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The Assessment of Solid Waste Management practicesin Addis Ababa City: the case of Bole Sub City

By

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This is to certify that the thesis prepared by Horro Leta entitled "**The Assessment of Solid Waste Management practices in Addis Ababa City: the case of Bole Sub City",** which is submitted in partial fulfillment of the requirements for the Degree of Masters in Public Management and Policy (MPMP), complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

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Abstract

Solid waste management practices in Bole sub city is un satisfactory and incomplete as illegal dumping of solid waste in open areas, in gullies , river courses and streets seen in daily life of residents. considering this, study is aimed at the overall assessment of the existing solid waste management practices of Addis Ababa city with particular reference to Bole sub city. In order to accomplish these objectives, the researcher used both primary and secondary sources. Bole sub city sanitation administration is the responsible institution to take over solid waste management practices of the sub city. Solid waste management activity in bole sub city takes place in two cycles. The first cycle is door to door collection and transportation of solid waste to transfer stations. This can be done by cooperative partnership associations. The second cycle is transportation of solid waste from transfer station to "koshe" disposal site and can be done by sub city sanitation administration. "Koshe" disposal site is generally described as open and unsanitary landfill that has different problems to environment and the community. The finding of this study revealed that the present status of Bole sub city solid waste management is poor. Institutional related problems, cooperative partnership association related problems, and limited participation of stake holders are the major factors that limits the proper solid waste management practice of Bole sub city.Therefore, the best ways that used to tackle the above problems are: giving training to cooperative partnership association and sanitation administration employees, developing institutional structure that have capacity to implement integrated MSWM approach which recognizes and comprises all stakeholders.

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DEFINITION OF TERMS

Sub city: means the second administrative stratum of the city.

Woreda: means the third administrative stratum of the city.

Case team: A group of experts that work together in one work process.

Sub city: means the second administrative stratum of Addis Ababa city.

Woreda : means the third administrative stratum of the Addis Ababa city.

Koshe: a local name given to Addis Ababa solid Waste disposal site

Liwach: A name given to individuals that exchange old shoes and old cloths of the society by house materials informally through door to door visit

Quraleos: A name which is given to individuals that buys reusable, and recyclable solid wastes from the society informally through door to door visit.

Sanitation agents: A person employed by the concerned organ to supervise and control over the illegal disposal solid waste.

Work process: Represents specific departments of an institution that organize to perform its assigned tasks.

LIST OF ACRONYMS

BPR =	Business Process Reengineering
CBOs =	Community Based Organizations
CSA =	central statistical agency
FDRE=	federal democratic republic of Ethiopia
JICAIIC =	Japan International Cooperation Agency Institute for International Cooperation
KG=	kilograms
M^3 =	meter cube
MoH =	Ministry of Health
MSSE =	Micro and Small Scale Enterprise
MSW =	Municipal Solid Waste
MSWM =	Municipal Solid Waste Management
NGOs =	Non Governmental Organizations
SBPDD =	Sanitation, Beautification and Parks Development Department
SPSS=	statistical packed for social science
Sq km=	square kilometer
UK =	United Kingdom
UN =	United nation
UNCHS =	United Nations Center for Human Settlement
UNDP =	united nation development program
UNEP =	United Nations Environmental Program
US=	United States
WHO =	World Health Organization

CHAPTER ONE

1. Introduction

1.1 Background of the Study

Waste was an early problem of mankind, and a growing one that is of major concern to every nation of the world (Allende 2009 cited in Yohanis Birhanu and Genemo Berisa 2015). In early pre-industrial times, waste generation was not an issue as population was smaller. Waste was disposed of in the ground where it would turn to compost to improve soil fertility. 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.

The rapid urbanization that has been taking place during the 20th century virtually transformed the world in to communities of cities and towns facing similar challenges on environmental issues in which most of them have to be addressed at international level (Smith, 2010). 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. As a result, solid waste management became a worldwide agenda at united nation conference on environment and development in RioDejieneiro in 1992 with a great emphasis on reducing wastes and maximizing environmentally sound waste reuse and recycling at first step in waste management (UNEP, 1996).

Solid waste is defined as “Anything that is neither liquid nor gas and is discarded as unwanted ‘and Solid Waste Management “The collection, transportation, storage, recycling, or disposal, of solid waste, or the subsequent use of disposal site that is no longer operational” (Solid Waste Management Proclamation No. 513/2007).

The objective of Solid Waste Management Proclamation No. 513/2007 is to enhance at all levels capacities to prevent the possible adverse impacts while creating economically and socially beneficial assets out of solid waste.

Solid waste management also defined as the collection, transportation, processing, recycling, and disposal of solid waste materials so as to reduce their effect on health, environment and aesthetics. Itis highly related with urbanization and industrialization Retrieved from (http://www.gdrc.org/, November 27, 2017). For instance in early societies, solid waste management consisted of digging pits and throwing garbage into them. When cities began to be more concentrated; however, solid waste management became a serious and complex issue. Houses that did not have room to bury their garbage would throw it into the streets. In response, many cities started to set up municipal garbage collection team's which would dispose of unusable garbage. This is mainly because modern societies generate far more solid waste than early humans ever did. As a result, recent event in major urban centers both in developed and developing countries have shown that municipal solid waste management has become a big challenge Retrieved from (http://www.gdrc.org/, November 27, 2017). In developed countries the daily life of people can generate greater quantity of solid waste than developing countries, but most parts of developed nations are efficient in handling waste when compared to developing countries because of their technologically complex, institutionally efficient and cost effective solid waste management systems. On the contrary compared to developed countries, developing countries produce less per-capita solid waste. But the capacity of developing countries to collect, process and dispose waste is limited due to inadequate infrastructure, finance, political instability, inefficient institutional capacity and structure, and low level of awareness.

In Ethiopia solid waste management was highly centralized until 2003. As part of a broader decentralization effort in that year the city administration of Addis Ababa divided into ten sub cities and 117 districts that comprise the local administration (FDRE 2003). The purpose of reorganizing the city was to give more power to lower administrative unit and to empower local communities and their institution. As a part of a reform, the city government promoted integrated solid waste management by local administrations, and strengthened the role of both formal, informal, public and private sectors in solid waste collection, transportation, disposal and recycling activities (FDRE 2003). In 2005 Addis Ababa city government decided to change the

system of solid waste and shifted the focus of waste collection, transportation and disposal towards government affiliated cooperatives and micro and small scale enterprise(MSSEs).

Informal private collectors were now excluded, and this results in systematic eviction of preexisting informal sector (Samuel Shimelis, 2006). Part of this decision was politically driven, as the micro and small scale enterprises (MSSEs) and cooperatives provided an additional source of employment that the city government and the ruling party could use to distribute patronage to party members. Today the majority of waste collection, transportation and disposal in Addis Ababa are carried out by these government affiliated organizations to gather with the city, sub city and woreda level government. This politically driven reconfiguration of services worsened the situation of solid waste management in the city. The existing waste management system is rated inefficient and characterized by in appropriate collection, lack of provision of containers and collection trucks, illegal dumping, and complex waste collection fees (Solomon Asrat, 2006).

Bole sub city one of the sub cities ofAddis Ababa in which proper provision of solid waste management services is still unsatisfactory and in complete in. As illegal dumping of waste on open areas, in gullies, river courses are considered as routine task of residents. The efforts made by the sub city administration to change the situation in the sub city are also insufficient as it compared to the extent of the problem. Therefore, in order to reduce this situation and achieve efficient solid waste management system of the sub city, detail study of the existing condition of municipal solid waste management practices of the sub city is required.

1.2 Statement of the Problem

Addis Ababa, the capital city of Ethiopia and the diplomatic center of Africa, where the African union is head quartered was found in 1887. According to central statistical authority (CSA 2016), close to four million people are now live in Addis Ababa , over 30 percent of the urban population in Ethiopia and it is one of the fastest growing cities on the continent. Its population has nearly doubled every decade and as result Addis Ababa has expanded geographically to cover an area of 540 sq km. Addis Ababa’s geographic location combined with its political and socioeconomic status, have made it the melting pot for hundreds of thousands of people that

come from all corners of the country in search of employment and services (SBPDA 2003; UN habitat 2008). Such rapid increase in population together with rapid development of the city has produced increasing volumes of solid waste and in turn it induced greater infrastructural demand, institutional setup and community participation for its management.

Bole sub city is one sub cities among ten sub cities in Addis Ababa and the sub city was divided into 14 woredas, 124 "ketenas" and 1344 blocks. According to central statistical agency report bole sub city has total population of 360,387 and the fourth in the number of population and the largest sub city in its area coverage. Due to its geographical location the growth and expansion of bole sub city increasing day today.

Currently Bole sub city sanitation administration office has practice its activity by supplying 10 trucks for daily collection, transportation and disposal of the sub city's solid waste. There are also 85 micro and small scale enterprises working in solid waste collection. Now these micro and small scale enterprises grow and changed to 13 cooperative partnership associations working in 14 woredas of sub city. In addition to this, there also private companies that collect solid waste generated by business institutions in the sub city. According to report made by bole sub city sanitation administration, 474,004 meter cube solid waste was collected and disposed in 2009 EC fiscal budget year. Out of these about 84.3% of solid waste was collected from residents of the sub city. But there are still Most of solid wastes that are generated in the sub city remain uncollected and simply dumped in open areas, road sides, river courses and in gully areas.

Furthermore the disposal method that Bole sub city and the city of Addis Ababa in general used is also open dumping type which widely practiced in many developing countries and has hazardous effect on health and the environment. Besides this, sanitation administration of the sub city does not operate any formal waste recovery or recycling activity by itself. As a result, municipal solid waste management of Bole sub city has not been carried out in a sufficient and proper manner. The environmental and sanitary conditions of the sub city have become more serious from time to time, and people are suffering from living in such conditions.Considering these, there is no related study conducted on this area to measure the status of solid waste management of the sub city. Due to these factors, detail study of the overall condition of solid waste management practice should be the first move required for reducing this gap. Therefore,

this study focused on assessing solid waste management practices of Bole sub city sanitation administrationand its institutional arrangement and capacity side by side the Contribution of cooperative partnership association in solid waste management.

1.3 Objectives of the Study

1.3.1 General objective;

The objective of this study is to assess the current solid waste management practices of Addis Ababa city with particular reference toBole sub city.

1.3.2. Specific objectives

Having the above general objective, the study is gear to attain the following specific objectives.

- To assess the major problems faced by cooperative partnership associations in solid waste collection and management
- To assess the process associated with solid waste management practices of the sub city.
- To assess present institutional arrangement and capacity of solid waste management of the sub city.
- To assess problems associated with solid waste disposal mechanism sub city

1.4 Research Questions

So as to achieve the intended objectives stated above, the following research questions were formulated.

- What is the major problem faced by cooperativepartnership associations in solid waste collection and management in the sub city?
- What are the processes associated with solid waste management practices of the sub city?
- What is the existing institutional arrangement and capacity of solid waste management of sub city?
- What are problems associated with solid waste disposal mechanism sub city?

1.5 Significance of the Study

This study may have two main significances. First it may give some guide line information to policy makers, solid waste managers and environmental protection agencies about existing situation of the sub city's solid waste management practices. The study may also important in putting baseline information to the next work who would like to conduct detailed and comprehensive studies related or other study area.

1.6 Limitation of the Study

This research does not conducted without short comings. Some of them areless cooperation fromcooperative partnership association in data collection. Official worker in the sub city also refused to give detail information related to operational cost of sanitation administration work process of the sub city. But, the researcher overcomes these problems by creating good rapportand giving detail information about the purpose of the research.

