



ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

**THE ASSESSMENT OF SOLID WASTE MANAGEMENT PRACTICES AND
PROBLEMS IN ADDIS ABABA: THE CASE OF AKAKI-KALITY SUB CITY**

BY:

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**A Thesis Submitted to the College of Business and Economics Graduate Programs of
Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of
Master of Arts in Public Management and Policy**

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DECLARATION

I, **ANGESOM TEKLE**, hereby declare that this research is my original work which to the best of my knowledge has not been submitted to any other university for the purpose of awarding a degree. Where the work of other authors has been used, it has duly been acknowledged.

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LIST OF ACRONYMS

CBOs	=	Community Based Organizations
SW	=	Solid Waste
HH	=	Household
JICAIC	=	Japan International Cooperation Agency Institute for International Cooperation
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
MSWM	=	Municipal Solid Waste Management
UNCHS	=	United Nations Center for Human Settlement
UNEP	=	United Nations Environmental Program
SWM	=	Solid Waste Management
WHO	=	World Health Organization
GDP	=	Gross Domestic Product

DEFINITION OF TERMS

CBO:	Community based organization is the association of people who live in the same area and work together to benefit the area where they live.
Compost-composting:	The conversion of the biodegradable organic matter in solid waste in to a material which can be used by farmers and horticulturalists for soil improvement and to a lesser extent fertilizing crops.
Disposal:	All actions concerned with placing waste and residues in their final resting place.
Dump-Dumping:	Often called crude dumping or open dumping is the uploading of waste on any available piece of ground, with no measure to minimize the environmental impact of this action.
Hazardous solid waste:	Any waste which requires special handling or treatment during or before disposal because of its reactive, toxic, corrosive, inflammable or explosive nature.
Municipal solid waste:	Unwanted materials which originate in homes, shops, offices, institutions and in streets and public places.
Organic:	Biodegradable when applied to solid waste.
Recycling:	The returning to the economy of material that someone else has discarded.
Refuse:	The same as municipal solid waste used interchangeably.
Solid waste:	Any material that is discarded by its owners and that is not discharged in gaseous form into atmosphere.
Collection:	In this context, waste collection is considered to start with initial storage of the waste and include all stages of collection and transport of the waste.

ABSTRACT

The study was conducted to assess the management of Domestic solid waste management practices using the case of Akaki-kality sub city in Addis Ababa Capital city of Ethiopia. Three specific objectives guided this study and these include establishing the status of the existing solid waste collection, transportation and disposal practices in Akaki-kality sub city; to examine magnitude of solid waste management problems and to design strategies to overcome waste management challenges in Akakai-kality sub city. A purposive and simple random sampling design was used for this study in which a total of 216 respondents informed this study. These were reached through purposive and random sampling. Observation, questionnaires and interviews were used during the collection of primary data. Data was analyzed quantitatively and qualitatively.

According to the findings of the study, people in Akaki-kality sub city use different methods in collection of solid waste transport it and later dispose at recognized site. It was found that solid waste management is the work of unions and the solid waste administration offices under the authority of the municipality. It established that materials such as sucks are used in the due course to collect solid waste.

The study concludes that the management and collection of solid waste is never a duty of neither one person nor one organization; rather all groups and individuals at hand. Therefore, there is a need for all people to work for the clean environment and a better life. The study also calls different groups and organizations to apply modern techniques for the collection, transportation and disposing of solid waste in Akaki-kality sub city.

Key Words: Domestic solid waste, solid waste collection, waste recycling, Akaki-kality sub city

CHAPTER ONE

INTRODUCTION

BACKGROUND OF THE STUDY

A study of the environment on the cusp of the 21st (twenty-first century) is an exciting endeavour as we attempt to move from confrontation to co-operative problem-solving and place the study of the environment on a sound scientific basis. At the dawn of creation there was a perfect balance between man and his environment. Due to human activities on earth the stable equilibrium between man and his environment was broken and hence the resultant environmental problems. As humans we are part of the environment and the way we interact with the environment influences the quality of our lives.

The daily activities of humans in order to obtain their basic needs and nutritional requirements to sustain a healthy life generate a lot of unwanted materials. Solid wastes are defined as “the unwanted remains, residues, discarded materials or by-products which are no longer required by the initial user” (Nyang’echi, 1992). Solid wastes are the by-products of human activities which include the processes of preparation, manufacture, packing, repacking, unpacking, and construction and renovation of structures. Solid wastes fall under the following classes: domestic wastes, industrial wastes, street wastes, commercial wastes and hospital wastes.

Due to the rapid increase in population, movement of people to metropolitan areas and expansion in industries, much pressure has been placed on solid waste management and the task of solid waste management has become difficult. Volumes of solid waste in towns will run in millions of tons and would accumulate if not collected. It is now an undebatable fact that for humans to safeguard, control and promote the environment there must be some appropriate facilities for solid waste management. In the absence of such facilities solid domestic waste will pose a significant health menace.

Environmental sanitation is of grave concern to governments and policy makers in a bid to prevent disease occurrence. It is incumbent upon us then to act now to manage waste matter properly to avoid the occurrence or incidence of communicable diseases. Waste matter at different stages of decomposition is allowed to grow in size developing into hills and becoming an eyesore in the community with its associated stench.

There are no proper solid domestic waste management practices in some sub cities including the Akaki-kality sub city. Most sub cities predominantly practice crude dumping. People deliberately ignore dump sites dotted in the communities and throw solid waste in the open spaces and gutters. Some people regrettably defecate into polyethylene bags and leave them as litter in the environment. Flies are attracted to them and may spread pathogens. Some influential people in the community attempt to liberate relatives and or acquaintances that have breached national sanitation laws from the grips of the law. Research indicates that pollution by man is increasing rapidly in many countries including Ethiopia (Freedman,1995).

Health and social side effects are equally as important as environmental impacts when considering Municipal Solid Waste Management (Gladding, 2002). For people in developing countries including Ethiopia, bodily wellbeing is a far more pressing concern than the fact that open burning of solid domestic waste contributes to acid rain or global warming. Outrage over health issues of poor solid waste management could therefore be a motivating factor towards more sustainable environmental practices, as suggested in Dryczek's discourse (Dryczek, 2001) on green rationalism. Waste management plays an integral role in human activity. Not only does it involve rationale decision making about whether to bury, burn, recycle, or produce less waste, it must also consider impacts to health, society, and the environment. Assessing the benefits and costs of various solid waste management policies and projects is complex because it involves numerous, interconnected economic, social, and biological components. The barriers to effective Municipal Solid Waste (MSW) management is not simply lack of policy but lack of infrastructure, education, social awareness of problems and solutions, and lack of institutions promoting sustainable actions. Barret and Sue (2001) assert that there is a pressing need to avoid or manage the damage that affects both people and natural ecosystems.

STATEMENT OF THE PROBLEM

According to Addis Ababa Health Bureau (Annual Health Report, 2016), improper environmental sanitation and solid waste management has been one of its major challenges over the years. The problem of waste disposal such as cartons, festal, plastic bottles and the like has been of a major concern in the Addis Ababa city. Solid wastes such as cartons, empty metallic tins or cans, plastic products and the like are scattered here and there in the communities. Like most other communities in Ethiopia, surface dumps are located at the outskirts of most sub cities of Addis Ababa present unsightly scenes of heaped decomposed and semi- decomposed household wastes, pollute the environment and produce offensive odour. These helps attract flies and other disease-vector organisms most of which cause serious health hazards. The stench emanating from these heaps becomes a nuisance to human habitation. Leachate from the dumps pollutes water bodies with poisons and pathogens. In the Ethiopian social settings, cleanliness is embraced as a virtue but most of the time the perception of cleanliness is restricted to one's immediate environs with little care for what happens outside their households. The belief is that the state will take care of things hence one should not be bothered.

To the ordinary Ethiopian, waste management is simply a process of waste collection and disposal. This problem of poor environmental sanitation affects all community members mainly children that suffer most in the event of disease outbreak. For example, the recent outbreak of cholera (□□□) in the community claimed a number of lives in the country. Children are found playing and defecating onto the rubbish dump bare-footed. This may cause disease infection in the children.

The researcher has the opportunity to see rubbish all around the city collectively within the streets, playing grounds, parks and even in health centers uncollected and transported timely. Solid waste disposed of at a refuse dump at the outskirts of city or at a refuse dump somewhere in the community on the surface of the land. Water bodies get polluted giving rise to water-borne diseases like typhoid and cholera. Disease connected with poor sanitation, such as malaria, diarrhea and intestinal worm infestations are very common. Flies, insects and some domestic animals are attracted to refuse dumps and bare decomposing bio-degradable solid waste where they feed and or breed in large numbers. Because of inadequate resources—machinery or equipment and personnel, the problem of environmental sanitation persists.

The City Health Bureau is awake to and acknowledges the actual truth that the city faces a primary public unhealthiness of solid waste management that needs study and addressing.

Most studies conducted so far in line with this thesis give more emphasis to the issues like; “willingness to pay” (Aklilu, 2002), “generation rate of the waste” (Lemma, 2007; Melaku, 2008) and even special emphasis given to the “determinants of recycling of solid wastes”; which is revolving on developed nations (Sterner and Bartelings, 1999). But such assessments do not guarantee to conclude about the determining factors of effective solid waste management at household level. In addition, even though there are some studies which directly or indirectly assessed the constraints of solid waste management, they have reached to different conclusions for similar research issue (Tewodros, 2007; Gebrie, 2009), which necessitated to have further study. It implies that, the studies conducted in other specific area do not guarantee to conclude about the picture of the rest parts of the world, especially at household level. Hence, whether the identified factors are significant or not depend on the existing situation of the given particular area. In other words, the poor performance of each town or nation solid waste management has its own main contextual factors or causes.

Therefore, this thesis is intended to fill the current literature gap related to the motive why the households dispose their wastes improperly, context specific factors of the study area. Moreover, it is also intended to fill the debate of different outcome within the same title. In addition, most of the studies have been conducted at the regional level and Addis Ababa - Ethiopia. So that, this work contribute to fill the research gap on SWM existed at sub city level and what factors mostly affecting at this micro level.

On top of these, this type of research has not been ever conducted in the selected area and the municipality also has not filtered or proved information about the problem of solid waste management. Hence, this study was timely to find the real constraints of the household SWM practice of the sub city and tried to provide feasible solution for the identified problems.

RESEARCH QUESTIONS

- (1) What methods of household solid waste management are used within the Akaki-kality sub city?
- (2) What factors make contributions to improper domestic solid waste management?
- (3) What are the consequences of improper domestic solid waste management?
- (4) What recommendations could be presented to improve upon domestic solid waste management within the Akaki-kality sub city?

OBJECTIVES

General Objective

- (i) To assess the domestic solid waste management techniques in the Akaki-kality sub city.

Specific Objectives

- (i) To define the techniques accustomed to collect, transport and dispose domestic solid waste.
- (ii) To identify the factors contributing to improper domestic solid waste management.
- (iii) To extract knowledge of respondents on the problems of improper domestic solid wastemanagement.
- (iv) To identify domestic solid waste disposal methods.
- (v) To bring out suggestions for improving domestic solid waste management.
- (vi) To make suggestions to all stakeholders as to how to improve upon domestic solid waste management.

SIGNIFICANCE OF THE STUDY

This research paper might have two principal significances. First it could supply a few guideline information to policy makers, solid waste managers and environmental protection businesses about current situation solid waste management of Akaki-kality sub city. The study may also important in providing information for further research who would like to conduct detailed and comprehensive studies either in Akaki-kality sub city or other study area.

