan preparation, monitoring & evaluation, Sanitation and Beautification work process constituting of Plan preparation, monitoring & evaluation, Sanitation and Beautification & green parks development case teams. From the key informant interview, municipal solid waste management functions and responsibilities are not decentralized to lower level departments and officials. Hence, these lower level departments and officials lack essential resources to carry out their duties. Having this institutional arrangement, the Sanitation and Beautification department within the municipality has the following major functions:

- regulate and monitor solid waste management services,
- enforce solid waste management rules and regulations,
- approve municipal contracts,
- encourage community participation in solid waste management,
- provide public gardens, recreational areas, public toilets and drainage services, and,
- undertake public awareness creation.

**Institutional Capacity of the Sanitation and Beautification department**

According to Alam (2016) institutional capacity is generally built by strengthening individual organizations, providing technical and resource support, ensuring integrated planning and effective decision-making processes within institutions. Institutional capacity building comprises the human, scientific, technological and organizational resource capabilities. In order to address all aspects of integrated solid waste management system effectively and efficiently municipalities need sufficient human and financial resources.

**Human Resources Capacity of the Sanitation and Beautification department**

In most developing countries, there is lack of human resources and technical expertise both at national and local levels. Many officers in charge of municipal solid waste management, particularly at the local level, have little or no technical background or training in engineering or solid waste management (Ogawa, 2002 cited in Afework, 2015). The activity of solid waste management is undertaken by one process leader and 9 MSEs organized by the government on contractual basis. When compared with work to be performed, the department has very weak
manpower and this inadequacy of manpower is due to lack of budget and this is the main problem for solid waste management of the town. Solid waste management workers should be equipped with the understanding of skills, knowledge and training for effective waste-management practices. But in Debre Markos town, MSEs are not well organized and suffer from lack of financial, technical and moral support which contributed to low solid waste management of the town.

Financial Resource Capacity of the Sanitation and Beautification department

Budgetary constraints are often felt in developing countries where resources are limited and the limited funds are mismanaged. Many municipalities are struggling to achieve acceptable quality and coverage of service due to these financial constraints. Concerning the financial aspects of waste management, there needs to be greater concern for budgeting and cost accounting as well as capital investment, cost recovery and cost reduction (McAllister, 2015). The SWM is given low priority and very limited funds are allocated to the sector by the government. This is acute where local revenue collection system is inadequately developed and financial base for public service is weak. The revenue gathered is not sufficient to purchase equipment and to employ additional workers to give efficient SWM service in the town. The SWM activities are performed without external donor support but with the help of communities and private sector. The budget needed to provide MSWM is covered by the municipality from its yearly budget which makes the SWM service dependent on the municipality. Solid waste management will continue to suffer since it is very difficult for waste management system to be effective without generating its own efficient revenue. So, to enhance the financial capacity of the SWM private sectors should be involved in service delivery and tied to collect charges from the service users.

Municipal Solid Waste Management Equipment

In municipal solid waste management, there are various facilities that should be accomplished for providing efficient and effective service to residents. But these facilities are highly correlated with the economic performance and good institutional concern of a given town or country (Solomon, 2011). In Debre Markos town, the SWM equipment are inadequate to collect, transport and dispose waste. Currently, the transportation of waste is under taken by one truck which is not efficient.

Generally, there is lack of adequate modern waste disposal equipment, inadequate number of containers and dust bins, lack of recycling materials such as garbage collection vehicles and none frequent use of environmentally adaptable equipment. This shows that, equipment is not sufficient to provide the service when compared with the increasing level of waste generation from the society. Waste collection can be improved by increasing the number of trucks, containers, dustbins, increased collection crews and provision of better collection equipment and tools. Moreover, the workers should also be provided with gloves, uniforms, health and safety measures.

Policy, legal and institutional frame work

The SWM policies and laws are important to ensure that the future directions, regulations, funding and action plans to improve solid waste management are properly coordinated and consistent with national policy and to facilitate cooperation between stakeholders (Suttibak and Nitivattananon, 2005). Ethiopia has Environmental policy which addresses different environmental issues including Solid Waste Management dealing comprehensively with all aspects of SWM being used in all of its regional states. The primary national policy on waste management is the Solid Waste Management Proclamation No. 513. Released in February of 2007.