1.7 Delimitation of the Study

The study was confined to bole sub city sanitation administration office of Addis Ababa city. This is mainly because there is a severe problem of solid waste management and limited surveys which were conducted so far regarding the sub city's solid waste management. In this study descriptive research method was employed using of survey. On the other hand, this study was cross sectional survey and delimited to overview of current condition of solid waste management practices and institutional arrangements and capacity of Bole sub city sanitation administration for delivery of proper solid waste management in the sub city.

1.8 Organization of the Thesis

This paper is organized in to five chapters. The first part is chapter one which is an introductory part of the paper. The second chapter deals with review of related literature obtained from various published and unpublished reference materials. The second part of the thesis is chapter three that describe the methodology of the research. The fourth chapter is result and discussion which present analysis and interpretation of data about the existing status and spatial coverage of

solid waste management practice, and institutional arrangement of sub city in solid waste management. The last part of this study was chapter five which is conclusion and recommendation. Bibliographies and appendices were also attached at the end of the paper

CHAPTER TWO

2. Review of Literature

2.1 Concepts of Solid Waste Management

2.1.1 Definitions of Key Terms

Waste - according to UK environmental protection act (1990), "it is any substance which constitutes scrap materials, an effluent or other unwanted surplus arising from application of any substances or article which requires to be disposed of which has broken, worn out, contaminated or otherwise spoiled."

Solid waste - can be defined as "any garbage, refuse, sludge, and other discarded solid materials resulting from industrial, commercial, agricultural operations, and community activities, but does not include dissolved materials" (U.S. Code of Federal Regulations, 1995 cited in Samuel, 2006). In short "it is anything that is neither liquid nor gas and is discarded as unwanted" (Federal NegaritGazeta of Ethiopia, proclamation number 513/2007). 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 and transportation, recycling, resource recovery, and disposal MSW under jurisdiction of local government. (Ministry of urban development and construction, solid waste management manual, 2012)

2.1.2 Sources and Types of Municipal Solid Waste

In order to categorize what exactly municipal solid waste constitutes, there have been different of categorization based on numerous classification criteria. Some of those criteria are source from which solid waste emanates, and nature of solid waste components. On the basis of the nature of items that constitute solid wastes, it can be classified into organic or inorganic, combustible or non-combustible, and putrescible or non-putrescible (Edelman, 1997 cited in G/Tsadkan, 2002).

With respect to source from which solid waste emanates, (Martin, 2000) categorized municipal solid waste from household (residential), institutional wastes, street sweepings, commercial areas wastes, as well as construction and demolition debris. In developing countries, MSW also contains various amounts of industrial wastes from small scale industries. In these sources there are diverse types of solid wastes. But, some of typical solid wastes of those sources are described by (Dereje, 2001) as follows.

Domestic solid wastes: wastes generated from household activities such as food preparation, cleaning, fuel burning, old cloths, furniture, obsolete utensils and equipment, packaging, newsprint, and garden wastes. In developing countries, food waste and ashes dominate households' solid wastes.

Commercial wastes: waste from shops, offices, hotels, restaurants, etc and typically consisting packaging materials, office supplies and food wastes. In low income countries food markets contribute the largest proportion of commercial waste.

Institutional wastes: waste from schools, hospitals, clinics, government offices, military bases etc, and comprise hospital and clinical wastes including potentially infectious and hazardous materials.

Industrial wastes: composition of industrial waste depends on the kind of industries involved. It consist food waste from kitchens, and canteens, packaging materials, plastics, papers and metal items.

Street sweepings: dust, soil, paper, etc. In developing countries street sweeping also include fruit and vegetable residues, household wastes dumped along roads, drain cleanings, animal manure and plant remains.

Construction and demolition wastes: its composition depends on type of construction materials used, but it typically includes soil, brick, stone, concrete, ceramic materials, wood, packaging materials and the like.

2.1.3 Generation rate and physical composition of Municipal Solid Waste

For effective and efficient management of solid waste generated in a particular city, adequate knowledge and data about the generation of solid waste is essential. In addition to this, to decide or determine types of facilities required for solid waste management, best disposal options, and projecting future needs requires precise information about quantities, compositions, densities, moisture content and calorific value of solid waste produced in a city (Rushbrook, 1999 in G/tsadkan, 2002). Though all the above characteristics are important Solid waste generation rate composition study is core stone for successful planning and implementation of solid waste management

2.1.3.1 Solid waste generation rate

Solid waste generation rate refers to the "amount of waste disposed during a given period of time and the quantification of it involves different methods: by measurement at the point of generation, through use of vehicle survey and by examination of records at the disposal facility" (UNEP, 2009; cited in Zebenay, 2010).

The rate of solid waste generated in a given town is basically determined by demographic growth, seasonal variation, geographic location, economic development and people's attitude towards waste. Nashiimirimana (2004) explained the influence of economic development by comparing gross national product of developed and developing countries with their waste generation rate. And he concludes that the higher the gross national product of a country result the higher the generation of waste. It means due to difference in level economic performance, waste generation rate of developed countries is highly greater than that of developing countries. Although developing countries have a lower rate of waste generation compared to developed countries, their quantum of waste is high owing to their higher levels of population growth. This clearly shows impact of population size on waste generation rate (Ibid, 2004).

On the other hand, people's attitude towards waste can also conditioned solid waste generation rate in the form of their pattern of material use and waste handling, their interest in waste reduction and minimization, and the degree to which they refrain from indiscriminate dumping and littering (Schubeler, 1996).

Therefore, an accurate knowledge of quantity and rate of solid waste generation in a given area is essential for preparation and implementation of appropriate MSWM. Because it provides information on human, financial and equipment resources required for collection and transportation of waste, to enact appropriate laws on waste reduction, and establish current and future needs for solid waste disposal sites.

2.1.3.2 Physical composition

Physical composition refers to quantity of various material types in a particular waste stream. Just like waste generation rate, physical composition of solid waste is also extremely variable as a consequence different factors. The major once are of the following:

- Economic level difference: higher income areas are usually producing more inorganic waste while lowIncome areas produce relatively more organic waste.
- Demography (difference in amount of population for example, tourist places).
- Locations: includes abundance and type of regions natural resource, and socio-cultural factors which highly contribute for variation of waste in different areas.
- Season: for instance during certain season's yard wastes such as grass clippings and raked leaves add greatly to solid waste). Urban waste generation and classification. Retrieved from (http://www.medcities.org).

2.1.4 Functional Elements of Municipal Solid Waste Management

In the course of municipal solid waste management there are six functional elements. Identification of these functional elements allows description of relationships involved in each element, and development of a framework. As a result, to handle a specific solid waste management it is obligatory to observe the following six elements in combination.

2.1.4.1 Waste Generation

Waste generation encompasses activities in which materials are identified as valueless and either thrown away or gather together for disposal. This functional element is very important because all activities that lead to identification and understanding of solid waste generation rate, volume,

composition, area specific variations of waste generation and their expected changes overtime are belong to this component solid waste management. So, this functional element is a vital stage for acquiring accurate information that is necessary to monitor existing management system and to make regulatory, financial and institutional decisions (Gebrie, 2009).

2.1.4.2 on site Handling, Storage and Processing

This functional element constitutes activities associated with handling, storage, and processing of solid wastes at point of generation. Waste handling involves activities associated with management of wastes until they are placed in storage containers for collection. It also encompasses movement of loaded containers to point of collection. Storage refers stock up of wastes as soon as they are generated. There are two types of storage activities at source. The first one is temporary storage done at household level as a part of their hygiene. The second type is communal solid waste storage system on public solid waste containers prepared by municipality. While processing at source involves activities such as waste composting and separation of solid wastes for reuse and recycling. All of these components are important for protection of public health and aesthetics and environment Retrieved from (http://www.gdrc.org/, November 27, 2017).

2.1.4.3 Solid waste Collection

Collection involves the process of picking up of wastes from collection points, loading them in to a vehicle, and transporting it to processing facilities, transfer stations or disposal site. In most municipal solid waste management systems, cost of collection accounts a significant portion of total cost. For instance, "in industrialized countries collection accounts about 60-70% of total cost, and 70-90% in developing and transition countries" (UNEP, 1996).

Collection is structurally similar in developing, transition, and industrialized countries, but there are important technical and institutional differences in implementation. In most cases, industrialized countries have more efficiency and effectiveness than developing ones in terms of their approach of collection, role of municipal governments, private-sector participation, and demographic and social factors relevant to collection. In developing countries, collection often involves a face to face transaction between generator and collector. The level of service is low,

and generators often have to bring their wastes long distances and place it in containers. As a result many collection activities in developing countries carried out by informal sectors (UNEP, 1996).

In general, there are four basic methods of solid waste collection described by (Tchobanolous, et al 1993 cited in Ramachandra and Bachamanda, 2006):

2.1.4.3.1 Community bin

Community bins are placed in convenient locations where community members carry waste and throw it in. This method is comparatively cheaper than other methods, and most widely adopted method in western countries. For this method to be adopted it is important that bins are covered, aesthetic, attended regularly, kept clean, easy to handle, and separate bins are provided.

2.1.4.3.2 Curbside collection

In Curbsidecollection homeowner is responsible for placing containers to be emptied at the curb on collection day and for returning empty containers to their storage location until the next collection.

2.1.4.3.3 Block collection

In block collection, collecting vehicles arrive at a particular place or a set day and time to collect waste from households. Households bring their waste containers and empty directly into the vehicle. This method requires a higher homeowner cooperation and scheduled service for homeowner collaboration

2.1.4.3.4 Door to door collection

InDoor to door collection waste is placed at doorstep at a set time when waste collector arrives. In this method, collector of waste has the responsibility to collect waste separately. This method is very convenient for households, however requires homeowner cooperation.

2.1.4.4 Transfer and Transport

These activities are associated with transfer of wastes from public storage facilities to collection vehicle and the subsequent transport of wastes to disposal site. Transfer refers to movement of waste or materials from primary collection vehicle to a secondary, larger and more efficient transport vehicle. When location of final disposal site is at a long distance from points of collection, transfer stations may be used. With respect to transfer stations, "there are two basic modes of operation: direct discharge and storage discharge. In storage discharge refuse is first emptied from collection trucks in to a storage pit or to a large platform. While in direct discharge station, each refuse truck empties directly in to larger transport vehicles" (Meenakshi, 2005).

Transportation on the other hand covers all types of vehicles under operation to transport solid waste from its generation point to transfer station and then to treatment or disposal site. "All vehicles in operation are considered including manually driven small carts, mechanically driven sophisticated transportation vehicles, and special vehicles for hazardous, bulky, and recyclable wastes. Generally, a properly design transfer and transportation system highly reduces cost of collection" (Ibid, 2005).

2.1.4.5 Processing and Recovery

This functional element includes all techniques, equipments and facilities used both to improve the efficiency of other functional elements and to recover usable materials, conversion products, produce energy, and compost from solid wastes. In addition it also provides several advantages. First, it can serve to reduce total volume and weight of waste material that requires collection and final disposal. Volume reduction also helps to conserve land resources since land is the ultimate sink for most waste materials. On the other side, it also reduces total transportation cost of waste to its final disposal site (Uriarte and Filemon, 2008).