SCOPE OF THE STUDY

The study was centered at the assessment of domestic solid waste management practices and problems in Addis Ababa, the case of Akaki-kality sub city and was restricted to the collection/gathering, shipment/transport and very last disposal of solid waste for the last 3 years i.e., 2015, 2016 and 2017 due to the fact most researches made before have been involved with household solid waste disposal and handling; and Akaki-kality was not investigated yet

separately.

PROFILE OF THE STUDY AREA

Akaki-kality is one of the ten sub cities of Addis Ababa, the capital of Ethiopia. As of 2011 its population was 195,275 of whom 98,374 were males and 96,901 were females. Formerly Akaki-kality was known as Woreda 26. Area: 118.08 sq.km, population: 195,275, population density per sq.km:1,653.7, No. of weredas: 11.

Factories and Industrial Plants

Leather Products Technology Institute, Thermo Plastics Industry, Nile Coffee Exports, Hashko Plastics and Shoe Factory, Gelan Metal Works Industry, Addis tyres, Adwa Milling, Akaki Garment Factory, Akaki Textile Factory, Alfubek Aluminum and Metal Works.

LIMITATIONS OF THE STUDY

The study was not able to cover the entire sub cities of Addis Ababa due to lack of resources such as financial support, time and personnel. The depth of the study may not be reached accordingly.

ORGANIZATION OF THE REPORT

Chapter one contains background information of the study, statement of the problem, significance of the study, research questions, objectives and limitations of the study. Chapter two offers literature review. Chapter three contains information on study method and design, study population, sample size, sampling technique, data collection techniques and tools, data analysis; Chapter four presents the results, discussion of results whilst chapter Five contains summary, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

DEFINITIONS AND CONCEPTS

SOLID WASTE

Waste is often found as a liquid or solid form. Solid waste is any type of wastes which is hard or not a water-like or liquid form; for example, used plastic bags, broken bags, leftover food or foods remains and the like. It is a by-product of human activities that tends to increase with the rate of urbanization, changing patterns of consumption and the improvement of living standards (ENPHO, 2008).

Rouse (2008) also noted that “Solid waste is defined as material which no longer has any value to its original owner, and which is discarded. The main constituents of solid waste in urban areas are organic waste (including kitchen waste and garden trimmings), paper, glass, metals and plastics. Ash, dust and street sweepings can also form a significant portion of the waste”.

However, most of the people are not aware about their role in the production of solid wastes or about the impact of a day to day activity of human beings on the rate of waste production. Due to this, such people do not have a time to think about how follow the proper disposal methods of wastes generated in their home in order to make attractive the environment.

Hundred and thousand years ago, the solid waste management system was not a big deal in the globe. “The first humans did not worry much about waste management; rather they simply left their garbage where it dropped” (Net Industries, 2010). This implies that solid waste management task is becoming a serious concern due to the alarmingly increasing rate of population growth and the development of urbanization in the world.

SOLID WASTE MANAGEMENT

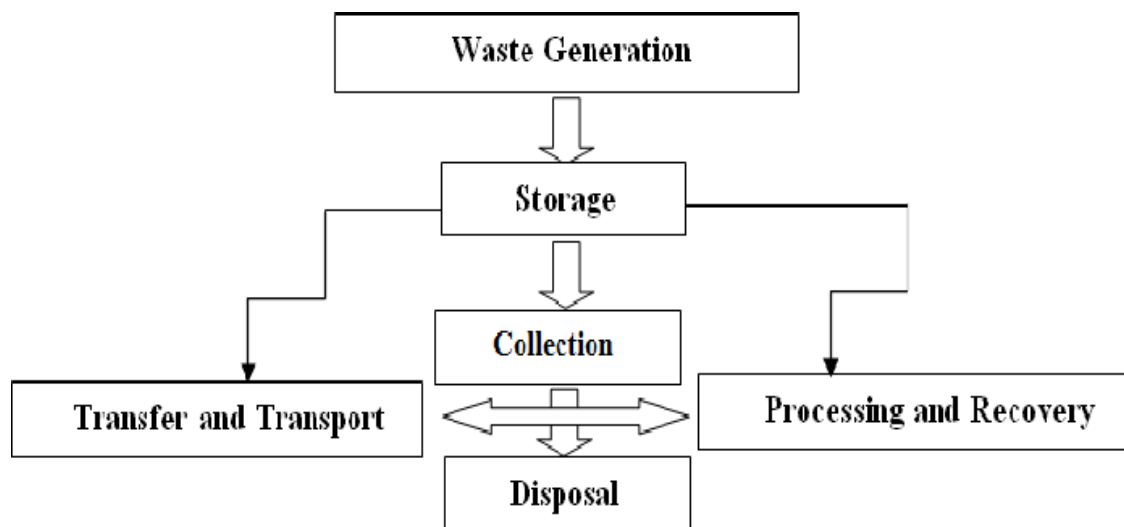
The human activities which take place in this world create waste. The wastes could be both solid and liquid types; and the way they are going to be handled, stored, and disposed can expose the environment and public health to risks (Zhu et al, 2008). SWM includes all activities that seek to minimize health, environmental and aesthetics impacts of solid waste. Management of increasing amounts of solid waste has become a major challenge in many cities

in developing countries.

If solid waste is properly used, it can be a valuable resource, but if it is not effectively managed, it can result in serious adverse impacts on environment and public health. Solid waste management is therefore a critical component within urban sanitation and it is also one of the most important and resource intensive services provided by municipalities (ENPHO, 2008: 1).

SWM is a management system of solid wastes which embrace all the activities ranging from generation to disposal. According to Rouse (2008), the basic concept of SWM involves the “collection, storage, transportation, processing, treatment, recycling, and final disposal of waste”. He also noted that, the management system should be simple, affordable, sustainable-economical efficient, environmentally sound and socially acceptable, and providing the service for both the poor and wealthy households.

Figure 2.1 Process of municipal solid waste management



Source: www.google.com/http://scialert.net/abstract/?doi=jest.2018.107.122

TYPES AND SOURCES OF SOLID WASTES

Solid waste classified based on its origin, risk potential, or characteristics. Based on origin, solid waste can be classified in to food waste, rubbish, ashes and residues, agricultural waste, municipal service, industrial process waste, and demolition and construction wastes. With regards to characteristics, it also classify as biodegradable and non-biodegradable. In addition, based on its risk potential, again it can be categorized in to hazardous and non hazardous wastes (CED, 2003).

However, solid wastes are usually classified based on their sources (from which they emanate). Based on this bench mark, it can be categorized in to domestic or household, commercial, institutional, industrial, municipal services, construction and demolition, agricultural wastes. The explanation of each type of waste summarized as follows

Table 2.1: sources and types of solid wastes

Source	Typical waste generators	Types of solid wastes
Household	Single and multifamily Dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g. bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, hospitals, prisons, government centers	Same as commercial
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc.

Municipal Services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches, and other recreational area, sludge
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Source: CED, 2003

PROBLEMS AND CHALLENGES OF SOLID WASTE MANAGEMENT

Since solid wastes are the product of human activities, it is almost normal come across some form of wastes from all types of human activities (Solomon, 2006). It implies that the production of waste is inevitable and its disposal is necessary. Hence, it is unthinkable to secure clean and healthy living conditions in cities and village without reliable and regular waste collection and disposal services.

He also noted that the dramatic increase in the quantities and compositions of solid wastes coupled with the rapid urbanization and population growth, which is the current feature of developing countries, need a serious establishment and development of an effective and economical solid waste management system. In other words, currently urbanization and population growth are alarmingly increases in developing countries coupled with the dramatic increase of solid waste generation rate. Therefore, since develop or establish an effective and economical waste management system is necessary, these less developed countries face various problems that prevent it from developing the needed system. Along with this view, Zurbrugg and Ahmed (1999) also stated that the collection and disposal of solid waste generated by the rapidly expanding cities of developing countries is increasingly beyond the capacity and financial means of the city administration.

Generally, the problem and challenges of solid waste management can be categorized in to:

1. inadequate service coverage
2. Operational inefficiencies of services
3. Limited utilization of recycling activities
4. Inadequate management of non industrial hazardous waste and
5. Inadequate landfill disposal

In different literature, various scholars discussed about the above stated problems or

challenges of solid waste management as the main problem areas of developing countries.

1. Inadequate service coverage

It refers to the insufficiency of municipal solid waste collection service in the given city. Zurbrugg (2003) stated that in the developing world the municipal solid waste collection services are delivered to only a limited part of the population. The populations who do not get the service of waste collection are low-income and live in pre-urban and slum areas. He also noted that the main reason for this limited collection services is lack of financial resources to cope with the increasing amount of generated wastes along with rapid growing cities. In other words, financial factor or constraint is the main cause for this inadequate service coverage of solid waste management activity.

It is the fact that in less developed countries both the government and generators do not have adequate finance or budget. Due to this, often inadequate fees charged on the generator and insufficient funds from a central municipal budget cannot be finance sufficient level of services. It is obvious that the main financial source of municipality is tax, which is not adequate to deliver effective solid waste collection service along with other responsibility of the municipality or city administration. But, even the government, particularly local government, gives higher priority to other way of city development while distributing annual budget from its available finance than solid waste management.

Zurbrugg and Schertenleib (1998) also found that Because of lack of financial resources to cope with the increasing amount of generated waste produced by the rapid growing cities and insufficient funds from a central municipal budget cannot finance adequate levels of service; again municipal solid waste collection scheme of cities in the developing world generally serve only a limited part of the urban population.

2. Operational inefficiency

In addition to lack of financial resources, operational inefficiency affects the availability and sustainability of solid waste collection services.

According to Zurbrugg and Schertenleib (1998) the municipal sector in less developed countries often spend 20 to 50 percent of the total municipal expenditure for solid wastes related services. However, even at this level of expenditure the level of service is very low.

They also noted that only 50 to 70 percent of solid waste is collected, which mean serving less than 50 percent of the population, and once collected, it is mostly disposed off inadequately in uncontrolled open dumps.

Operational inefficiency of municipal solid waste collection service can be due to inefficient institutional structure, inefficient organizational procedure or deficient management capacity of the institution as well as the usage of inappropriate technologies (Zurbrugg, 2003). It implies that like inadequate service coverage of SW happened because of financial problem; operational inefficiency operated by municipality happened due to institutional factors such as organizational structure, and technical skill of the human resources.

Adequate number of human resources, technical skill to operate the system and training are the crucial point for the success of solid waste management operations. However, with the reality of developing countries, many officers in charge of solid waste management, particularly at local level, have little or no technical background or training in management (Ogawa, 2005, as cited in Puopiel, 2010). In other words, since there little or no training for employees or no technical knowhow, the operation of solid waste collection service is become inefficient. Besides, if the institution or municipality structure does not show the responsibility of the sector or other related procedures and there is lack of management capacity, operational inefficiency would be happened in solid waste collection services.

Operational inefficiency of solid waste collection service can be solved or minimized either through training to employees of the institution or through involving private sectors in such solid waste management system. Along with this idea, Zurbrugg (2003) also stated that because of the failure of municipal system to provide adequate and efficient service, currently many developing countries have great interest in involving private sectors or companies in solid waste management. Besides, he also noted that arrangement with private sectors have not all been successful; rather the main factor for the success of private participant is the ability of clients (mostly municipal administration) to write and enforce an effective contract. Moreover, it is important to consider the other three key components of successful arrangement. They are: competition, transparency, and accountability on private sectors side.