The proclamation’s main goal is to increase community participation. The proclamation states: it is essential to promote community participation in order to prevent the adverse effects and to enhance the benefits resulting from solid wastes and solid waste management action plans designed by and implemented at; the lowest administrative units of urban administrations can ensure community participation (Proclamation No. 513, 2007). The Solid Waste Management Proclamation works hand in hand with the Environmental Pollution Control Proclamation No. 300/2002 which mandates that all urban governments are obliged to devise and implement safe and effective mechanisms to handle, transport and store municipal waste. It also states that any transporting or treatment of municipal waste can only be done with a permit from the Ethiopian Environmental Protection Agency. In Amhara region, for example, where Bahir Dar is the capital, the regional law is the Basic Solid Waste Management Directive of Amhara Regional State Health Bureau 2009, which addresses issues of garbage classification, collections and storage, treatment, disposal and recycling in the same manner as the national governmental policy (Forum for Environment-Bahir Dar, 2010 cited in Cheever, 2011).

According to Meaza (2016), the laws and regulations are well prepared; nevertheless, there is a huge gap between what is written in the papers and what is done practically. The efforts required to implement the regulations have somehow been missed. In most cases, it is also difficult for residents to follow the regulation because they do not have access to a proper solid waste management system that allows them to manage their waste in line with the regulations. Therefore, there is a need for proper research for a strategy to implement regulations, policies and declarations and on how to embed the values in the society.
Table 1: Federal Laws and Regulations directly or indirectly address solid waste management issues in Ethiopia

<table>
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<tr>
<th>Proclamation/Regulation Number and date</th>
<th>Title</th>
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<tr>
<td>Proc. No.300/2002</td>
<td>2. Environmental Pollution Control Proclamation</td>
</tr>
<tr>
<td>Proc. No.414/2004</td>
<td>4. Ethiopian Criminal Code article No. 520 (a, b, c), article No. 519, article No. 830</td>
</tr>
<tr>
<td>Regulation 159/2001 E.C.</td>
<td>6. Prevention of Industrial Pollution Regulation</td>
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Source: ISWM plan-Bahir Dar, 2010

CONCLUSION AND RECOMMENDATIONS

This study has tried to assess the efficiency of SWM service delivery and policy issues in Debre Markos town. It showed that, the service is not efficiently and properly provided due to lack of financial and technical aspects. The department has very weak manpower and workers are not equipped with the understanding of skills, knowledge and training needed for effective waste management practices. There is no decentralization of respective functions and responsibilities between higher and lower departments and officials. This has resulted in inadequate resources for municipal solid waste management. Generally, there is lack of adequate waste disposal equipment, inadequate number of containers, lack of recycling materials, none frequent use of environmentally adaptable equipment. Waste was also disposed into an open area, river and drainage system and there was no punishment on individuals who dispose waste in unauthorized places. The existing system of solid waste management is not environmentally sound, effective and efficient due to lack of community participation and organizational capacity. Based on the findings of the study, the following recommendations are forwarded for effective SWM in Debre Markos:

- Strengthening Institutional Capability building and Staff Skill Development.
- Public awareness and education
- Community participation, role of NGOs and public-private partnership should be encouraged
- Integrated SWM technologies should be adopted
- Designing revenue generation mechanisms
- Service payment rate of private collectors and MSEs should be improved
- Solid waste combusting for energy recovery is recommendable
- Proper implementation and monitoring of suitable policies and legal framework.
- The recently constructed modern land fill should substitute the open land fill and should start its function.

The above recommendations are essential to improve municipal solid waste management and the government should also monitor and evaluate municipalities to ensure that, municipal solid waste is managed in an adequate, sustainable and environmentally sound manner.

ACKNOWLEDGEMENT

The authors acknowledge governmental and other concerned bodies for their support in providing the necessary data and assistance during our field work and those who participated in reviewing the contents of this paper.

COMPETING INTERESTS

The authors declare that, they have no competing interests.

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Accepted 14 August 2019


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