Solid waste processing and recovery has been carried out beginning from separation and processing of wastes at the source. But, separations of mixed wastes usually occur at materials recovery facility, transfer stations, combustion facilities and disposal sites. It often includes separation of bulky items, separation of waste components by size using screens, manual separation of waste components, and separation of ferrous and non-ferrous metals. Then they

enter in small and large scale industries for recovery activities. For example, organic fraction of MSW can be transformed by a variety of biological and thermal processes. The most commonly used biological transformation process is 4aerobic composting and, the most commonly used thermal transformation process is incineration. (http://www.medcities.org)

2.1.4.6 Disposal

This is final functional element in solid waste management system. Disposal activities are associated with final dump of solid wastes directly to a landfill site. Today disposal of wastes by land filling or land spreading is the ultimate fate of all solid wastes whether they are residential wastes, or residual materials from materials recovery facilities. "However, in most developed countries this method is officially banned allowing only sanitary landfill for final disposal. Because sanitary landfill is not a dump it is an engineered facility used for disposing of solid wastes on land without creating nuisances or hazards to public health and environment" (Techobanglous, 2002) cited in (UNEP, 2009). "Though it is the most common technology around the world, conventional and environmental unfriendly methods such as open-burning, open-dumping, and non-sanitary landfill can still be used as disposal method" (UNEP, 2009).

2.1.5 Environmentally Sustainable Municipal Solid WasteManagementMethods

2.1.5.1 Incineration

Incineration is one option for sustainable solid waste management. It is defined as the process of burning solid waste under controlled conditions to reduce weight and volume of solid waste, and often to produce energy. This process is really waste reduction, not waste disposal, though following incineration ash must still be disposed. It is recognized as a practical method of disposing of certain hazardous waste materials (such as medical waste). Incineration can be carried out both on a small scale by individuals and on a large scale by industry. Retrieved from (http://urbanindia.nic.In/ publicinfo/swm/chapter2.pdf) web page accessed, November, 27, 2017.

This facility does not require much area so that it is common in countries like Japan where land is scarce web page accessed, November, 27, 2017. Incineration has several advantages and disadvantages. These are summarized below.

Advantages Disadvantages

- Requires minimum land
- Can be operated in any weather condition
- Produces stable odor free residue
- Can generate electricity
- Effective way for hazardous waste management
- Reduce solid waste weight up to 70 % and volume up to 90 %
- Expensive to build and operate especially for developing countries
- High energy requirement
- requires skilled personnel and continuous maintenance
- Emission of gaseous pollutants
- If not carried out properly, incineration results air pollution
- Difficult to site because of citizens opposition
- Encourages waste production because it is output approach

Source: (Miller, 2007)

Generally, according to UNEP (1996) there are considerations that we should keep in our mind when we want to choose incineration. These are:

- The necessary environmental controls are properly installed and maintained.
- The facility is properly sized and sited to fit well with other components of the MSWM
- The material to be burned is combustible and has sufficient energy content.

2.1.5.2 Composting

It is a process of allowing biological decomposition of solid organic materials by bacteria, fungi, worms, insects, and other organisms in to a soil for transforming large quantities of organic materials to compost (humus like materials). “The organic materials produced by composting can be added to soil to supply plant nutrients such as nitrogen, phosphorus, potassium, iron, sulfur, and calcium, slow soil erosion, make clay soils more porous or increase water holding

capacity of sandy soils" (Enger and Smith, 2008). Retrieved from (http://www.gdrc.org/, November 27, 2017).

There are three scales at which composting has been implemented; residential level, decentralized community level, and centralized and large scale municipality level. The larger the undertaking the more capital investment is required. Most developing countries which have found success with composting revealed that composting works best when implemented at household level, with some project doing well at community level as well. At municipal level financial commitment required to maintain equipment has resulted in wide spread failures (zerbock, 2003).

Generally composting has many advantages; first it would reduce amount of waste requiring ultimate disposal and extending the life of landfills. When it done correctly the end result becomes a useful product, capable of being used at household or farm level to augment soil nutrient levels and increase organic matter in the soil, increasing soil stability. If the product has high enough quality and markets exist, it can be sold. Environmentally, process of composting is preferable than landfill processes. In a landfill, bacteria break down organics an aerobically (in absence of oxygen) and resulted in release of methane gas. However, in composting organic matter is decomposed using an aerobic process and produces no methane by product (zerbock, 2003). Contrary to the above benefits, composting has the distinction of being failed waste management system.

In cities of developing countries, most large mixed waste compost plants have failed or operate at less than 30% of capacity. The problems most often cited for such failures include: high operation and management costs, high transportation costs, poor quality of product as a result of lack of sorting (especially plastic and glass fragments), poor understanding of composting process, and high competition from chemical fertilizers (which are often subsidized) (UNEP, 1996).

2.1.5.3 Reuse and Recycle

Reuse involves cleaning and using materials over and over. In other words, it means the use of a product more than once in its original form for the same or a new purpose. It relays on items that

can be used over and over instead of throw away items. This method is used to decrease the use of matter and energy resources, cuts pollution, creates local jobs, and saves money (Miller, 2007). “Reusing is more efficient and better than recycling and composting methods because cleaning and reusing materials in their present form avoids the cost of energy for remaking them in to something else” (Miller,2007).

In addition to reuse, recycling is also an obvious solution of solid waste problem. It is an important way of collecting solid waste materials and turning them in to useful products that can be sold in the market place. Such materials can be reprocessed in two ways: primary and secondary. “Primary recycling is a process in which original waste material is made back in to the same material for example, newspapers recycled to make newsprint. In secondary recycling, waste materials are made in to different products that may or may not be recyclable for instance, cardboard from waste newspapers” (Miller, 2007).

Recycling is both environmental and economical issue. Many people’s are motivated to recycle because of environmental concern i.e. it reduces pollution, it also save energy, space and resources, helps to protect biodiversity and reduce litter. Economically, it can save money for items like paper, metals and some plastics, and generally it is important part of economy. However there are also some critics forwarded on recycling dominantly on economic aspect of its benefits. Economists say that recycling does not make sense if it costs more to recycle materials than to send them to a landfill or incineration. They also forwarded that recycling is often not needed to save landfill space because many areas are not running out of it (Miller, 2007).

2.1.6 Institutional Aspects of Municipal Solid Waste Management

2.1.6.1 Relationships between Institutional Structures and Municipal Solid WasteManagement

It is a common perception that improving MSWM means making waste collection and disposal systems more efficient, raising public awareness and enforcing environmental MSWM laws. However, according to Antipolis (2000)in Obengetal,(2008) “a prerequisite for all these factors is a well planned management, operating within an enabling institutional framework, and capable

of generating the financial resources required to meet operating, maintenance and investment costs. Otherwise, poorly managed facilities lead to declining service levels, which in turn reduce the chances of good cost recovery in terms of both willingness to charge and willingness to pay" (Obengetal, 2008). In addition, several studies also point out the strength of institutional structure as a key underpinning factor to sustainable solid waste management. For example, (Schubeler et al, 1996) stated key institutional structure issues associated with MSWM which are considered as the building blocks of an enabling institutional framework for MSWM. These are:

- Decentralization of responsibility of MSWM i.e. a corresponding distribution of powers.
- Private sector involvement and participation of communities and user groups. Private sector involvement in MSWM implies a shift in role of government institutions from service provision to Regulation. As a result, create essential conditions for successful private sector.
- Capacity building measures for MSWM should give primary attention to strategic planning and financial management.
- The contribution of informal waste collection workers may be significantly improved through appropriate organizational measures (Schubeler et al, 1996).

2.1.6.2 Relationship between Institutional Capacity and Provision of Municipal Solid Waste Management

First of all, Institutional capacity means "the ability of institutions to perform functions, solve problems, and set and achieve objectives in a sustainable manner" (UNDP, 2008 in Abeje, 2009). According to Hilderbrand and Grindle's in Watson (2004) capacity of an institution to deliver municipal solid waste management is mainly depend on three factors. These include;

- Capacity of individuals to perform their job or tasks;
- Considerations of structure and culture characteristics of organization and its leadership;
- Institutional context of public sector and expansion of the task network.

A. The capacity of individuals to perform job or tasks

Environmental capacity building initiatives have not only stressed the importance of organizational and institutional strengths, but also the abilities of agents, the role of human capital, technical expertise and functional skills needed to carry out environmental protection measures. In relation to solid waste management, "the capacity of an individual is expressed based on the will and ability to set MSWM objectives and achieve them using one's own knowledge and skill, linguistic competence, expertise, will and sense of responsibility" (JICAIIC, 2005). "Strengthening the efficiency of environmental protection through capacity building has therefore focused increasingly on improving the skills of individuals through various forms of training because sustainable policy implementation capacity cannot be achieved without strengthening the ability of institutions and employees to carry out policy initiatives" (Hirschman, 1993cited in Watson, 2004).

B. Structure of the organization and task networks

For the purpose of evaluating institutional capacity for MSWM, it is more important to examine the present level of cooperation between government agencies charged with waste management responsibilities; the present state of solid waste management policy; efforts undertaken for its implementation and the level of cooperation between its implementing agencies; and the level ofmunicipal government financial and decision-making autonomy for determining appropriate waste management options for their area (Hirschman,1993cited in Watson,2004).

Specifically, organizational capacity for MSWM can be viewed in terms of, human aspect (human resource in the engineering, management, and planning sections in MSWM, including the development of such resources), physical assets(facilities, equipments, land, fund, and capital all required to provide MSWM), intellectual assets (expertise in MSWM system; statistical information including waste flows, literature; manuals; and research data, organization forms, management, leadership, and ownership that can put these assets to good use, and also a shared awareness with in organizations (JICAIIC, 2005).

C. Institutional context of the public sector and expansion of the task network

Institutional context refers to the environment and conditions necessary for demonstrating capabilities at the individual or organizational level, including the decision making process,

systems and frame works necessary for the formation, implementation of policies and strategies that are over and above an organization. As a result, for better provision of solid waste management service it is necessary to have the following capacities;

- Formal legal framework, laws, decrees and ordinances that define wastes and clarify where the responsibility for waste management lies. And formal regulations and standards on management, treatment and disposal of wastes; standards on waste generation rates, environmental standards; and legal force.
- Articulated solid waste management policies, policy objectives.
- Social infrastructure for solid waste management services, social organizations involved in solid waste management (CBOs), NGOs, formal and informal recycling markets and industries.
- partnership designed to ensure that the opinions of local residents and communities are taken account of good governance, involving a partnership between all stakeholders in MSWM, Social ownership of the implementation of solid waste management (public feeling, consensus or willingness to work together, etc (JICAIIC, 2005).

2.2 Municipal Solid Waste Management in Developing Countries

The rapid extent and nature of urbanization in developing countries made MSWM as a major issue of concern in those countries. "In the next 35 years, the urban population of world is expected to be double to more than five billion people, and from this 90% of growth is taking place in developing countries" (World resource institute, 1997; in Ahmed and Ali, 2002). As a result of this, the existing MSWM of developing countries fail to catch up with the rapid increase of solid waste production in these countries. To show this situation, UNCHS (1996) cited in Schertenleib and Meyer (1992) report identified "one third to one half of solid waste generated with in most cities in low and middle income countries are not collected, rather it ends up as illegal dumps on streets, open spaces, and sewerage systems, and contribute to spread of diseases".

Furthermore, MSWM schemes generally serve only part of the urban population. For instance, "in Kenya –Nairobi municipal solid waste collection service is mainly concerned in central

business district and more affluent communities. As a result, in poor suburban zones indiscriminate disposal of solid waste at riversides, roadsides, and other open spaces are common" (Henry et al., 2005 cited in Gebrie, 2009).