3. Limited utilization of recycling activities

Informal sectors have traditionally playing an important role in recycling or recovering of inorganic materials from municipal solid wastes although such activities are seldom recognized, supported, or promoted by the municipality authority. However, the cost of separated materials, its purity, its quantity, and its location are some of the key factors that affect the potential of sectors to recover the resources. Besides, the cost of storage and transport are major factors that decide the economic potential for resource recovery. Although the sector has great recovery potential, reuse of organic waste material, often contributing to more than 50 percent of the total production of waste, is still limited. On the other hand, recycling or recovery of resource has great advantage such as reduces cost of the disposal facilities, prolonged the site life span, and reduce the environmental impact of disposal sites as the organics are largely blame for the polluting leachate and methane problems. That is why solid waste managers in many parts of the world are now exploring measures to reduce the flow of biodegradable materials to landfills (Zurbrugg, 2003).

4. Inadequate management of non-industrial hazardous waste

It refers to the management potential of solid wastes that generated mostly by hospital, clinics, or other health institutions.

According to Zurbrugg and Schertenleib (1998) 85%, 10%, and 5% of the total solid wastes generated from hospital and clinics can be classified as regular domestic wastes, infectious and non-infectious but hazardous wastes respectively. Due to this, it is necessary to separate the generated wastes, as the non-infectious and non-hazardous wastes can be managed like ordinary household solid wastes.

In addition, hazardous and infectious solid wastes should be collected in different categories according to the way they should be processed at latter steps. However, even if most hospitals and clinics require separation of their waste and burning of their generated wastes, often their incinerators are usually out of order and these wastes enter the municipal waste stream. If this is so, it causes serious health problem to the public, especially to children, to scavengers, to collection crews and to workers at the landfills (Zurbrugg and Schertenleib, 1998).

5. Inadequate landfill disposal

The municipal solid wastes in less developed countries are often disposed off on land in a more or less uncontrolled manner. Such inadequate dumps make uneconomical use of the available free space; allow free access to waste pickers, animals and flies (Zurbrugg, 2003).

According to Zurbrugg (2003), the main reasons for this inadequate disposal of waste, especially the situation where local governments are weak and underfinanced with rapid population growth, are financial and institutional constraints.

The other major reason for inadequate disposal is lack of appropriate guide lines that constitutes siting, design and operation of new landfill including the missing of recommendation for possible upgrading options of available open dumps. Most of the time almost all of the municipal officials in developing countries think that uncontrolled waste disposal is the best; that is possible. Even the available guidelines are developed based on technological standards and practices that suited to the situation and regulations of high income countries. In other words, the available guidelines do not take in to consideration the different technical, economical, social, and institutional aspects of less developed countries (Zurbrugg and Schertenleib, 1998).

METHODS USED TO COLLECT AND TRANSPORT SOLID WASTE

Disposal is broadly defined to include the collection, storage, treatment or processing, utilization, or final disposal of waste. It involves the process of getting rid of the waste materials that people generate (Mantell, 1972). According to the World Book Encyclopaedia (1994) edition W113, the chief methods used to dispose of domestic wastes include land disposal, incineration, recycling and waste reduction. Land disposal is where garbage is hauled to an area owned by a community or private firm. Such areas range from unsanitary open dump to properly operated sanitary landfills.

Open dumps are poor methods of waste disposal because of the environmental problems they cause. Incineration is the process of burning waste products. Burning in many of these incinerating plants releases gases and solid particles that may cause health hazards, damage property and kill plants. Recycling is the process of turning waste into something useful. That is, reusing materials instead of throwing them away. Recycling and waste reduction help lessen the

amount of refuse that may be buried in land or burned in incinerators. The recycling process is the best method of solid waste management (Foess, 1969).

According to Barrow (1995), a wide range of agricultural and domestic wastes cause eutrophication when they are discharged into streams, rivers and lakes resulting in “Biological Oxygen Demand (BOD)” killing the aquatic flora and fauna.

Most cities in developing countries do not have adequate provisions for collection and disposal of domestic solid wastes, the accumulation of which represents a growing health hazard. Economically, domestic solid waste puts greater pressure on a nation’s financial status particularly in developing countries such as Ghana. According to Habitat News (1991), waste disposal may absorb 1% of the Gross National Product (GNP) of a country, 20% to 40% of municipal budget of cities in the developing world.

Disposal areas have become unavailable as cities’ suburbs have expanded beyond their former boundaries as places to put the wastes are filling up and a few new locations are made available (Mantell, 1972). Although the habit of the “throw away” culture of domestic waste dies hard especially when backed by ideological views opposing any form of regulation, regional planning is necessary for effective collection, processing and disposal of solid waste, but such planning is lacking in many communities (Mantell, 1972).

FACTORS CONTRIBUTING TO IMPROPER SOLID WASTE MANAGEMENT

A combination of poverty, population pressure and economic hardships are placing a considerable strain on household environments in Addis Ababa. In Addis Ababa, the municipal authorities have not been able to keep pace with the rapid accumulation of waste. This has resulted in waste being found in gutters, drains, and in rivers. These practices have also created an unhealthy environment in Addis Ababa (Tsiboe and Marbell, 2004). As one report by the Environmental Protection Agency states, “municipal solid waste has been disposed of anywhere anyhow without regard to the nuisance and harm caused to the environment. All kinds of wastes, regardless of their nature, are being dumped indiscriminately into depressions, sand pits, old quarries, beaches, drains and even in certain areas, along streets.”(EPA, 2004). Majority of the people in Ethiopia live below the internationally recognized poverty line of one dollar a day. In view of this, one can imagine the pressure that is put on the city’s infrastructure in the course of day to day activities. Some say the problem of waste disposal in Addis Ababa is cultural, others

say it is economic, yet others point in the direction of poor management (Tsiboe and Marbell, 2004). Kendie (1999) argues that the recent upsurge in waste disposal problems stems from the fact that, “attitudes and perceptions towards wastes and the rating of waste disposal issues in peoples’ minds and in the scheme of official development plans have not been adequately considered. Kendie (1999) and Satterthwaite (1998) virtually agree in principle that the waste problem emanates from poverty and lack of funding as a result of low level of economic growth. Agbola (1993) traces the root cause of the problem to imbibed behavioural patterns and acquired values, which are given expression in the people’s culture. Post and Obirih-Opere (2003) have pointed to performance and weakness in the waste management institutions as the bane of the waste problem.

Table 2.2 classes of problems not unusual to Waste management in developing international locations

(1) External problems	• population explosion, rapid urbanization, expansion of squatter settlements • socio-economic crisis • insufficient public education and community participation
(2) Simultaneously external and internal	• rapid increase in the volume of municipal and industrial solid wastes, lack of waste reduction efforts • loss of interest in solid waste problems among relevant and neighborhood authorities of government • immature system of local autonomy • lack of coordination among sectors, organizations and municipalities • lack of a clear policy on waste pickers • loss of ability in public cleansing departments, insufficient improvement packages for human capital • friction among management and exertions inside public cleaning departments or services • inadequate legal systems, insufficient law enforcement • weak financial base

(3) Internal problems	• lack of organizational capacity in municipal waste management • lack of short-medium- or long-term planning • insufficient operation and upkeep structure for equipment and device, low utilization capacity • use of technology that is technically, economically or socially inadequate
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Source: Prepared by YOSHIDA Mitsuo as quoted in Sakurai (2000)

TYPES OF SOLID WASTE MANAGEMENT

The four most common methods of municipal solid waste management are landfilling, incineration, composting and anaerobic digestion. Incineration, composting and anaerobic digestion are volume reducing technologies; ultimately, residues from these methods must be landfilled (Seo, 2004).

Landfilling is the only true “disposal” method of managing MSW. It is also the most economical, especially in developing countries where it typically involves pitching refuse into a depression or closed mining site (Daskalopoulos and Auschutz, 1998). Landfills produce landfill gases and Leachate which can harm human and natural systems. Landfill gases (LFGs), produced when methanogens decompose complex molecules, are primarily methane and carbon dioxide (up to 90%), but also include CO, nitrogen, alcohols, hydrocarbons, organosulphur compounds, and heavy metals (El-Fadel, 1997). Leachate forms as water percolates intermittently through the refuse pile, and can contain high levels of nutrients (nitrogen, phosphorous, potassium), heavy metals, toxins such as cyanide, and dissolved organics (El-Fadel, 1997).

Incineration is the high temperature combustion of wastes. Non-combustibles must be sorted out before incineration. Benefits of incineration include reduction of volume of waste and energy production in the form of electricity and heat (Seo, 2004). However, construction and start-up costs of incineration facilities can be prohibitively expensive for developing nations.

Composting and anaerobic digestion use natural microbial organisms to decompose the organic fraction of MSW(Seo, 2004). The non-organic fraction must be landfilled or incinerated. These methods reduce the volume of waste that must be landfilled, and end products can potentially be used as agricultural fertilizers, or processed into fuels for motor vehicles (Sonesson, 2004). However, like incineration, project implementation can be too expensive for poor communities.

CONSEQUENCES OF IMPROPER SOLID WASTE MANAGEMENT

Improper solid waste management activities can bring about the following:

- Increase disease transmission or otherwise threaten public health. Rotting organic materials pose great public health risks, including, as mentioned above, serving as breeding grounds for disease vectors. Waste handlers and waste pickers are especially vulnerable and may also become vectors, contracting and transmitting diseases when human or animal excreta or medical wastes are in the waste stream.
- Contaminate ground and surface water. Municipal Solid Waste (MSW) streams can bleed toxic materials and pathogenic organisms into an open refuse dump, and other ailments are also high. During the rainy season part of the dump is submerged in water, mixing with leachate, and threatening the health and water supply of the surrounding area. If the landfill is unlined, this runoff can contaminate ground or surface water, depending on the drainage system and the composition of the underlying soils. Many toxic materials, once placed in the general solid waste stream, can be treated or removed only with expensive advanced technologies. Currently, these are generally not feasible in Africa. Even after organic and biological elements are treated, the final product remains harmful.
- Create greenhouse gas emissions and other air pollutants. When organic wastes are disposed of in deep dumps or landfills, they undergo anaerobic degradation and become significant sources of methane, a gas with 21 times the effect of carbon dioxide in trapping heat in the atmosphere. Garbage is often burned in residential areas and in landfills to reduce volume and uncover metals. Burning creates thick smoke that contains carbon monoxide, soot and nitrogen oxides, all of which are hazardous to human health and degrade urban air quality.
- Damage ecosystems. When solid waste is dumped into rivers or streams it can alter aquatic habitats and harm native flora and fauna. The high nutrient content in organic wastes can deplete dissolved oxygen in water bodies, denying oxygen to fish and other aquatic life form. Solids can cause sedimentation and change stream flow and bottom habitat. Siting dumps or landfills in sensitive ecosystems may destroy or significantly damage these valuable natural resources and the services they provide.
- Injure people and property. In locations where shantytowns or slums exist near open dumps or near badly designed or operated landfills, landslides or fires can destroy homes

and injure or kill residents. The accumulation of waste along streets may present physical hazards, clog drains and cause localized flooding.

- Discourage tourism and other business. The unpleasant odour and unattractive appearance of piles of uncollected solid waste along streets and in fields, forests and other natural areas can discourage tourism and the establishment and/or maintenance of businesses (Zeiss, 1998).

USES OF DOMESTIC SOLID WASTE

Wastes become waste because we fail to use them for the purpose for which they could be used. Gourlay (1992) reported that environmentalists have joined hands with scientists and the more responsible sectors of industry and agriculture not merely to find better ways for disposing of wastes, but to seek its uses, reduction and eventual elimination. Before the advent of mineral fertilizers, manure and composts were the only source of nutrients for crop plants (F.A.O. and Environment, 1986).

Solid domestic waste can be used as organic fertilizer. The amount of organic residues used in developing countries in 1971 was eight times higher than mineral fertilizers and exceed the world supply of mineral fertilizer (F.A.O. and Environment, 1986).

There is a growing awareness of the usefulness of organic fertilizers as a means of maintaining and improving soil productivity when applied alone or in combination with mineral fertilizers.

F.A.O. and the United Nations Development Programme (UNDP) are enhancing the long tradition in Asia of recycling. According to Kordyles (1990) vegetable waste and putrescible matter are very useful in the preparation of compost and natural organic fertilizers. A research conducted by Chowder and Salaam (1995) indicated that nearly 2,364 tonnes of solid domestic waste are produced annually in a village with a population of 510 people. About 77% of the wastes were used as domestic fuel, animal fodder and organic fertilizer for crop production. Food residues, cereal straw, legumes, tuber crop peels and others have been generally utilized as animal feed. For instance, waste from plantain, cassava, yam and potatoes are processed into animal feed for which there is a large market.

Domestic wastes covered with a layer of sand or clay media increase plant height, leaf area, plant dry weight, induce early flowering, enhance early yield and increase total yield (Salaam, 1996).

Gourlay (1992) reported that workers at the United States Department of Agriculture (USDA)

conceived the idea of producing true high quality protein by using poultry manure. He further noted that cocoa seed coat is rich in digestible protein and minerals can be milled and incorporated into animal feed in small quantities. Fresh coconuts are used in making a reddish dye and used to dye fishing net. Mantell (1972) also confirmed that cocoa pods are dried and used as fuel. Brewer (1996) has reported that various agricultural wastes provided satisfactory substrates for vegetable growth and increased yield.

Approaches to Solid Waste Management

There are alternative systems how the solid wastes can be disposed without scarifying the quality of the environment and the safety of human health.

I. The conventional approach to solid waste management

Wastes generated in the home separate at sources based on their nature and stored until a small amount is accumulated. In this approach, the generator households are responsible to transport these stored wastes to the nearest dustbin or container, which is provided by the city municipality. Then, the municipality is responsible for the remaining activity of waste management, which transferring the collected wastes from the containers to the final disposal sites. Thus, the direct involvement of private waste collectors, as far as this approach is concerned, is rare (World Bank, 2000; Rahman, et al., 2005).

World Bank (2000) also stated that, problems in this system are often observed due to the failure of involved stakeholders, which are explain as follows: most of the time, the city administration fail to provide adequate number of containers or even the provided dustbin may not position in a convenient locations. Due to such reasons, the households may motivate to dispose their wastes on road, in sewerage, inside the villages or other illegal places. Moreover, poor motivation for appropriate disposal, lack of awareness or social factors are the other forces which make the environment unacceptable for certain members of households , who are interested to transport their wastes to the containers. On top of these, because of institutional and financial difficulties, the municipality may delay the collection and transfer of wastes to final disposal sites.

Rahman, et al. (2005) also noted that in conventional system of collection and disposal of wastes, the city municipality truck visit the transfer station point at a regular interval and collect and hauls the stored wastes to the final disposal place.

2. Community participation based approach

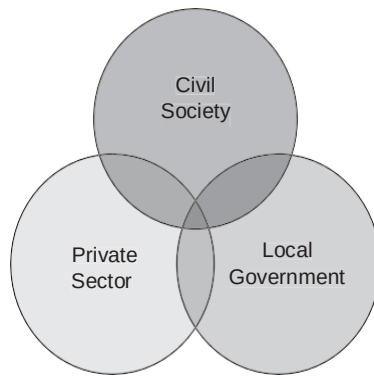
This is the other option that explains the way how the stakeholders involved and discharging their responsibility. As stated above, in conventional approach there are various reasons which lead the approach to fail or the households to dispose their wastes inappropriately. Similarly this approach also has its own problems that can create difficulty while managing the solid wastes. However, in the community based approach, unlike conventional based approach, involves the primary collectors; it may be paid door to door collectors, community based organization (CBOs) or NGOs. Due to this reason, in this system, at least the difficulties which emanate from the institution financial point of view can be minimized.

The households are responsible to store their waste in plastic bags or other available materials by sorting in terms of their nature and hand over to the door to door / primary collectors. Whereas, the primary collectors are accountable to appropriately collecting solid wastes from the households and dispose on the town transfer station or secondary collection, given that the town municipality built the transfer station point nearest to the primary collection area. Moreover, the city municipality is responsible to collect and transfer wastes from secondary collection place to final disposal sites (World Bank, 2000; Rahman, at el., 2005). It implies that if each responsible stakeholders undertaken their responsibility as given, it is possible to say there is effective management in their side; for example, if the households are sorting their wastes and handing over to the assigned primary collector, regardless of the way how primary collectors and municipality are handling their responsibility, it is possible to say solid wastes management at household level is effective.

Key Solid Waste Management Strategic Issues

On the topics above the main problem areas of solid wastes management in developing countries with the cause or constraints that prevent effective waste management are discussed. Therefore, how to develop effective solid waste management system through avoiding the available constraints is the question of this topic.

Figure 2.2 Targets of capacity development for comprehensive urban solid waste management.



According to USAID (2004), the key overriding issues that influence the situation in which solid waste collection is enhanced are the following:

I. Private sector involvement

It is undeniable that most of the solid waste related activities are given to municipality or the town health institutions. However, as discussed above, because of one and other problems most of the duties are unable to fulfill to assure economically feasible, environmentally sound and sustainable ways of dealing with waste generation, collection treatment and disposal. If this is so, it leads to a serious problem of environmental pollution and human health too. Along with this view, Zhu, et al. (2008) also noted that “the failure of municipal solid waste management can result in serious health problem and environmental degradation”. He also noted the reasons like the failure of municipality in solid waste management contributes a lot to flooding, breeding of insects, spreading of diseases, several environmental impact such as pollution of water resources and air. Hence, since the municipality by itself cannot handle wastes effectively, the active participation of other stakeholders including private sectors and community based organization should be developed.

Private companies have been able to bringing the necessary finance and operating efficiencies that can help the municipalities to save money while achieving successful solid waste results. However, the experience of such approach is not that much in developing countries (USAID, 2004).

The private solid waste collector’s service is best option for effective management, especially when the activity is beyond the capacity of the city administration or municipality. It is highly supported by: Because of the poor performance of municipality the unsatisfactory situation created; this unsatisfactory situation makes it necessary for the municipal

authorities to seriously consider new concepts and approaches for improving services. Private sector participation is an interesting option for boosting performance, whereby the municipal authorities change their role from service provider to regulator and service facilitator (Zhu, et al., 2008:73).

Moreover, including the private sectors in solid waste management, which is generated from any sources, also allow the establishment of performance standards that the involved private sectors are required to follow. This performance standard is defined in the contract that they may sign for the work (USAID, 2004).

II. Public awareness, cooperation and participation

Public education or awareness of solid waste and its management is very crucial to improve management system. Public attitudes towards inappropriate disposal of solid wastes must be adjusted in order to avoid placing of additional burden on the collection program. While create awareness on generators sides, it is very important to give emphasis on selection of information that flow to the public. In other words, the information should give an assurance about whether the public (generators) are aware of the negative aspect of inappropriate solid waste management (USAID, 2004). This view also highly strengthened by: Attitudes may be positively influenced through awareness-building campaigns and educational measures on the negative impacts of inadequate waste collection with regard to public health and environmental conditions, and the value of effective disposal. Such campaigns should also inform people of their responsibilities as waste generators and of their rights as citizens to waste management services (Schübeler, 1996:35).

Besides delivering required and related information to the public, it is also very crucial to recognized that solid waste management collection requires the participation of households, as generator, who involved in storage of the wastes in households, transferring wastes to communal containers, and the payment of the user fees. Due to this, the potential and interests of households to contribute to the service is very important (USAID, 2004).

This institution also noted that, the public awareness package also attempt to create a link between the actual cost of justifiable level of collection service and the generators willingness to pay. As per experiences, which have shown throughout the world, the

generators are willing to pay more for improved level of service. However, in some places, fees have increased without realizing a significant improvement in service. If this so, it is became an obstacle to creating additional revenues required to enhance services.

Generally, there are various forms of community participation including:

- individual participation
- collective participation
- material or financial contributions and
- Active participation in formulating projects. According to USAID (2004), each of the above forms of participation should be parts of the city's solid waste management program.

III. Cost recovery and financial resources

It refers to the degree of possibility to have a clear link between the actual cost of solid waste collection service and the revenue that generators must pay for them. In other words, revenue driven for solid waste management services would be equal to the overall costs of the package. Besides, residential generators must be educated to the fact that there are different components to the solid waste management services that they receive.

Effects of Solid Waste

It is the fact that, if solid wastes are not managed properly there are many negative impacts on aesthetic, human health and ecology (water and air pollution). Therefore, In order to control the management activity in a good manner and have a proactive measure for such negative impact, one must have a good understanding about the effects and risks that may arise from improperly managed solid wastes.

According to Melaku (2008), the following are some of the most important effects because of uncontrolled solid waste disposal systems.

- ❖ Uncollected wastes cause blockage of drains, which result in flooding and unsanitary conditions.
- ❖ Flies and Mosquitoes breed in some constituents of solid wastes, and flies are very effective vectors that spread disease.

- ❖ Waste dumps are good shelter for rats. Rats consume and spoil food, spread disease, damage electrical cables and other materials.
- ❖ Uncollected wastes degrade the urban environment, discouraging efforts to keep the streets and open places in a clean and attractive conditions.
- ❖ Dangerous items (such as broken glass, razor blades, needles and other healthcare wastes, aerosol cans and potentially explosive containers) may pose risks of injury or poisoning, particularly to children and people, who sort through waste.
- ❖ Waste items that are recycled without being cleaned effectively or sterilized can transmit infection to later users.
- ❖ Polluted water (leachate) flowing from waste dumps and disposal sites can cause serious pollution of water supplies.
- ❖ Waste that is treated or disposed of in unsatisfactory ways can cause a severe aesthetic nuisance in terms of smell and appearance.
- ❖ Fires on disposal sites can cause major air pollution, causing illness and reducing visibility, making disposal sites dangerously unstable, causing explosions of cans, and possibly spreading to adjacent property.

2. Empirical Literatures

Longe et al (2009) made their study on the title of people's perception on household solid waste management in OJO local government area in Nigeria. They applied both quantitative and qualitative methods, particularly statistical tools with severity index, in order to analyses the survey data gathered from randomly selected 60 respondents. The research objectives were assessing the existing household solid waste management practices and public perception on the effectiveness of the current system. Beside the assessment of effect of demographic factors on people perception, they were develop three means in order to assess or evaluate the public perception on solid waste management in the study a(i.e. public opinion and perception on SWM service, willingness to pay for SWM service, and level of patronage of available SWM service).