Transport of waste from households, commercial areas, institutions and other generation sites is also a growing problem in developing countries. The transport of waste becomes longer and more time consuming, and hence, more expensive and less efficient. In developing countries many sources of waste might only be reached by roads or alleys which may be inaccessible to certain methods of transport because of their width, slope, congestion, and surface. This is especially critical in unplanned settlements such as slums or low income areas. In addition to this vehicles that serve for waste transports are also outdated, poorly maintained and frequently out of action (zerbock, 2003).

The operational inefficiency of MSWM in developing countries is also further reflected in resource recovery. Although the material recovery from the waste stream has a great potential in economic as well as environmental point of view, municipality and formal private sector contribution in this activities is minimum. Besides this, waste disposal is also a neglected area in many low income countries and causes for environmental health hazards. Most of municipal solid wastes in developing countries are dumped on land in a more or less uncontrolled manner. These dumps make very uneconomical use of the available space, allow free access to waste pickers, animals and flies and often produce unpleasant and hazardous smoke from slow-burning fires (Zurbrugg, 2003).

2.2.1 Constraints of Municipal Solid Waste Management in Developing Countries

As it is noted earlier a typical solid waste management system in a developing country displays an array of problems including low collection coverage and irregular collection services, and crude open dumping and burning without air and water pollution control. These problems are caused by various factors which constrain development of effective municipal solid waste management systems. They can be categorized into technical, financial, institutional, social constraints, and awareness and attitudes (Ogawa, 2002). Each of these constraints is discussed below.

2.2.1.1 Human and Technical Constraints

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 management (Ogawa, 2002). This is a main reason for lack of comprehensive waste management planning in developing countries. Furthermore, collection and analysis of solid waste data are generally not given sufficient attention. As a result, there are few opportunities for waste management administrators to become experts and to formulate and implement waste management plans that are tailored to the actual situation in their country. This in turn makes it extremely difficult to license or develop technologies that are best suited to the local conditions

Moreover, research and development activities in municipal solid waste management have often low priority in developing countries. This lack of research and development activities in developing countries leads to selection of inappropriate technology in terms of local climatic and physical conditions, financial and human resource capabilities, and social or cultural acceptability. “Several guides or manuals on appropriate solid waste management technologies in developing countries are available in the literature, and selection of technology could be made sometimes based on these guides. However, in most cases these guides must be modified to local conditions prevailing in the country, and therefore local studies are normally still needed” (Ogawa, 2002).

2.2.1.2 Financial Constraints

MSWM is given low priority in developing countries; as a result, very limited funds are allocated to the sector by government. This problem is acute at the local government level where local revenue collection system is inadequately developed and financial base for public service including MSWM is weak. In addition to limited funds, many local governments in developing countries lack good financial management and planning. For instance, “in a developing country town over 90% of annual budget provided for solid waste management was used up within first six months. Lack of financial management and planning, particularly cost accounting depletes limited resources available for the sector even more quickly and causes solid waste management

services to halt for some periods, thus losing trust of service users" Zurbrugg (2003) in Gebrie (2009).

2.2.1.3 Institutional Constraints

The waste management regime in developing countries is seldom integrated, and there is often no clear assignment of responsibilities and schedules among the organizations involved. Furthermore, there is often no umbrella organization to coordinate overlapping responsibilities for waste management that involve more than one agency. This situation not only hinders effective implementation of waste management operations, but also produces confusion in relation to technical cooperation and assistance projects among donors. Along with these organizational and structural problems, lack of an effective legal system and technical standards constitute a major constraint. Legal provisions related to solid waste are often incorporated as fragmented elements in disparate laws, such as laws for public hygiene, local administration, and environment protection Generally speaking, there is no integrated legal framework to deal with waste management in developing countries (web page accessed, November, 27, 2017.).

2.2.1.4 Social Constraints

Social status of solid waste management workers is generally low both in developed and developing countries, but more severe in developing countries than developed countries. Such people's perception leads workers to disrespect their work and in turn produces poor quality of their work. At dump sites, transfer stations, and street refuse bins, waste picking or scavenging activities are common scenes in developing countries. People involved have not received school education and vocational training to obtain knowledge and skills required for other jobs. They are also affected by limited employment opportunity available in formal sector. The existence of waste pickers Chapter 1 Characteristics of Solid Waste Problems in Developing Countries.Retrieved from http://www.jica. go.Jp.

Scavengers create often an obstacle to the operation of solid waste collection and disposal services. However, if organized properly their activities can be effective in waste management system. Such an opportunistic approach is required for sustainable development of solid waste management programs in developing countries

2.2.1.5 Awareness and Attitudes

Public awareness and attitudes to waste can affect the whole municipal solid waste management system. All steps in municipal solid waste management starting from household waste storage, to waste segregation, recycling, collection frequency, willingness to pay for waste management services, and opposition to sitting of waste treatment and disposal facilities depend on public awareness and participation. Thus, lack of public awareness and school education about the importance of proper solid waste management for health and well-being of people severely restricts use of community based approaches in developing countries and also crucial factor for failure of a MSWM service in developing countries (Zurbrugg, 2003).

2.2.2 Municipal Solid Waste Management in Ethiopia

Solid waste management is becoming a major public health and environmental concern in urban areas of Ethiopia. In Ethiopia, like developing countries, increase of solid waste generation is resulted from rapid urbanization and population booming. "The average solid waste generation rate is about 0.221kg per person per day and it is also estimated that only 2% of the population received solid waste collection services" (Zebenay, 2010). This shows that the operational condition of MSWM service and efforts made to change the situation are low. As a result, small proportions of the urban dwellers are served and large quantity of solid waste left uncollected.Solid waste along road sides and open areas is a common practice due to inadequate supply of waste containers and longer distance to these containers. The involvement of private sectors are also very limited, but currently a number of micro and small scale enterprises are emerging to participate in primary solid waste collection i.e. collect garbage at source from households and transport it to the municipal waste containers and transfer points. To sum up the real Cycle of Waste in Addis Ababa, (1999). Addis Ababa, Ethiopia. Retrieved fromhttp://www.globnet.org.

2.2.2.1 Laws and institutions

In order to fully understand the current waste management practices and the resulting affect it is important to examine the legal that governs the waste in Ethiopia. In terms of environmental law,

Ethiopian constitution is the most importsource of environmental law. The constitution of federal democratic republic of Ethiopia:

> *Government shall endeavor to ensure that all Ethiopians live in clean and healthy environment (article 92.1)*

The government issues environment proclamations that are aimed at various sectors of the environment. The major environmental body in Ethiopia is the environmental protection authority (EPA). The EPA issued the environmental policy of Ethiopia which refers to waste management in two different articles, either directly or indirectly.

Article 3.7 Addresses issues related to human settlement, urban environment and environment health

Article 3.8 addresses issues related to the control of hazards materials and pollution from industrial waste

The primary national policy on waste management is the solid waste management proclamation No.513/2007; the proclamations 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 waste
- solid waste management action plans designed by and implemented at the lowest administrative units of urban administration can ensure community participation(proclamation No.513/2007)

Table 2.1 breakdown of solid waste proclamation No. 513/2007

Solidwastemanagementactivity	Law or act	Description
Source reduction/segregation households	Solid waste management proclamation, article 11.1	Households shall ensure that recyclable solid wastes are segregated

Collection and storage	Solid waste management proclamation article 11.2	Urban administration shall ensure that adequate HH solid waste collection facilities are in place to ensure the installation of marked waste bins by streets and in other public places guaranteeing the collection of solid waste from bins with sufficient frequency
Transportation	Solid waste management proclamation article 13.2	Urban administration shall set the standards to determine the skills of drivers and equipments operators and prevent overloads of solid waste
Disposal /landfill	Solid waste management proclamation article 14,15	Construction of solid waste disposal sites and auditing existing solid waste disposal waste
Recycling and reuse	Solid waste management proclamation article 7.1	Manufacturing or importer of glass container or till cans shall etc collect and recycle glass or tins

Source: environmental policy review 2011

2.2.2.2 Solid waste management in Addis Ababa

Addis Ababa capital city of Ethiopia and the seat of the African union and the united nations economic commissions for Africa and the gate-way for diplomats and tourist. Per Capita Generation Rate City of Addis Ababa generates a solid waste of 0.4kg/per day. More than 200,000tones are collected each year which is about 550tones per day,the composition of solid wastes are:

- 76% households,
- 18% institutions, commercial, factories, hotels,
- 6% is street sweeping. (www.un.org>meetings2010.icm0310)

Addis Ababa municipality Spends large proportion of its budget on collection, transport, and disposal of solid waste collection. Services divided in to two sub-systems, primary and secondary collection. Primary collection is done by micro and small Enterprises and the PaymentisVolume based rate (30 birr perm3).Secondary collection is carried out by sanitation administration of sub cities. (www.un.org>meetings2010.icm0310)

The role of Addis Ababa municipality in recycling is absent and mainly focuses on collection, storage, transportation and disposal of solid waste. Most of the collection of recyclable wastes in the city is performed by the informal sector Recyclable materials are used by local plastic, shoe, and metal factories. Transport and disposal solid waste mainly conducted by municipality the role of private sector on transportation of solid waste is highly limited. (www.un.org>meetings2010.icm0310)

CHAPTER THREE

3. Methodology of the research

3.1 Research Methodology and Sampling Procedures

3.1.1 Research Design

This study employed descriptive research method. Because, it was more appropriate to describe the existing situation of solid waste management practices of the sub city by using survey and through grasping the idea of subjects of the study (cooperative partnership associations who is responsible for solid waste collection, officials of bole sub city sanitation administration and selected woreda sanitation administration officials) responses, opinions, and perceptions about the sanitation administration of Bole sub city.

3.1.2 Sampling technique and sample size

3.1.2.1 Sampling technique

In order to collect primary data, the researcher used both probability and non probability sampling technique.The first sampling technique used is non probability sampling technique. First samples of woreda 1,4,10 were selected purposively. This can be done based on geographical location, population density and availability of different infrastructures. The Second sampling technique used is probability sampling technique.Therespondents of both cooperative partnership associations and sanitation administration employees were selected using systematic sampling method

3.1.2.2 Sample size

In all cases, sample sizes will be determined by considering financial, time and resource constraints.There are 213 employees who are working in these three woredas sanitation administration office. In addition to woreda official there are 85 employees working in bole sub city sanitation administration office. Generally there are 348 populations directly working in sanitation administration. Samples size was determined by online sample size determiner

software (https:/www.surveymonkey.com) with confidence level 95% margin of error 7.6. Accordingly the result is 113 samples and these are selected using simple random sampling. Finally samples respondents were selected from the list of members of selected cooperative partnership association using systematic sampling technique with a sample interval of 3.

The second samples were selected from cooperative partnership association of the selected woredas who are responsible for solid waste collection. Currently about 3 cooperative partnership association having a member of each woreda (woreda 1, 96 members, woreda 4, 57 members and woreda 10, 149 members) totally 302 is working in the three selected woredas of Bole sub city.

From a total population size of 302 cooperative partnership associations Samples size was determined by using online sample size determiner software (https:/www.surveymonkey.com) with confidence level 95% margin of error 7.6.The result shows 108 sample sizes were used for reliable result. Then samples of respondents can be selected from the list of members of selected cooperative partnership association using systematic sampling technique with sampling interval of 3.

3.1.3 Data Source,data CollectionMethod and data collection instruments

3.1.3.1 Data source

In this study both primary and secondary data sources were used. Primarydata was gathered from sample respondents of cooperative partnership association and sanitation administration employees, usingfield observations and conducting interviews. On the other hand, secondary data was extracted from different sources including published and unpublished materials from sanitation administration office, finance and economic development office, and the sub city administration.