This research finding shows that demographic factors have a significant impact on the people's perception towards solid waste management service in the study area. They found that gender difference (being male or female) have a significance impact on perception. In addition, educational levels and income of the respondents have a significance positive relationship, whereas, age of the

respondent have a negative relation with perception of the people on solid waste collection services. Regarding to willingness to pay, even though the result show a positive relationship between willingness to pay and people perception, till the people are ready to pay for collection service if it delivered regularly. However, in the study area there is lack of accessing the private waste collectors' service. Therefore, the local authority should give attention to performance monitoring and control of the services of private sectors in order to enhance and sustain good service delivery.

All in all, they found that inadequate service coverage and lack of timely household waste collection are the main problems in this particular area. To develop effective solid waste management system and to sustain the private sector participation in solid waste management activity through avoiding the above mentioned problems, they suggested the following: Modern waste management methods that place emphasis on waste reduction, recycling and re-use should be encouraged in the local government area and in the entire State with legislative backing, increase awareness and re-education household waste minimization and sorting before collection should be encouraged, the responsible bodies should introduce training and re-training and re-orientation program for the private sectors and the waste generators respectively on issues of waste management techniques as a matter of urgency in order to enhance the overall success of the current SWM system. Puopiel (2010) studied on solid waste management in Ghana: the case of tamale metropolitan area. His research objective was to examine the factors of effective solid waste management in the metropolis and suggest possible measures to tackle the problem. He gathered the necessary data from 156 randomly selected samples and analyzed through descriptive statistics such as table, percentage and pie-chart.

Finally he found that inadequate skip supply for storing wastes, lack of routine collection of wastes, poor methods of waste management, and inadequate resources for waste management institutions to effectively collect the waste generated are the main factors that affect the effectiveness of solid waste management in the area. In other words, he found more of institutional factors. To effectively tackle the problems enumerated, some measures are recommended by the researcher. These are: Provision of adequate skips and dustbins, regular collection of Waste, use of Integrated Solid Waste Management Model, proper Management of Landfill, and adequate resources of Waste Management Institutions.

Kamara (2006) carried out study on household participation in domestic waste disposal and recycling in the Tshwane Metropolitan Area: An environmental education perspective. The

objective of this research was to investigate the relevant factors affecting household participation in domestic waste disposal and recycling in Tshwane Metropolitan Area. The researcher collected data from 46 randomly selected households through standard household survey questionnaire and analyzed through quantitative way of analysis, particularly used descriptive statistics. As hypotheses, the research stated socio economic factors (educational level and income or wealth) and institutional factors can be the main factors of household participation.

Finally, as expected, the conclusion confirmed that, the main factors of household participation on domestic solid waste management are socio-economic factors (income and educational level) and institutional factors. It had shown that the wealthier people in the study area participating in domestic solid waste management than the poor one. In addition, the people's participation on household solid waste management and their educational level have a positive relationship.

Moreover, this study found two other major factors that are related to institutional factors: low level of awareness on environmental implication of proper waste management and low level of household coverage with the provision of waste management facilities. Therefore, it suggested that there is a need to increase the outreach of awareness creation on household sides, particularly the positive implication of proper solid waste management and the institution, again, should provide adequate facilities for proper waste management.

Zahur (2007) made study on solid waste management of Dhaka city: public private community partnership. He assessed the solid waste management system in order to show the effect of private sector and community based organization involvements for the improvement of waste collection system in the area. As the data shows, although municipal officials recognized the importance of adequate solid waste collection and disposal as well as resource recovery and recycling, it is mostly beyond their resource to deal effectively with the growing amount of solid waste generated by the expanding cities. Consequently solid waste is indiscriminate by dumped on roads and in open drains thus leading to serious health risk and degradation of living environment for millions of urban people. Through time, however, the importance of community and private sectors involvement in solid waste management and use of adapted technologies were recognized for improving the solid waste management

system. It implies that access to door to door solid waste management, either self-organized private sectors or NGOs or CBOs, is very crucial for the improvement of household solid waste management.

Jenkins, et al (2000) carried out study on The Determinants of Household Recycling: A Material Specific Analysis of Recycling Program Features and Unit Pricing. Ordered probit econometrics model was used to analyze data of set of socio-economic variables including recycling program policy variables and unit pricing program policy variables as explanatory variables in order to investigate the main determining factors for recycling of solid wastes at household level.

In this study drop-off and curbside from recycling program policy variables and household's income, family size, household head age and its educational level from socio-economic variables were found to be the main determinants of household solid waste recycling practice.

He further found that like household income and education, household size also has a positive and significant relation with the intensity of recycling of household solid wastes. Its justification was when the family members are increasing it would contribute to the number of occupants. Due to this, the increasing number of occupant in a specific area, the intensity of recycling activity in the area would be increases.

Poswa (2004) conducted a study on the importance of gender in waste management planning: a challenge for solid waste managers. He used simple descriptive statistics to analyze the data obtained from randomly selected 400 sample households. The ultimate goal of the research was to contribute some issues for the improvement of solid waste management services to the residents in developing communities. Therefore, to achieve this overall aim the researcher derived one objective: to assess the effect of socio-economic factors (in particular gender) in the planning and operation of a solid waste management system.

Finally, this study found that women in most homes in the middle and low socio-economic status suburbs in the study area were more active in the enquiry. It was justified as indicating their active role in family affairs including waste handling in their respective homes.

Moreover, the study concluded that, there were great differences between men and women on the choice of type of waste collection service system. Women most of the time preferred a door-to- door waste collection system unlike men whose choice was a drop off centre. Such variation or differences can be attributed to the cultural traditions, which govern gender relations in the households. He also said that, like the finding of World Bank, 2009, women in most societies are responsible for the domestic works, which include many tasks including childcare, shopping, cooking, cleaning and wellbeing of their husbands.

Bizatu and Negga (2010) conducted a study on community based assessment on household management of waste and hygiene practices in kersa woreda, Eastern Ethiopia. In this study the researchers' objective was to assess the status of waste management and hygiene practices in Kersa Woreda, Eastern Ethiopia. Therefore, in order to achieve this main objective, the researchers collected data from randomly selected 444 sample households through survey questionnaire and then analyzed the data via SPSS version 16 including statistical tests at 95% confidence interval.

From the study they found that majority of the households (66%) disposed off their solid wastes in open dumps and 6.9% of the households had temporary storage for solid wastes. With regard to sex and solid waste management, the study indicated that, about 98.4% of the selected households revealed that the responsibility of waste management is left for women and girls. In addition, the waste management status in the study area was highly related with the educational level of the households.

Generally, the study concluded that household management of waste is in poor condition. Health-workers and local authorities must pay special emphasis to improve these conditions. Tewodros (2006) carried out study on household behavior and solid waste management: survey evidence from Mekelle. The objective of this thesis was to explore the structure and performance of household waste management practices such as source reduction & separation and final disposal by investigating the relationship with economic, demographic and environmental behavior of households. Besides, it conducted for the purpose of investigating the supply side of waste infrastructure facilities in relation to household solid waste collection, disposal and recycling. He used both multinomial logit and probit

estimation econometric models in order to identify and describe the main determinants of household's choice on dump sites. The researcher collected the necessary primary data from randomly selected 200 sample households.

The study estimated that demographic factors and institutional factors have a significance impact on the household choice of disposal sites.

Finally he found that demographic factors such as age, sex, educational level, family size, number of females in the household, who are below 15 years old and years of stay in the city do not have a significant effect on the site selection of the households to dispose their wastes, Whereas, institutional facilities like distance of containers from peoples house and inadequacy of waste storage containers in the city have a significant contribution for households to dispose their wastes in unauthorized place. Due to this, the researcher concluded that, institutional factors are serious causes for the action of households in the case of dispose wastes in illegal places or sites. On the other hand, the educational level and other demographic factors are not. It mean that, the number of years that the household head stay in the class does not matter; rather the awareness of households about solid waste positive and negative impact through environmental education or changing the household awareness about waste and its management have a strong improvement on disposal system.

Gebrie Kassa (2009) study on Management of Domestic Solid Waste in Ethiopia: Operational Analysis and Assessment of Constraints in Bahir Dar Town, the Capital of Amhara National Regional State, Ethiopia. The main objective of the research was examining the operational processes and associated institutional, financial, and socio-cultural constraints.

The study result indicated that inefficient organizational structure, scarce and frequent turnover of workers, unequal distribution and improper assignment of facilities, lack of financial & legal instruments, poor handling of waste by the community are the major factors that influences solid waste management. Besides, demographic factors also have a significance impact on the effective management of household solid wastes.

G/tsadkan (2002) made a study on Domestic Solid Waste Management in Mekelle City: Tigray Region. His objective was to examine the overall pattern of solid waste generation, collection and disposed and also the extent of household participation on the management of

solid wastes in Mekelle city by analyzing primary (which are collected from the selected 300 households) as well as secondary data. In this study, the researcher was applied descriptive and inferential statistics and map at the time of data analysis.

Finally, findings of this study show that the management practice of wastes in this particular city was very poor. Hence, the study goes further and found out the main causes for this poor performance of the city's solid waste management. Then, it indicated the finding as follows: the main causes for the poor performance solid waste management in the study area include improper organizational structure, shortage and dissatisfaction of the workers, inadequacy and improperness of the collection and transportation facilities (both the containers and vehicles), unfair distribution and sitting (placement) of the containers, and inadequate financial resources.

Moreover, there were no detailed solid waste management related regulations and public education. The solid waste collecting, transporting and disposal techniques used were also part of the main constraints of the solid waste management in the city of Mekelle.

The findings also indicated that certain social-cultural factors have worsened the problem of solid waste management in Mekelle.

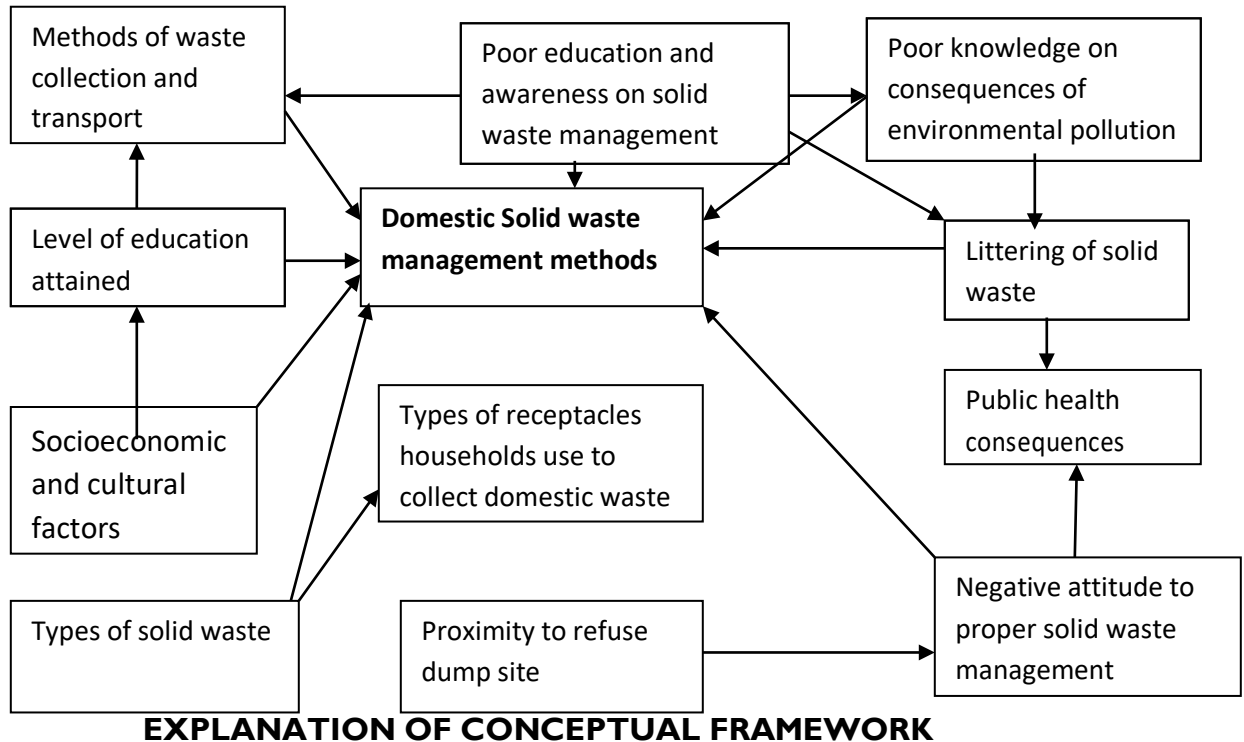
The leading constraints in this aspect include inappropriate handling of solid wastes at home, improper dumping of wastes in the container and the illegal disposal of solid waste everywhere in city.

Solomon (2006) conducted a study on solid waste management: a case study of household solid waste management in Arada sub city, Addis Ababa, Ethiopia. The objective of this study was assessing the performance of household solid waste management in the sub-city. The researcher was applied qualitative description to interpret and present the data that obtained from randomly selected 400 sample households.

Finally, he found that even though household solid-waste service is given to the population in the sub city, the service is considered poor by the population due to institutional, socio - cultural and financial factors such as lack of adequate facilities for solid waste collection and disposal services, displeasure of the workers with incentives, unfair placement and improper use of waste containers, inadequate assignment of budget to the sector, illegal ways of disposing wastes, and insignificant participation of the community in waste management.

CONCEPTUAL FRAMEWORK ON SOLID DOMESTIC WASTE MANAGEMENT METHODS

Figure 2.3 Conceptual frameworks on solid domestic waste management methods.



Poor education and sensitization on solid domestic waste management will lead to poor knowledge on consequences of environmental pollution which will in turn affect the solid domestic waste management methods. Poor education and sensitization on solid waste management may lead to littering of waste; littering of waste has public health consequences and at the same time may be a determinant of solid domestic waste management method. Poor education and sensitization on solid waste management directly impinges on solid domestic waste management methods and on methods of waste collection and transport. Methods of waste collection and transport affects waste management methods. Level of education attained is affected by socioeconomic factors. Educational level attained may lead to choice of method of waste collection and transport; it also directly affects solid domestic waste management methods. Socioeconomic and cultural factors have a direct bearing on solid domestic waste management methods. Types of solid waste generated may determine solid domestic waste management

methods and types of receptacles households may use to collect domestic waste which may in turn affect the choice of solid domestic waste management method. If houses of people are far away from refuse dumps, it may lead to negative attitude to proper solid waste management and this will have negative public health consequences. Negative attitude to proper solid waste management directly affects solid domestic waste management methods.

CHAPTER THREE

METHODOLOGY

STUDY DESIGN AND TYPE

A descriptive cross-sectional study was used to gather data on the methods used to collect and transport solid domestic waste, factors contributing to improper solid domestic waste management and solid domestic waste disposal methods. Interviews were organized to elicit information on consequences of improper solid domestic waste management and suggestions offered to improve solid domestic waste management.

STUDY POPULATION

The study population involved was four hundred forty three (443) solid waste collectors, twenty (20) transporters, thirty six (36) staff and managing officials and key informants in the Akakality sub city with specific reference to solid waste collection, and transportation.

SAMPLING TECHNIQUE AND SAMPLE SIZE

Purposive and simple random sampling techniques were applied in sampling the respondents. Purposive sampling technique is chosen because the investigator believed that the study subjects had in-depth information which would give optimal insight into the issue under investigation. A simple random sample of one sub city out of the ten sub cities in the city was selected. According to the number of sampling units in the sub city, 35% out of 443 solid waste collectors which is one hundred fifty-five (155) using simple random sampling because the population is below 1,000, twenty (20) transporters or drivers by census and thirty six (36) staffs by census were selected from the sub city respectively. Five (5) key informant officials were selected by the purposive sampling technique. Simple random technique ensures that each member of the population was chosen at random in the study area, with no subjective or bias on the part of the researcher. Therefore; two hundred and sixteen (216) respondents became the actual study units.

DATA COLLECTION TECHNIQUES AND TOOLS

The main data collection tool was a structured questionnaire backed by interview and observation. The main issues that were addressed in the design of the questionnaire included the respondents' educational background, bio-data of respondents, knowledge level on solid waste management, attitude and behaviour towards sanitation programmes, types of receptacles used to

collect solid domestic waste, frequency of emptying storage receptacles, methods of transport of solid waste, method of refuse disposal, proximity to dump site and availability of community storage receptacles. Interviews were conducted to elicit suggestions from respondents for improving solid domestic waste management and consequences of improper solid domestic wastemanagement.

The questions were both closed and open-ended. Interviews and observation as regards how the respondents collect, store, transport and finally dispose of their solid domestic refuse were employed to find out more relevant facts about how solid domestic refuse is being managed in the studyarea.

Collection of data was done from March to April 2019. Since most of the respondents were illiterate, their responses were recorded in English after the questions had been interpreted in the local language to them. However, for the few literate ones, the questionnaire was handed over to them and they were requested to use four days to complete the items. The response rate for the self-administered questionnaire was 93%. The data collected by the questionnaire were recorded in tables expressed as frequencies andpercentages.

QualityControl

Quality control was done through validity and reliability of the instruments. Validity is the appropriateness and the extent how a research instruments measure what they are intended to measure (Oso and Onen, 2008). To establish validity of instruments, the researcher administered five (5) numbers of questionnaires independent of solid waste experts out of the study area, in order to establish weaknesses relating to ambiguity which was done and amended. Having amended the instruments, Content Validity Index (CVI) for questionnaires was computed by first giving the instruments to two independent professional judges on a rating system of relevant and non-relevant. Judges being two with two different scores, the scores were added up and divided by two in order to get the highest rating scale. The researcher computed the CVI by dividing the highest rating scale which was 4 by the total number of the questionnaires which was 5. The CVI was therefore 0.8; Amin (2005) asserted that for the instrument to be accepted as valid, the average index should be 0.7 or above. Since this was 0.8, the researcher had to realize that the instrument were accurate enough to be used.

Reliability is the consistency of an instrument to produce the same results each time it is

measured under the same conditions with the same subjects (Barifaijo, and Oonyu, 2010). Smith and Smith (2004) noted that reliability estimates are used to evaluate (1) the stability of measures administered at different times to the same individuals or using the same standard (test–re-test reliability) or (2) the equivalence of sets of items from the same test (internal consistency) or of different observers scoring a behavior or event using the same instrument (inter-rater reliability). Test–retest reliability was carried out in a lapse of two weeks before carrying out the study which yielded 0.89. After realizing that instruments produced similar results, the researcher therefore inferred that the instruments were reliable for use and later used them to carry out the study.

ETHICAL CONSIDERATION

The nature, purpose and procedure of the study were explained to each participant and they were made aware that they were free to refuse to answer any questions or drop out of the study at any time and will not affect them. Consent was then obtained from each participant in the study where participants either appended their signatures or thumbprints. Participants were assured of the confidentiality of personal information and written materials. There are no known risks to who take part in this study. Participants will rather benefit from the study since they have an opportunity to express their views and experiences with regards to solid domestic waste management.

DATA ANALYSIS

Both qualitative and quantitative techniques were used for data analysis. Data were entered into a computer and analyzed with Statistical Package for the Social Sciences (SPSS) version 20 and Microsoft Excel 2007. Quantitative way embrace percentages, means, graphical and tabular analysis, maps, ratios, rates and statistical distribution. Quantitative way of analysis was used for the data collected from the structured questionnaire. Qualitative technique was used to describe the data gathered from interview and document analysis.

CHAPTER FOUR

DATA PRESENTATION AND INTERPRETATION

INTRODUCTION

This chapter presents the findings of the study. It starts with the response rate, the bio-data of respondents, the status of the existing solid waste management, the magnitude of solid waste management and ends with the strategies to end the solid waste problem.

RESPONSE RATES

The researcher organized 216 questionnaires and distributed all, the return and the not-return responses are presented in Table 4.1 of this chapter

Table 4.1: Response rates

Categories of questions	Frequency	Percentage
No. of responses	200	92.59
No. of non responses	16	7.41
Total Supplied	216	100

The primary information presented in table 4.1 shows that 216 questionnaires were supplied to respondents. Of these, 92.59 percent were returned while 7.41 percent were never returned. The researcher was however convinced that the 92.59 percent that were returned was bigger enough to give accurate significance to the study.

BIO-DATA OF RESPONDENTS

The bio-data of respondents is presented by gender, age, level of education and experience in waste management collection and transportation. The study begins with gender as presented in the bar chart 4.1 of this chapter

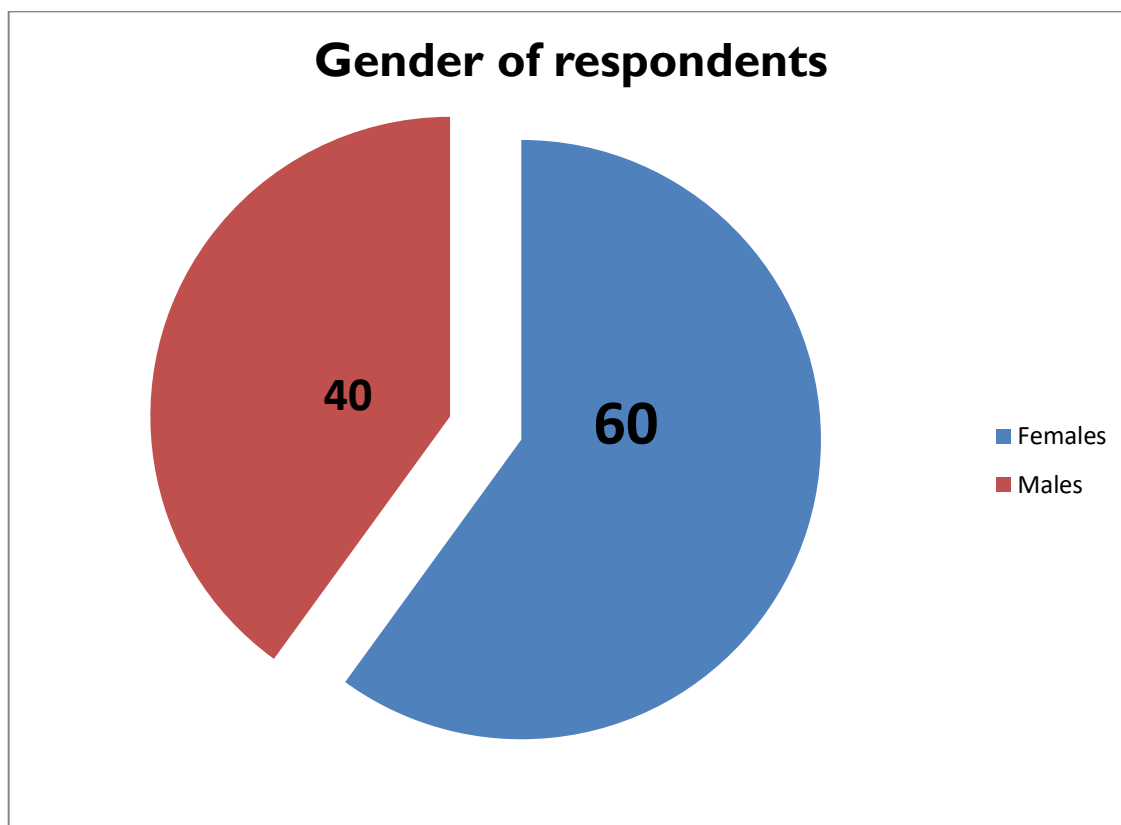


Fig 4.1: Gender Consideration

As presented in the Bar chart 4.1, 60 percent of the respondents were Females and 40 percent were Males. This data stems from the fact that most of solid waste management jobs are dominated by females in Akaki-kality sub City. It was also found that even females are among the solid waste collectors working in domestic workers. Age was yet another feature to describe the respondents as presented in Table 4.2 of this chapter. Table 4.2: Age of respondents