3.1.3.2 Data collection methods

In this study different data collection methods were employed. These are questionnaires, interviews and observation. With regard to questionnaires, there were two types of questionnaires (both open and close ended) were preparedfor both sanitation administration

employees and for cooperative partnership association. These questionnaires were first prepared in English and it translated in to Amharic for making it easily understandable to samples. After preparation, around 20 questionnaires were randomly distributed as pretest in order to correct unclear and misleading questions. In addition interviews (structured and unstructured) and uncontrolledobservation were employed.

3.1.3.3 Data collection instruments

Two types of questionnaires (both open and close ended) were prepared for both sanitation administration employees and for cooperative partnership association. Both structured and unstructured interviews were used for data collection from sub city's sanitation administration head, workers and cooperative partnership associations about the overall institutional setting, capacity and constraints.

Apart from these, the researcher used field observation as a data collection instrument for this study. Field observation was also employed to assess spatial distribution of solid waste management infrastructures, illegal dumping, solid waste collection and transportation systems and disposal site facilities of the of the sub city.

3.2 Data Analysis

The data generated from the secondary material was used to supplement and validate the data generated by the primary techniques. The researcher was utilized the research questions and the theoretical formulations as an analytical framework for analyzing the data. The Collected primary and secondary data were analyzed with different techniques and by using different Software such as SPSS software was used for working data collected with questionnaires. Other software such as Microsoft office Word, Microsoft office Excel was used to write texts, create Tables and graphs. In addition the data presentations are supplemented with photographs.

3.3 Ethical Consideration

The researcher received a letter of introduction from Addis Ababa University College of business and economics department of public administration and development management post

graduate programs coordination office. Participants of the study were informed about the objectives of the study emphasizing that the data will be used only for the intended academic purpose. The data was collected by employing various s techniques with the consent of the participants of the study. Careful attention was given regarding respecting the rights, needs, and values of the study subjects, and maintaining confidentiality of the data and acknowledging sources of information.

CHAPTER FOUR

4.1 Descriptive analysis of the survey data

Out of the total 221 selected samples in the survey 21 were incomplete or unusable and therefore are excluded. The remaining 198 questionnaires provided and completed choice sets. From the samples questionnaires administered 100 questionnaire completed by sanitation administration and the remaining 98 questionnaires was completed by cooperative partnership association. The total response rate 90.41% and this response rate is decreased do the nature of work of samples.

4.2 Socio Economic and Demographic Characteristics of respondents

In this study the questionnaire survey was conducted among 219 samples with a response rate of 90.41%. Among those sample respondents 66 % sanitation administration employees' are females and 44.19% cooperative partnership associations are females. The age of respondents for the sample ranges from 31 around 40 years which shares 47 % for both cooperative partnership association and sanitation administration employees' of total sample with a minimum of 22 and a maximum of 58 years. Only 1.98% of samples of cooperative partnership association have educational level of certificate and above and 16.66 % of the respondents did not attend any formal education. 77.14% cooperative partnership association have got 2500 – 3000 birr and only 8% cooperative partnership association have got above 3000 birr monthly Income. The average family size of the survey households was 4.1 with minimum of 1 and maximum of 9. Detail descriptive statistics for some selected socio-economic variables are shown in Table 4.1 below.

Table 4.1: Socio economic and demographic characteristics of respondents

Variable	Category	Frequency	Percentage

sex	Sanitation Administration employees	female	66	66%
		Male	34	34%
		Total	100	100%
	Cooperative partnership association	Male	57	55.86%
		female	41	44.19%
		Total	98	100%
Age	Sanitation Administration employees	18-22	-	0
		23-30	33	33%
		31-40	47	47%
		41-50	16	16%
		51-60	4	4%%
		TOTAL	100	100
	Cooperative partnership association	18-22	1	0.98%
		23-30	34	33.32%
		31-40	48	47.04%
		41-50	15	14.7%
		51-60	-	-
		TOTAL	98	100%
Educational level	Sanitation Administration employees	1-4	21	21%
		5-8	24	24%
		9-12	32	32%
		Certificate, diploma and above	23	23%
		Total	100	100%
	Cooperative partnership association	No formal education	17	16.66%
		1-4	20	19.6%
		5-8	48	47.04%
		9-12	11	10.78
		Certificate, diploma and above	2	1.96%
		Total	98	100%
Average monthly Income by birr	Sanitation Administration employees	Below 2000	8	8%
		2001-3000	40	40%
		3001-3500	22	22%
		3501-4000	21	21%
		Above 4001	9	9%
		Total	100	100%
	Cooperative partnership association	Below 1000	-	-
		1001-2000	2	1.96%
		2001-2500	9	8.82%
		2501-3000	79	77.42%
		Above 3000	8	7.84%
		Total	98	100%

Source: survey data, 2018

4.3 solid waste collection and transportation in Bole sub city

Collection and transportation of solid waste involves the process of picking up of waste from place of generation, taking it to nearby public solid waste containers or transfer stations, and finally dumping it to disposal site. This functional element is very decisive and mandatory component of municipal solid waste management because productivity and efficiency of this service is highly determined by it. Currently in Bole sub city, there are two methods of waste collection. These are door to door collection and transfer stations to disposal site.

4.3.1 Door to Door Solid Waste Collection and Transportation Systems

This method is largely implemented for collection of solid waste from residential areas. It is mainly provided by cooperative partnership association and by informal waste collectors like "koraleos". According to data found from sub city sanitation administration report 2774 meter square solid waste was daily collected from Bole sub city administration residents only. Currently in bole sub city there are thirteen cooperative partnership associations which engaged in deliver of solid waste collection service to the fourteen woredas of Bole sub city. These cooperative partnership associations have paid in average 30birr for one meter cube solid waste they collect from the resident's house. Accordingly cooperative partnership association asked How often do you they collect solid waste from residence and 96.4% of the respondents answer that they collect solid waste daily from residence. This shows that their high motivation regarding solid waste collection door to door service. In addition to this 92.12 % cooperative partnership association answered they think that their customers or the residents are satisfied by the service they render. Related with this, the researcher also observed that they are operating and contributing to the cleanness of their respective woredas.

4.3.1.1 Solid Waste Separation, Processing and Recovery

In this study solid waste separation, processing and recovery activities at source and by sub city refer all activities or efforts of separation of recyclable, reusable, compostable wastes to sell or to Recover resources by themselves. Practicing these types of activities is very important to waste generators as well as sub city since it minimizes cost of disposal, generates revenue, and prolongs lifespan of disposal site. This is one of the reasons why solid waste managers in many

parts of the world are now exploring ways to reduce flow of biodegradable and recyclable materials to landfill sites. Accordingly respondent of cooperative partnership association were asked about whether they separate and store the collected solid waste and 94.1 % of respondents answer yes. In addition the response of sample also shows that about 96.76% respondents separate solid wastes as degradable and non degradable. According to the personal interviews with leaders of cooperative partnership association, Household awareness about usefulness of such discarded wastes for "kuraleos" and "Liwach" together with their low economic performance led households to separately store such wastes and generate income and new equipment's to their house. This activity of households strongly shares cooperative partnership association responsibility.

4.3.1.2 Problems faced by cooperative partnership association

Even though the rapid pace of urbanization of and parallel increment of its solid waste volume are adding burden to cooperative partnership association of the sub city, the existing situation cooperative partnership association which directly responsible for collecting solid waste from residence is very poor. For instance the cooperative partnership association asked for how do they use proper safety materials like glove, safety shoes and gown on their daily work and the only 3.92 % was using these materials and the remaining respondent totally does not use safety material in general. According to interview made with cooperative partnership association head the majority of the household doesn't separate sharp material (needle, pin, damaged glasses etc) solid waste accordingly. Due to this and lack of proper usage of safety materials members of cooperative partnership association are susceptible to different problems when they separate biodegradable and non degradable solid waste. In addition to this, there is lack of training and protective material given by the woreda or sub city when they enter to this Work. Lack of health insurance, Lack of respect from the community as well as from sanitation administration is the other problems which demoralize the cooperative partnership association. Consequently members of cooperative partnership association are vulnerable to different moral and health problems due to the nature their work and lack safety.

4.3.2 Collection and Transportation of Solid Waste from Transfer Stations to disposal site

According to the interview taken from Bole sanitation administration head the duty of collection and transportation of solid waste to disposal site is done by sub city sanitation administration. In order to do these, there are 28 lifter trucks and 5 compacter trucks used for transportation of solid waste from transfer stations to final disposal site by loading metallic solid waste container. The lifter truck vehicle carries a single container with a maximum capacity of $8m^3$ (on average 2960kg) at a time. On the other hand compacter truck carries 80 m^3 solid wastes on average.

Table 4.2 average daily transportation of solid waste from transfer station to disposal site

Type of trucks	Carrying capacity	Average number trucks daily deploy	Trips per day	Total solid waste disposed per day
Lifter truck	8 m^3	10	10	800 m^3
Compacter truck	$80m^3$	4	5	1600 m^3

Source: Bole sub city sanitation administration, 2018

According to the data depicted above in the table 4.2, about 2400 m^3 solid waste daily transported from transfer station to disposal site using 10 solid waste lifter trucks and 4 compacter machine trucks. Consequently, it looks that there is high miss use of lifter truck because out of 28 lifter trucks only 10 (35.71%) lifter trucks are daily deployed.

The driver told me that the collection of waste from these transfer stations is performed in accordance with the schedule prepared by sanitation administration. Accordingly, members of sanitation administration employees were asked about their opinion on collection, transportation and disposal service coverage all parts of the sub city. The result was presented on the table below.

Table 4.3 perception of sanitation administration employees on the solid waste collection and transportation coverage

Perceptions	frequency	Percentage
Strongly agree	9	9%
Agree	21	21%
disagree	56	56%
Strongly disagree	14	14%

Source: Bole sub city sanitation administration, 2018

According to the response of the samples from sanitation administration employees more than half of (56%) of them don't agree that the service of collection, transportation and disposal solid waste does not cover all parts of sub city , 21 % of respondents agree that the service cover all parts of sub city , 14 % of respondents strongly disagree that the service cover all parts of the sub city and only 9% percent of respondents strongly agree that the service cover all parts of the sub city. This result implies that the service coverage of the solid waste collection, transportation and disposal by Bole sub city sanitation administration is poor.

In addition to this, the respondents were asked whether the daily collected solid wastes were daily disposed or not and about 84% samples answers "no" and among this 56 % of respondents justification is due to lack of functioning trucks, 21% of respondents justification is due to poor coordination between cooperative partnership association and logistic service of sub city , 14% of respondents justification is due to shortage of efficient supervision and the remaining 9% of respondents justification is due to lack human resource. These situations make the sub city solid waste collection and transportation to be very low.

According to interview made with the head of cooperative partner association the collected solid waste stored for long period of time on the transfer station causes bad Odor which is another problem for members of cooperative partnership association and the surrounding community and diminishes the quality of fresh air and complain arise. This fact clearly indicates

how the sub city solid waste management is very poor and below expectation. Typical views of this stored solid waste are shown in the following pictures.

Picture 4.1: partial view of solid waste deposited in Bole sub city around local name "AMCE". Source: field observation, 2018

4.4 Street Sweeping Activity in Bole sub city.

In addition to collection of solid waste from transfer stations, street sweeping is also included in municipal solid waste management service offered by sanitation administration. Street sweeping takes place every day since it needs to be done more frequently because of no enough street dustbins and regular generation of solid wastes like plastic bottles, chat, pieces of paper, residual vegetables and fruits such as banana, orange etc. Bole sub city has a total of around 530 km roads(off this first class road 71km second class road 288 km third class road 171 km). For cleaning these roads Bole sub city sanitation administration uses both street sweeping machine trucks and street sweeping workers are employed at woreda level.