Age	Frequency	Percentage
18-30	15	7.5
31-40	120	60
41-50	45	22.5
51-60	15	7.5
61 and above	5	2.5
Total	200	100

The information presented in Table 4.2 reveals that 60 percent of the respondents were in the age group between 31-40 years, 22.5 percent were in the age group between 41-50 years, 7.5 percent were in the age group between 18-30 years, 7.5 percent were in the age group between 51-60 years and 2.5 percent were in the age group of 61 and above. The data set of this nature reveals that solid waste management in Akaki-kality sub city is never discriminative by age. The department employs all groups of people to work for a cleaner environment. Education was also another bio-data that this study examined among respondents as presented in Table 4. 3 of this chapter

Table 4.3: Levels of education

Levels of education	Frequency	Percentage
Primary	130	65
Secondary	43	21.5
Diploma	12	6
Degree	13	6.5
Others	2	1
Total	200	100

The primary data presented in Table 4.3 shows that 65 percent of the respondents had primary level of education, 21.5 percent had secondary level, 6.5 percent had degrees, 6 percent had diploma and 1 percent was among other levels of education. The data set distribution was due to the fact that majority of the respondents came from groups that normally collect solid waste and transport it to the disposable centers. Table 4.4: Experience of working in solid waste management

Experience	Frequency	Percentage
Less or one year	15	7.5
Two years	35	17.5
Three years	45	22.5
Four years	50	25
Five years and above	55	27.5
Total	200	100

The primary information presented in Table 4.4 reveals that 27.5 percent had spent five years of work with solid waste management office, 25 percent had spent four years, 22.5 percent had spent three years, 17.5 percent had spent two years and 7.5 percent had spent less than one year. Respondents were also requested to rank the services delivered from the solid waste management in Akaki-kality sub City and responses are presented in Table 4.5 of this chapter.

Table 4.5: Overall ranking of solid waste service provision

Status	Frequency	Percentage
Excellent	5	2.5
Very good	5	2.5
Good	25	12.5
Fair	125	62.5
Bad	40	20
Total	200	100

In accordance to primary data in Table 4.5, it is found that 62.5 percent of the respondents reported that the services are fair, 20 percent responded that the services are bad, 12.5 percent supported the view that services are good, 2.5 percent supported that the services are excellent and 2.5 percent supported that the services are very good.

METHODS USED TO COLLECT AND TRANSPORT DOMESTIC SOLID WASTE

With the door to door approach (120), larger boxes for refuse are positioned by using certain selected regions and refuse from individual homes in the catchment place are sent to the metal barrels. Paid staff transport and take away the waste to the refuse dump sites. With the communal method (65), individual household wastes are carried immediately to larger residents' storage receptacles for onward transmission to the refuse dump site by paid employees. Ten (10) respondents used the wheelbarrow to transport their waste to the dump site and 5 used other methods such as sending their waste to a nearby bush or the farm.

Table 4.6 Methods of waste collection and transport

Method	Frequency	Percentage (%)
Door to door	120	60
Communal	65	32.5
Wheelbarrow system	10	5
Others	5	2.517
Total	200	100

A 60 percent of the respondents in the study collected and transported their waste by the door to door method (from individual households to containers placed in front of selected houses) and 32.5 percent by the communal method (from individual households to community storage receptacles for onward transmission to dump site), 5 percent used the wheelbarrow system and 2.5 percent used other methods. Basically, solid waste collection is the process of transferring solid wastes from storage receptacles into vehicles and then transporting it to the disposal sites (Nyang'echi, 1992). In this study, no vehicles were involved in waste collection but rather people carried waste from the storage sites to the dump site. Some of the receptacles leaked and dropped some of the waste on the ground and may spread pathogens. Bad odour is also released polluting the air. Water bodies get polluted giving rise to water-borne diseases such as cholera and diarrhea. Tsiboe and Marbell, 2004) add weight to this fact by stating that in Akaki-Kality sub city disposal sites are located near the city and are polluting the area creating an unhealthy environment.

THE STATUS OF THE EXISTING SOLID WASTE IN AKAKI-KALITY SUB CITY

One of the objectives of this study was to establish status of existing solid waste collection, transportation and disposal practices in Akaki-kality sub city. This section therefore starts with solid west collection as presented herewith.

SOLID WASTE COLLECTION

Under this sub-section, the study aimed at establishing whether solid waste is collected regularly or not and the findings of the study are presented in Table 4.7 of this chapter.

Table 4.7 Solid Waste is regularly collected

	Frequency	Percent
Strongly disagree	110	55
Disagree	45	22.5
Neutral	5	2.5
Agree	25	12.5
Strongly agree	15	7.5
Total	200	100

The information presented herewith in Table 4.7 shows that solid waste is not collected regularly. This was supported by 55 percent of the respondents who strongly disagreed and 22.5 percent of the respondents who disagreed. On the other hand, 12.5 percent agreed, 7.5 percent strongly agreed and 2.5 percent was neutral. The researcher was informed that collection is normally done by employees of Akaki-Kality sub city as presented in figure 4.1



Picture 4.1: Collection of solid waste in Akaki-kality sub city. Source: field survey, 2019

FACTORS CONTRIBUTING TO IMPROPER DOMESTIC SOLID WASTE MANAGEMENT

The factors identified were low level of education of respondents, lack of proper storage receptacles, lack of community storage receptacles, distance to the dump site, types of refuse dumps used, and method of disposal of waste and unavailability of land for dump site.

AVAILABILITY OF COMMUNITY STORAGE RECEPTACLES

Table 4.8 Availability of community storage receptacles

Storage receptacle	Frequency	Percentage (%)
Available	35	17.5
Unavailable	165	82.5
Total	200	100

The primary data presented in table 4.8 shows that Eighty three (82.5%) of the respondents had no community storage receptacles while 17.5% had them. The presence or in any other case of community storage receptacles can also have an effect on the sort of solid home waste management practiced. The study went further to establish whether citizens use sucks to collect solid waste and quantitative results are presented in Table 4.9

Table 4.9: Residents use sucks to collect solid waste

	Frequency	Percent	Valid Percent
Strongly disagree	5	2.5	2.5
Disagree	10	5	5
Neutral	5	2.5	2.5
Agree	100	50	50
Strongly agree	80	40	40
Total	200	100	100

According to table 4.9, we see that 50 percent of respondents agreed that sucks are used to collect solid waste and 40 percent strongly agreed. On the other hand, 5 percent of the respondents disagreed while others 2.5 percent were strongly disagreed respectively; and only 2.5 percent of the respondents were neutral. While carrying out the study, the researcher

observed some of sucks that were filled with solid waste and were ready for transportation to the disposal point. The photos were taken and presented in the Picture 4.2



Picture 4.2: Sucks filled with solid waste in Akaki-kality sub city. Source: field survey, 2019

The researcher found that sucks are bought by different households for the use of solid waste. When the sucks are full with solid waste, they are taken to the collecting sites while others are kept nearby homes waiting vehicles to transport them to disposable sites.

Table 4.10: Solid waste collection from generation (households) to storage sites

	Frequency	Percent	Valid Percent
Strongly disagree	5	2.5	2.5
Disagree	10	5	5
Neutral	25	12.5	12.5
Agree	55	27.5	27.5
Strongly agree	105	52.5	52.5
Total	200	100	100

The primary information presented in table 4.10 shows that 52.5 percent of the respondents strongly agreed with the statement and 27.5 percent agreed. 12.5 percent of the respondents were neutral, 5 percent disagreed and 2.5 percent strongly disagreed. The study therefore established

varied responses of collecting solid waste from collection centers to transfer or storage sites and the biggest percentage agreed. Responses were also received if curbside collection system is used in solid waste management in Akaki-kality sub city and responses have been presented in Table 4.11 below.

Table 4.11: Curbside collection system is used in Akaki-kality sub city

	Frequency	Percent	Valid Percent
Strongly disagree	25	12.5	12.5
Disagree	100	50	50
Neutral	15	7.5	7.5
Agree	55	27.5	27.5
Strongly agree	5	2.5	2.5
Total	200	100	100

According to primary data provided in table 4.11, 50 percentages of the respondents disagreed with the statement and 27.5 agreed. Alternatively, 12.5 percent of the respondents strongly disagreed with the statement, 7.5 percentages were neutral, and 2.5 percent strongly agreed. The study thus found that some areas of Akaki-kality sub city use curbside while the majority of the people do not use them. On setout collection, quantitative findings are presented in table 4.12

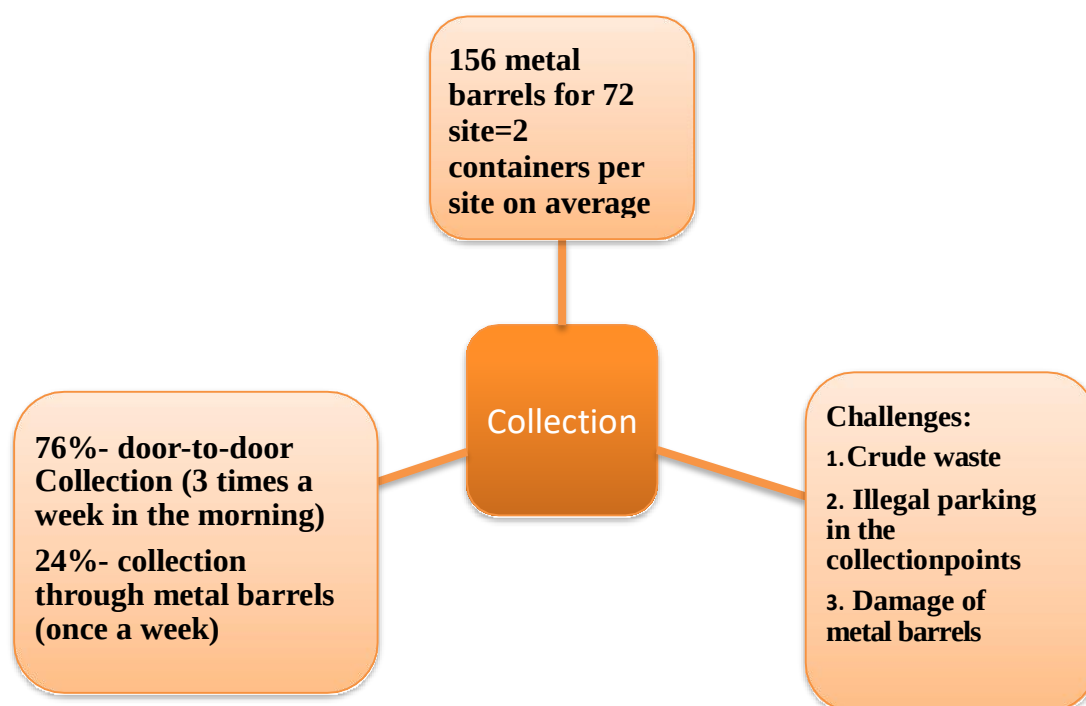
Table 4.12: Setout collection system is used in Akaki-kality sub city

	Frequency	Percent	Valid Percent
Strongly disagree	5	2.5	2.5
Disagree	13	6.5	6.5
Neutral	19	9.5	9.5
Agree	67	33.5	33.5
Strongly agree	96	48	48
Total	200	100	100

In accordance to primary data in table 4.12, a percentage of 48 of the respondents strongly agreed that setout collection system is used in Akaki-kality and 33.5 percent agreed. On the other

hand, 9.5 percent was neutral, 6.5 percent disagreed while 2.5 strongly disagreed.