Addis Ababa city sanitation administration agency citizen charter, service provision standard for street sweeping of first rank road is three times per day, for second rank road two times per day and for the third rank road is one times per day.

According to interview made with Bole sub city sanitation administration currently, bole sub city sanitation administration is cleaning streets of the sub city using 3 street sweeping truck

machine and 718 street sweeping employees. The first ranks 71 km road cleaning is done using street sweeping machine truck. Cleaning the streets with this machine can take place during night time to avoid dust emission to nearby community and traffic congestion. Each street sweeping truck machine has capacity of cleaning 37 km per one day. Currently street cleaning service of first class road is done once per day which is below service provision standard Addis Ababa sanitation administration agency.

The service provision for street sweeping for second class road and third class road is done by street sweepers. Street sweepers are separately spaced in 3 km for two persons on streets, and clean roads using brooms that gifted from their respective woreda sanitation administration. After cleaning they used wheelbarrows to collect piles of solid wastes from streets, and then most commonly they placed in their respective transfer station.

Most of street sweeping takes place around the center of the town where streets are busy with many activities. However, from my own observation and interview made with sub city Sanitation administration head there is street sanitation problem. Moreover, residents and society are very careless to clean their front yards and street and see it as the responsibility of the municipality.

4.5 Existing Situation and Management of Solid Waste Disposal Site

Solid waste collection and transportation is not an end to solid waste management. Proper solid waste management also requires proper disposal of waste in a proper place. In sight of Addis Ababa solid waste disposal site and its management is inadequate and very poor. The site called "Rappi" or "Koshe" which is located in South West part of the city far from the sub city and generally described as open dumping and unsanitary landfill site. Under such condition the site has been functioning for the last 50 years.

The site is also characterized by poor road infrastructure; especially in rainy seasons the problem is highly intensified. The bottom line here is that the site has various social and environmental problems. Some of the major problems associated with this unsanitary open landfill include:

1. Unsystematic solid waste disposal posed serious environmental and health risks especially hazardous medical wastes of hospitals and health care units.

2. Due to high methane gas in the site, there is frequent fire which is a threat to human safety and cause of air pollution.
3. Odor is also another problem at the disposal site which diminishes the quality of fresh air in the surrounding area and causes residents be affected by different respiratory diseases.
4. There is high leachate generation from the site which has high potential for soil and ground water as well as surface water contamination.
5. The site is open to human scavengers and animals like, dogs and donkeys. This situation caused solid waste scattering to the surrounding and posing health risk on the local community.

According interview made with Bole sub city sanitation manager in order to solve the above of disposal site problems the sanitation administration agency of Addis Ababa constructed modern new disposal site in nearby Oromiaregion "Sendafa" town. But currently this new disposal site is not working because of conflict arises due to Addis Ababa city master plan program.

According to proclamation of solid waste management No. 513/2007 the construction solid waste disposal site should have to consider,

> *Urban administrations shall ensure that any new solid waste disposal site being constructed or an existing solid waste disposal site undergoing any modification has had an environmental impact assessment according to the relevant law. Article 14(3)*

Considering the above proclamation the construction of this disposal site needs to get consent of the government of Oromiaregional state and the local community in general specially the project affected people.

> *Solid waste may be transported from one Regional State or urban administration to another Regional State or urban administration only if the recipient Regional' State or urban administration has notified the sender in writing of its capacity to recycle or dispose of it in an environmentally sound manner. Article 6(3)*

According to this proclamation inter regional movement of solid waste can be done with capacity and willingness of the recipient region or urban administration.

In addition to curb these solid waste disposal problems the government of Addis Ababa in general plans to use the Reppie waste to electric power plant project which is under construction by Ethiopian electric power.Reppie will help the city of Addis Ababa to dispose three quarter of its daily solid waste in efficient and environmental friendly manner while at the same time producing an expected electricity production capacity of 185 GWh per year. Reppie waste energy plant is expected to receive 1400 tones of municipal waste a day representing the annual waste disposal capacity of 420,000 tones, and will be a vital waste disposal and renewable electricity energy generation facility.Over 80% of this waste is eliminated and remains converted into ash. The bottom ash will be sold as a building material to the local construction industry or safely used as landfill cover in new site. (www.ethpress.gov.et)

4.6 Rules and Regulations of Solid Waste Management, and Its Status of Enforcement

Since bole sub city has no mandate to prepare its own rule and regulation, it follows solid waste management related rules and regulations derived from Addis Ababa sanitation administration agency.

There was a question forwarded to the respondents on whether they know the rules and regulations of solid waste management of the Addis Ababa city or not. In response to this, more than (65%) of sample of sanitation administration did not know the city's rules and regulations related with solid waste management. Therefore, this lack of information causes low enforcement of rules and regulations hindered effective solid waste collection, storage and disposal system of the sub city at large

4.7 Institutional Arrangement and Capacity of Solid Waste Management Service of Bole sub city

It is a common perception that improving solid waste management means making waste collection and disposal systems more efficient, raising public awareness and enforcing solid waste management laws. However, a prerequisite for all these factors are a well planned

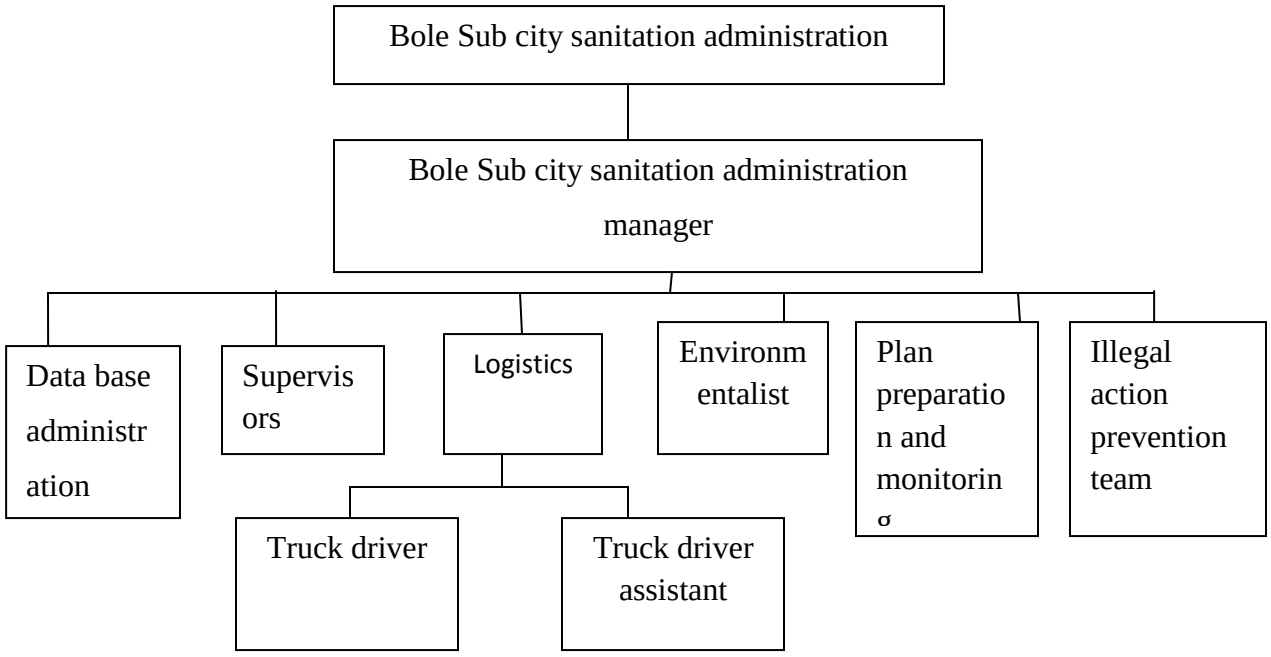
management operating within an enabling institutional framework and capable of generating financial resources required to meet operating, maintenance, and investment costs Antipolis (2000) in Obeng et al,(2008). So in order to build an acceptable and satisfactory level of solid waste management service, the responsible institution primarily need to have well organized management that functions within an adequate institutional arrangement, skilled man power and financial resources, appropriate rule and regulation, short and long term strategy, and good cooperation with different stakeholders. Otherwise, if one or more of the aforementioned resources and frameworks are missing, then proper solid waste management remains unattainable. This is one key reason why solid waste management in Addis Ababa in particular in bole sub city is very poor in terms of status as well as spatial coverage.

Therefore, before trying to find any solutions to this problem, first of all it is important to do detail assessment and get better understanding about the fundamental characteristics of the institution which is responsible for delivery of solid waste management in the sub city. Hence, in dealing with institutional arrangement and capacity of solid waste management service of sub city, this research focused on organizational structure, strategic goal and objective, institutional mandate, human resource, material and enforcement of rules and regulations, and inter organizational and stakeholders linkage.

4.7.1 Organizational Structure of Bole sub city Sanitation administration

It is obvious that for sound municipal solid waste management of any town, there should be well arranged and capable institution. The opening pace towards building of this type of institution is begun from building clear and efficient organizational structure of responsible institution of the city's solid waste management. In line with these issues, Bole sub city sanitation administration is organized under a jurisdiction of Addis Ababa city Sanitation administration agency.

Currently Bole sub city sanitation administration structure constitutes of different case team. Its internal arrangement constitutes sub city sanitation administration manager and six different case teams. These teams are directly responsible to the sanitation administration manager and there is no work process between the manager and these teams. Structurally, the current internal arrangement of the Bole sub city sanitation administration looks like this.



Source: Bole sub city sanitation administration 2018

According to interview made with sub city sanitation administration head Addis Ababa city sanitation agency was designing new organizational structure in general as city which is going to be implemented in near future.

4.7.2 Strategic Goal and Objectives of bole sub city Sanitation administration

Following the current organizational structure, Addis Ababa city administration sets its goal and objective in its strategic plan. Accordingly, the goal that the department has set is 'to make clean Addis Ababa clean 2020 GC, beautiful and hospitable city for residence as well as work. Accordingly Bole sub city sanitation administration derived its goal from the city administration and its objectives constitute:

- cleaning areas which are characterized by illegal solid waste disposal and change them to greenery and Parks
- improving the status of solid waste management by outsourcing it to private sectors

- practicing reuse and recycle preparation
- encouraging the participation of community and other stake holders through giving training and support

However, these objectives are simply put for paper value rather than for practical problem solving. For instance, from the above strategic objectives of the department two of them i.e., giving training to the community and other stakeholders, and practicing reuse, recycle are not properly put in to operation by sub city sanitation administration. With regard to outsourcing of solid waste management to private sectors, the department has participates private investor who has the capacity to collect the solid waste specifically from business sector institution by their own vehicles. However, these private sector enterprise handled by Addis Ababa city sanitation administration agency and do not have any contact with the sub city sanitation administration. On the other hand, the department has done little on mobilizing various actors to involve in solid waste management through community participation and partnership creation.

4.7.3 Institutional Mandate of Bole sub city Sanitation administration

The mandate given to the Bole sub city sanitation administration is only limited to solid waste management service provision i.e. collection, transportation and disposal of sub city's solid waste. But, other related critical mandates are given to the law and order enforcing office and health office. For instance, law and order enforcing office has the responsibility to control illegal solid waste disposal and penalize dwellers when they throw wastes in unauthorized places. Whereas health bureau has the following mandates:

- monitor and supervise city's sanitation service
- undertake public awareness creation program about sanitation

Nevertheless, because of loose cooperation and low emphasis of these stake holder organizations, this type of work process created a great weakness on the sub city's solid waste management. According to the Bole sub city sanitation administration manager explanation this situation resulted additional burden of collecting illegally dumped solid waste to the sub city.

4.7.4 Effort of Bole sub city Sanitation administration to Participate Different Stakeholders

For many services that are delivered in many urban areas of the world, stakeholders' participation is regarded as a backbone because delivery of one big service by one actor makes the service very difficult and complex. However, the involvement of various stakeholders with their specialization can make the service provision easy, satisfactory and efficient. Similar to this, for proper management of municipal solid waste management of a given city and to keep its sustainable functioning, participation of stakeholders also plays determinant and irreplaceable role. In developed countries, all these groups and individuals do play an important role beginning from policy preparation to provision of waste collection, resource recovery, and supplying waste collection equipment. However, in developing countries, it is recently that some urban authorities have recognized these actors, and eventually integrated them in to their municipal solid waste management systems (Achankeng, 2004).

Bole sub city sanitation administration is characterized involvement different of stakeholders' including the community in strategy formulation. There also private sector stake holders like licensed solid waste service renders in bole sub city sanitation administration. According to interview made with sub city sanitation administration head, though Bole sub city sanitation administration gives emphasis to different stake holders they fail to practice their responsibilities.

Efficiency of solid waste management service could be real if and only if stakeholders are aware of their responsibilities and tries to practice it with a higher level of commitment, otherwise the movement to provide MSWM service without holding them is considered as clapping by one hand. The following table depicts the list of stake holders and their respective authorities.

Table 4.4: List of stake holder organizations and their aspect of involvement in solid waste management

no	List of stake holders organizations	Aspects of involvement
1	Sub city administration	• Creation of suitable conditions including good governance and due emphasis to sanitation • Following the report to check whether the activities are takes place in the planned time schedule
2	Finance and economic development	• Follows proper utilization of budget • Follows proper utilization of resources and progress report
3	Health office	• Protect health of the society through controlling and supporting solid waste management of the sub city like supervision and awareness creation.
4	law and order enforcing	• They have the power and responsibility to penalize and control illegal dumping of solid waste.
5	Micro and small scale enterprise office	• Organize micro and small scale enterprises solid waste collectors
6	Addis micro finance	• Making payment to the micro and small scale enterprise based on their convenience.
7	Beautification and parks development	• Identifying the potential areas which needs to be cleared and following the implementation
8	Nongovernmental organization	• Financial and technical support and following the implementation
9	Cooperative partnership association and private sanitation agents	• Properly collecting based on the schedule by reducing the time of solid waste accumulation on the transfer stations
10	city plan information	• Based on city master plan identifying places for sanitation activity and following the implementation
11	The community	• Giving enough emphasis to solid waste • Participation in avoiding the illegal activity solid waste dumping
12	Capacity building office	• Following the implementation of new change programs • Developing employees performance
13	Private sector solid waste service render	• Collecting solid waste from business institution

Source: Addis Ababa sanitation administration agency cascaded annual plan 2009 EC

From the above stake holders sub city administration, finance economic development, private sector solid waste service renders and Addis micro finance have high involvement in planning and implementation of solid waste management. The involvement of stake holders likehealth office, law order enforcing and nongovernmental organizations in the implementation solid waste management is very low. Therefore these governmental institutions and other stake holders should recognize their defect and give great emphasis in awareness rising activities, financial, technical, material and moral support to the proper implementation of solid waste management of the sub city

4.7.5 Institutional Capacity of Bole sub city Sanitation administration

Institutions play vital roles in guiding change, facilitating development and succeeding national socio economic and political goals if they are well equipped in terms of various types of resources.

These dominant resources which determine an institutional capacity are: human, material, and financial resources. Otherwise, they can cause for failure of designed goal since the management of an institution with a relatively low capacity has its own impact on its effectiveness.

With this intention, in order to manage solid waste properly, the capacity of institution that is delegated with solid waste management of the sub city also needs to be raised to a higher level with adequate man power, technical skills and equipment used. But, status of the existing institutional capacity of sanitation administration of bole sub city is basically inadequate arising out of insufficient manpower, and material resources.

4.7.5.1 Human Resource Capacity of bole sub city sanitation administration

The most important factors that have influenced level and quality of operation of solid waste management services related with manpower of resource are actual size and required size, job requirement and actual qualification of staff, recruitment qualification, payment system, staff management activities like incentives and promotional opportunities, adequacy of waste management training and technical assistances, and moral aspiration of workers. As a result, to gain a better understanding of the human resource capacity of Bole sub city sanitation

administration questionnaire which focused the above factors was prepared and distributed to all solid waste related workers and an interview with the head of the sanitation administration was made in addition to secondary data received from the department.

However, as it is clearly observed in table 4.6, currently the Bole sub city sanitation administration continues its function using 89 permanently employed workers out of these 79(88.76 %) of employees are solid waste truck drivers and assistant of solid waste truck drivers. The remaining 11.24 % are officer working in different positions.

Table 4.5 existing human resource and number of workers in Bole sub city sanitation administration.

No	Job title	Recruitment type	Existing number of workers
1	Manager	Permanent	1
2	Office assistant (secretary)	permanent	1
3	Data base administrator	Permanent	2
4	Environmentalist	Permanent	1
5	Logistics	Permanent	1
6	Illegal actions preventions and law enforcement	Permanent	2
7	Supervisor	Permanent	2
8	Driver (Solid waste collection vehicle)	Permanent	38
9	Assistant (Solid waste collection vehicle)	Permanent	41

Source: Bole sub city sanitation administration, 2018.

Based on the information obtained from interview made with the manager, currently there is no structure at sub city level and employees are assigned from different department. Due to these reason it impossible to assess human resource capacity by comparing required number of workers and vacant position.

Beside this employees extremely upset by the job burden, failure to address fundamental need of workers such as salary increments, incentive, and promotion opportunities are also considered as main reason that contributed to poor solid waste management of the sub city.

4.7.5.2 Solid Waste Management Equipment's of Bole sub city sanitation administration

In the process of any municipal solid waste management there are various facilities/infrastructure that should be accomplished for providing efficient and effective service to citizens. But these facilities are highly correlated with the economic performance and good institutional concern of a given city. For instance, it is possible to observe developed countries which give high concern or attention to solid waste management and used different sophisticated technologies for managing it.

Opposed to this, in developing countries solid waste management is mainly under taken by very inefficient equipment's and technologies due to low level of economic development and low attention given to this service. The situation of solid waste management infrastructures or facilities in Bole sub city is also not different from the rest of developing countries. Currently, Bole sub city sanitation administration runs this service with supplying different solid waste collection and transportation trucks.

Table 4.6 Type and quantity of solid waste management equipment's (trucks) used for solid waste collection and transportation.

No	Type of equipment	Quantity	Currently operating	Not operating
1	Compacter truck	5	4	1
2	Lifter truck	28	17	11
3	Street sweeping truck	4	3	1
4	Pick up	1	1	-

Source: Bole sub city sanitation administration, 2018

Besides this, the Bole sub city sanitation administration has one disposal site commonly used to all Addis Ababa. This disposal site in average 14 km away from the center of sub city. Obviously these amounts of equipment or facilities are not sufficient to convey the service when we compared with the rapid expansion of Bole sub city and the level of increasing waste generation rate of the society and considering the distance of disposal site.

From the above table it shows that 3 different type of solid waste collecting transporting trucks (1 compacter truck, 11 lifter trucks and 1 street sweeping truck) is not operating. This shows that there are miss uses of resources (trucks) which exacerbated the poor quality of solid waste management.

The distance of disposal site from the sub city also exposed the department to a lot of expenses for fuel, tire, filter spare parts and maintenance.

Apart from this, absence of enough public storage facilities such as public storage containers and dust bin also another problem area that greatly minimizes the performance of solid waste management of Bole sub city sanitation administration and it is regular to observe accumulated solid wastes like plastics, papers, food wastes etc on different parts of the sub city like the street, open areas, rivers etc. this also contribute low efficiency of solid waste management of the sub city.

CHAPTER FIVE

5. Conclusion and recommendation

5.1 Conclusion

This paper has attempted to asses solid waste management practices of bole sub city in general. In particular, the study explored major problems faced by partnership associations in solid waste collection and management, present institutional arrangement and capacity of solid waste management of the sub city, process and problems associated with solid waste disposal mechanism of sub city and the problems and gaps associated with solid waste management practices of the sub city.

These investigations were addressed by employing questionnaires, field observation, semi structured and unstructured interview with head and workers of sanitation administration and cooperative partnership associations, and also reviewing published and unpublished documents. Finally, on the basis of qualitative and quantitative analysis of data, the findings of this study are summarized as follows.

The responsibility of solid waste management of Bole sub city isunder sanitation administration of the sub city that is directly responsible to the Addis Ababa sanitation administration agency. The institutional arrangement of Bole sub city sanitation administration constitutes sub city sanitation administration manager at the top and six different case teams. The case teams are environmentalist's team, logistics, data base administrator team, supervisor team, illegal action team and plan preparation and monitoring team. There is no work process between the manager and the case team.

Solid waste collection and transportation takes place in two cycles. These are door to door solid waste collection and transportation to transfer station and collection and transportation of solid waste from transfer station to disposal site. Door to door collection of solid waste is done by cooperative partnership association. About 2774 meter square solid waste was daily collected from bole sub city administration. In doing so about 96.76% of respondents separate solid waste as degradable and non degradable.

Solid waste collection and transportation from transfer station to disposal site is done by sub city sanitation administration. In order to do this, in averageabout 10 lifter trucks (whose carrying capacity is $8m^3$) and 4 compacter trucks (whose carrying capacity 80 m^3) are daily deployed. In general about 2400 m^3 (86.51%) daily collected solid waste was transported from transfer station to "koshe" disposal site. The remaining 13.48 % of daily collected solid waste does not disposed daily.

The "koshe" disposal site is generally described as open dumping and unsanitary land fill that have different problems like leachet generation, bad odor which diminish the quality of fresh air,open to human and animal scavengers which caused solid waste scattering to the surrounding and posing social problem to the community.

Street sweeping service was also offered by sanitation administration of the sub city. Currently Bole sub city sanitation administration is cleaning the streets using 3 street sweeping machines and 718 street sweeping employees. More than half (56%) of respondents answers the solid waste management service does not cover all parts of the sub city. Most of street sweeping activities take place in main business areas where streets are busy with many activities. Currently, Street sweeping service is below Addis Ababa sanitation administration service provision standard.

Finally, this research investigated three main factors which are contributing for poor status of Bole sub city solid waste management practices:

1. Institutional related problems of bole sub city sanitation administration

These institutional related factors are Failure of Bole sub city sanitation administration to transport daily collected solid to disposal site, weak enforcement of rules and regulations for illegally disposed solid wastein the sub city**,** Low motivation and productivity of workers due to failure to address fundamental need of worker, lack of proper use of solid waste transportation trucks(trucks stay longer period time of garage for maintenance), Weak organizational structure of sanitation administration which creates job burden onsome group of workers and Poor solid waste disposal mechanism (unsanitary open landfill) of sanitation administration of Bole sub city

are the major institutional problems that are contributing for poor status of solid waste management practices.

2. Cooperative partnership association related problems

There also cooperative partnership association related problems that are contributing to poor status of solid waste management practices of Bole sub city. These are Lack of proper solid waste management training when they enter into solid waste collection **,** Limited cooperation of residents in separately storing of biodegradable and non degradable solid waste, Lack of proper use safety equipments like glove, gown and safety shoes on the daily work of cooperative partnership association and Lack of respect from the community as well as from sanitation administration is the other problem which demoralize the members of cooperative partnership association.

3. Limited participation and contribution of stakeholders

The provision of solid waste management of Bole sub city is dominantly performed by the sub city sanitation administration with very limited contribution from stake holders. Though Bole sub city sanitation administration participate different stakeholders in planning the aspect of involvement some stake holders like NGOs, health office, law and order enforcing, city plan information and the community in implementation of the plan is limited.

5.2 Recommendation

Based on the findings of this study, the following measures are very important to overcome problems associated with solid waste management of Bole sub city.

1. Education related measures

- Sanitation administration of sub city should have to give training and support for cooperative partnership association on solid waste management and how to use proper safety materials when they enter to work.
- The residents of Bole sub city have low awareness and knowledge about solid waste management issues. This clearly indicates the need of wider public awareness creation

activities. So that the sanitation administration as well as health office of Bole sub city should deliver adequate training and awareness creation to residents about side effects of solid waste, and application of sustainable solid waste management practices.

2.Institution related measures

- The sanitation administration of the sub city should give priority to fulfill infrastructure facilities i.e. place back the public solid waste containers and enough dustbins with a close supervision, frequent emptying of solid waste and even distribution.
- Improve the number and productivity of sanitation workers by giving reasonable salary Increment, moral respect, training, promotion opportunities, changing their requirement type, and providing health insurance and health protection facilities
- Organize efficient controlling mechanism and sanitation agent to prevent illegal solid waste disposal
- Employing local rules and regulation which penalize persons who illegally dispose their waste, and strictly enforce under close supervision.
- Close negotiation and discussion with Oromiaregional state for using newly built Sendefasolid waste disposal site. This will help bole sub city sanitation administration to find an option for solid waste disposal site decreases traffic congestion problems.
- Improving solid waste collection and transportation by increasing the number of compacter trucks which have a capacity of carrying 80 m^2 instead of lifter trucks which have capacity of carrying $8m^2$. This increase efficiency of solid waste collection and decreases different expenditures like for tire, fuel.
- Prepare sound sanitation administration institutional arrangement, which have both horizontal and vertical integration among woredas and sub cities, allows strong stakeholders participation, and characterized by real decentralization of tasks and authority.

3. Stakeholder related measures

- Bole sub city sanitation administration Open its door to all stakeholder and also ensure their involvement in planning and implementation of solid waste management activities.

- Promote and initiate communities and different CBOs of the sub city to involve in solid waste management. In addition organize voluntary groups that work on solid waste management through giving different incentives and providing necessary equipments that used a for solid waste management

- Bole sub citysanitation administration should have create interaction with NGOs and donor agencies and watch these bodies as partner for delivery of best solid waste management because they are one means to get managerial and technical skill building trainings. In addition, they can also provide awareness rising and skill building support to community based groups, informal sectors, formal sectors, and also to the sanitation administration itself.

- Recognizing and encouraging the emerging role of handcrafts through reduction of taxes, and by providing space and equipments to produce recycled materials and creation of market for it.

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Annex I

This Questionnaire is prepared for an academic purpose for the fulfillment of MA degree in Public management and policy. Specifically the objective of the study is to assess the current practice, solid waste management in bole sub city. Therefore, your response is very important for the success of the study because all information that you provide determines the analysis and conclusion of the research. Hence, you are kindly requested to give your response by selecting informed that your response is kept in confidential and you are not required to write your name. I would like to thank you for your cooperation.

Research questionnaires for cooperative partnership association members

Part one: back ground information about respondents

1. Sex: Male ☐ Female ☐
2. Age _____
3. Educational level:

No formal education ☐ 1-4 grade complete ☐

5-8 Grades complete ☐ 9-12 grades complete ☐

Certificate, diploma and above ☐

4. Average monthly income (in birr):

Less than 1000 ☐ 1001-2000 ☐ 2001-2500 ☐

2501-3000 ☐ greater than 3000 ☐

5. Number of family members supported _____

Part two: Questionnaires prepared for investigating cooperative partnership association awareness, and practice together with their attitude regarding solid waste management sub city

1. How often do you collect solid waste from residence?

A. Every day B. with two days interval C. with three days interval

D. with one week interval E. if others please specify it_____.

2. Have you ever obtained training, education or information about solid waste management, and other problems created due to carelessly thrown solid waste?

A. yes B. no

3. Do you really think your customer satisfied by your service of solid waste collection?

A. Yes B. No

4. Do you separate and store the collected solid waste?

A. yes B. no

5. If you answer for the question number 4 is "yes" how you separate the solid waste produced?

A. metals B. plastics C. Bottles, glasses D. organic wastes

E. textile and old shoes G. if other please specify _____

6. How do you transport the collected solid waste to the temporary storage place?

A. using different car B. using simple cart C. by carrying

D. if other please specify _____

7. Depending on question number 6 where do you find these materials?

A. by our self B. from sub city C. if other please specify _____

8. Do you use proper safety materials like glove, safety shoes and gown on your work?

A. Yes B. No

9. If you answer is **yes** for question number 8, who can provide you safety materials like glove, safety shoes and gown?

A. by our self B. from sub city C. if other please specify _____

10. If you answer is **yes** for question number 8, How do you evaluate your habit in using safety material mentioned in question number 8 in your routine work?

A. Very weak B. weak C. fair D. strong E. very strong

11. Do you know the rules and regulations of solid waste management of the city?

A. yes B. no

12. How do evaluate the effort made by the sub city to provide efficient solid waste management service compared with other services such as water supply, electricity, telephone etc.

A. Very weak B. weak C. fair D. strong E. very strong

13. How do you evaluate the fairness of payment provided for solid waste collection?

A. Very weak B. weak C. fair D. strong E. very strong

14. How do you evaluate the effort and collaboration from the society in daily door to door solid waste collection?

A. Very weak B. weak C. fair D. strong E. very strong

15. What are the major problems you faced when you collect solid waste door to door?

A._____

B._____

C._____

D._____

E._____

Questionnaires prepared to collect data from of the samples of bole sub city sanitation administration employees and from sample selected woreda sanitation administration employees

Part one: back ground information about respondents

1. Job title in your department _____

2. Employment condition

Contract ☐ permanent ☐

3. Sex: Male ☐ Female ☐

4. Age _____

5. Educational level:

1-4 grade complete ☐ 5-8 Grade complete ☐

9-12 grade complete ☐ Certificate, diploma and above ☐

6. Average monthly income (in birr):

Less than 2000 ☐ 2001-3000 ☐ 3001-3500 ☐

3501-4000 ☐ greater than 4000 ☐

Part two: questionnaires prepared for investigating sanitation administration employees awareness, and practice together with their attitude regarding solid waste management sub city

1. Do you know the rules and regulations of solid waste management of the city?

A. yes B. no

2. Have you ever been participated in solid waste management trainings or education?

A. Yes B .No

3. Have you ever done supervision and control on illegal dumping of Solid wastes on the streets, open areas, river side's and other areas?

A. yes B. no

4. Did your office take action on those illegally dispose solid wastes according to the rules and regulations?

A. yes B. no

5. If your answer for question number 4 is no, why do not your office don't take action according to the law? Please List the reasons

1._____

2._____

3._____

4._____

6. How do evaluate the effort made by sub city to provide efficient solid waste management service compared with other services of the town such as water supply, electricity, Telephone etc.

A. Very weak B. weak C. fair D. strong E. very strong

7. Do you work on Saturday and Sunday as the collection, transportation and disposal is usual work?

A. yes B. no

8. If your question for number 7 is yes, do you get over time payment?

A. yes B. No

9. How do evaluate your organization efficiency and capacity to handle solid waste management responsibilities?

A. Very weak B. weak C. fair D. strong E. very strong

10. Do you really think that collection, transportation and disposal service cover all parts of the sub city?

A. strongly agree B. agree C. disagree d. strongly disagree

11. Do your organization transport the daily collected solid waste to the disposal site?

A. Yes B. no

12. If your answer for question 10 is yes, why don't the collected solid waste left indisposed

A. lack of enough trucks

B. lack of cooperation between those who collect solid waste and transport solid waste

C. lack of human resource

D. lack of supervision

E. if other specify _____

13. Why do you think people dispose solid in improper way like dumping in the road side, open fields, bridges, river side and other areas?

A. lack of awareness of the impact

B. shortage of access to formal solid waste collection

C. lack of nearby temporary solid waste collection containers

D. negligence of the some people

E. if other specify _____

14. What are the major problems associated with transportation of solid waste to disposal site in your sub city

_____

_____

_____

_____

_____

15. What are the major problems associated with solid waste deposal in your sub city

_____

_____

_____

_____

INTERVIEW QUESTIONS

Dear respondent this interview is conducted for an academic purpose for the fulfillment of MA degree in public management and policy. Specifically the objective of the study is to assess the current practice of solid waste management in bole sub city. Therefore, your response is very important for the success of the study because all information that you provide determines the analysis and conclusion of the research. Hence, you are kindly requested to give your response. Please be informed that your response is kept in confidential. I would like to thank you for your cooperation.

Interview questions for cooperative partnership association chairman

1. How do you collect your payment from sub city sanitation administration office? Explain the process and price per kg or ton
2. What are the major problems your member cooperative partnership association can face when they collect solid waste door to door and what do think is the solution?
3. Are you provided with medical care, safety wares, and other materials that are necessary to keep your health?
4. Do you think the controlling mechanism of sanitation administration of the sub city is effective? If your answer is "no", what do you think the reasons?
5. Do you think residents of the woreda you work have clear and adequate awareness about solid waste management systems?
6. What do you think should be done to improve the situation of sub city solid waste management system in general?

Interview questions for sub city sanitation administration head

1. What types of solid waste disposal methods does your department adopt?

2. Does your department collect charge from the residents of the sub city for its solid waste management service delivery?

3. Mention the types and total number of equipments that your department used for collection,

Transportation and disposal of solid waste of the sub city?

4. Is there a mismatch between the amounts of solid waste that regularly generated in the sub city and total quantity of solid waste that is collected and disposed by your department? If there, please discuss the major reasons of a mismatch.

5. Does your department practice different types of resource recovery, waste minimization or waste treatment activities? If any, please describe those activities and, if not please mention the major reasons?

6. Did your department carry out the following surveys on disposal sites in order to evaluate its suitability? If your department under take the survey, specify the outcomes. But if didn't carry out, please specify the major reasons.

A. Surrounding land use assessment

B. Distance of Disposal sit versus future expansion of the town

C. Its appropriateness based on the master plan of the town.

D. Cost benefits analysis of the area

7. Explain the overall institutional structure, mandate and functions of sanitation Administration department and, the major positive and negative impact of this arrangement on the existing performance municipal solid waste management of the town.

8. Do you think that there is inadequacy of man power in your organization? If there is, what do you think the reason behind this?

9. Do employees leave your department frequently? If yes, please specify their major Reason and your department response for it.

10. Do you think that your organization has sufficient autonomy from other levels of government in its every day decision making.

11. Does your department invited different stake holders of solid waste management to participate both in planning and implementation process of municipal solid waste management? If yes, please describe those actors and their significant activity.

12. List challenges of your department