Figure 4.2 Waste collection cases of "Akaki-kality" sub city



SOLD WASTE TRANSPORTATION

On solid waste transportation, quantitative findings are presented in table 4.13 of this section

Table 4.13: Transportation of solid waste is done by private company

	Frequency	Percent	Valid Percent
Strongly disagree	93	46.5	46.5
Disagree	53	26.5	26.5
Neutral	10	5	5
Agree	27	13.5	13.5
Strongly agree	17	8.5	8.5
Total	200	100	100

The findings presented in table 4.13 shows that 46.5 percent of the respondents strongly

disagreed that transportation of solid waste is done by private company and 26.5 percent disagreed.

On the other hand, 13.5 percent agreed, 8.5 percent strongly agreed and 5 percent was neutral. The study went ahead to establish whether transportation of solid waste is done by appropriate equipment and the findings are presented in table 4.14

Table 4.14: Transportation of solid waste is done using appropriate equipment

	Frequency	Percent	Valid Percent
Strongly disagree	35	17.5	17.5
Disagree	95	47.5	47.5
Neutral	25	12.5	12.5
Agree	30	15	15
Strongly agree	15	7.5	7.5
Total	200	100	100

The information presented shows that 47.5 percent of the respondents disagreed with the statement, 17.5 percent were strongly disagreed, 15 percent of the respondents agreed, 12.5 percent were not sure, and 7.5 percent strongly agreed as presented in table 4.14. Appropriate vehicles that are used in transportation of solid waste include vehicles as presented in Picture 4.3 of this chapter.



Picture 4.3: Appropriate transportation system for solid waste. Source: field survey, 2019

From Fig 4.3, it is indicated that Akaki-kality sub city has got different vehicles transporting solid waste. These are normally accompanied by the people who assist in collection as presented in the Fig of reference.

SOLID WASTE DISPOSAL PRACTICES

The study also established that there are different disposable practices that are normally used in Akaki-kality sub city and quantitative findings supporting such are presented in the table 4.15 of this chapter.

Table 4.15: Recycling and composting are used in Akaki-kality sub city

	Frequency	Percent	Valid Percent
Strongly disagree	25	12.5	12.5
Disagree	121	60.5	60.5
Neutral	14	7	7
Agree	35	17.5	17.5
Strongly agree	5	2.5	2.5
Total	200	100	100

According to primary information in table 4.15, 60.5 percent of the respondents disagreed with the view that recycling and composting are used in Akaki-kality sub city, 17.5 percent of the respondents agreed, 12.5 percent strongly disagreed, 7 percent were neutral and 2.5 percent strongly agreed. This data pattern is attributed by the fact that some respondents are aware of the use of recycling and composting while others are ignorant about the practices in Akaki-kality sub city. On whether open dumping spaces are commonly used as final disposal facilities, the findings of the study are presented in table 4.16 of this chapter.

Table 4.16: Open dumping spaces are commonly used as final disposal facilities

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	23	11.5	11.5	11.5
Disagree	71	35.5	35.5	47
Neutral	54	27	27	74
Agree	39	19.5	19.5	93.5
Strongly agree	13	6.5	6.5	100.0
Total	200	100	100	

As presented in table 4.16, 35.5 percent of the respondents disagreed with the statement that open dumping spaces are commonly used as final disposal facilities, 27 percent were neutral, 19.5 percent agreed, 11.5 percent strongly disagreed and 6.5 percent strongly agree. Like in table 4.16, the data patterns support the view that some respondents use open space while others do not use them.

DOMESTIC SOLID WASTE DISPOSAL METHODS

One hundred twenty six (126) respondents that is 63% disposed of their refuse at the refuse dump, 8.5% dispose on the road to dump site and corresponding to 28.5% into the nearby bush. This situation remarkably contributes to improper domestic solid waste management.

Table 4.17 Domestic solid waste disposal method

Method of disposal	Frequency	Percentage (%)
On the road to dump site	17	8.5
At the refuse dump	126	63
Into the nearby bush	57	28.5
Total	200	100

According to table 4.17, 63% of the respondents disposed of their refuse at the refuse dump sites which are mostly surface dumps. This is reiterated by Asomani-Boateng and Haight (1998) who also had 79% of their respondents using the same method. This method of waste disposal according to Mantell (1972) causes environmental problems. They can destroy an area's appearance and provide a home for animals and insects that spread diseases. Barrow (1995) strongly disagrees with this method of disposal practiced by the people by pointing out that when wastes (agricultural wastes) are drawn into streams by run-off water, eutrophication, resulting in 'biological oxygen demand' (BOD) kills the aquatic fauna. The respondents adopted this practice of waste disposal probably due to lack of knowledge on how to manage solid domestic waste. Reports by the World Encyclopedia (1994 Edition) indicated that recycling is the best method of wastes disposal because it helps to manage wastes, re-use and lessen environmental hazards as compared with other methods. People should be encouraged to put their waste into useful agricultural inputs such as compost.

AVAILABILITY OF LAND FOR DUMP SITE

Around sixty-three percent (62.5%) of the respondents stated there is no land for dump site. The remaining 37.5% had land for dump site.

Table 4.18 Availability of land for dump site

Avail able	Freq uenc y	Perce ntage (%)
Yes	75	37.5
No	125	62.5
Total	200	100

A greater percentage of respondents mentioned unavailability of land for dump site (62.5%). Absolutely, this situation could promote indiscriminate or crude dumping with its attendant terrible public health effects. Fasida (1996) additionally emphasized that the paramount consideration inside the management decisions involving waste disposal is site location. Much interest is not given to the location of sites for waste disposal the end result of that is the prevalence of disease outbreak. Responses were also received examining if landfilling is used in Akaki-kality sub city and quantitative results are presented in table 4.19 of this chapter.

Table 4.19: Land filling is used in solid waste disposal

	Frequency	Percent	Valid Percent
Strongly disagree	12	6	6
Disagree	32	16	16
Neutral	10	5	5
Agree	125	62.5	62.5
Strongly agree	21	10.5	10.5
Total	200	100	100

As presented in table 4.19, 62.5 percent of the respondents agreed that land filling is used in solid

waste management, 16 percent disagreed, 10.5 strongly agreed and 6 percent of the respondents strongly disagreed. Despite respondents that disagreed with the statement, the researcher found that the percent of respondents that agreed was big enough to be convinced that land filling is used in the solid waste management in Akaki-kality sub city, yet the technology used is still poor as the practice looks like the same as open dumping as shown on the Picture 4.4 Qoshe/Repi disposing site



Picture 4.4: Repi (Qoshe) Disposing site. Source: field survey, 2019

THE MAGNITUDE OF SOLID WASTE MANAGEMENT PROBLEMS

The study established that solid waste management associated problems in Akaki-kality sub city are basically related to inadequate institutional facilities to deal with the problem arising out of shortage of skilled manpower, modern technology, resource allocation, legal and administrative enforcement issues of the environmental regulations. Coupled with these, there is loss of public consciousness and environmental ethics that bring about uncontrolled solid waste disposal. The financial factor remains to be the main constraint as well as lack of sufficient awareness at the grassroots level of the waste generators resulting to the problem of littering. The uncollected waste is illegally dumped in an open spaces, water bodies or even burnt on the street and roadsides as presented in Picture 4.5



Picture 4.5: Illegally dumped waste besides the road in Akaki-kality. Source field survey, 2019

The study additionally mounted that poor waste management is similarly associated with a negative impact on the general public waste because of environmental pollutants. The superiority of diseases because of the incubation and proliferation of flies mosquitoes and rodents; in turn, transmit diseases that affect population's health including malaria, diarrhea and cholera. The research additionally indicated that open dump sites or open disposal areas are fundamental hassle to the environment, especially on air that the people inhale and on the water runoff that result into water supply. Dump sites emit obnoxious odours and smoke that cause infection to people dwelling round or near in the direction of them. Besides, these sites have high economic and social cost in public health services. Through observation, it was established that the dumping site at Repi (Qoshe) Kolfe sub city is located in the place where people lives in a surrounding environment.

Speaking with the dumping site manager, the researcher established that people living in the surrounding dumping site are to be moved away to live in another area. However, this requires an important budget with much financial capacity.

The problem of municipal solid waste management (MSWM) in Akaki-kality sub city is compounded via the speedy city populace boom due to rural to city migration which overstretch

assets. The booming of town population and increasing enterprise activities manner huge volumes of wastes that pose threat to public health and the surroundings whilst you remember that they are predominantly decomposable organic and electronics wastes also are developing from current times in the waste stream. The problems of MSWM are of instant significance in many areas of Akaki-kality sub city and waste management is referred to as one of the key problems in urban management aside from water and sanitation.

CHALLENGES OF MSWM IN AKAKI-KALITY SUB CITY

In order to examine the strategies used to reduce solid waste in Akaki-kality sub city, the researcher identified the challenges to be solved. Among others, the study noticed infrastructural challenges. Collection and transportation operations from illegal settlements constitute the largest infrastructural challenge. The researcher was informed that many informal settlements are not easily reached by both the division and the private collectors due to the poor road network. Also the landlords have not been informed on the need to manage solid waste and have from time and again put up structures without solid waste management disposal sites due to limited land. This has therefore led to several unofficial dumping sites around the area mostly located in wetlands, abandoned building and the road sides. From the researcher's observation, when one looks at the location of the new opened dumping site in SANDAFA Sector which is used by all sub cities of the Addis Ababa City, the study also showed that it is far away from the city's densest suburbs and is only reachable by dirt road and the steep slopes make it challenging for both large garbage trucks and common residents to reach it and is now closed by the Oromia regional state.

There are socio-economic challenges in Akaki-kality sub city. The study indicated that private sector has been given concerned in gathering and transportation of wastes to the landfill. The general public has no longer taken brilliant steps in solid waste management practices like source reduction, re-using, recycling or nicely disposing away with the component that cannot be reclaimed. As an alternative the public has for the most part maintained the "I do not care" mindset of generating as plenty rubbish as possible unconscious of the implications. Negative or poor mindset toward solid waste management (SWM) in Akaki-kality sub city changed into additionally compounded by some other challenges. The prevailing mindset of the citizens toward waste gathering and disposal or treatment is at lower stage. The urban citizens typically

do now not participate in waste management responsibly and that is worsened by the incapacity of the Addis Ababa city authorities to enforce current waste management regulation. There are also negative factors of thoughts-set and lifestyle which have avoided in some cases the very important detail of public participation. The very low fee, poor mind-set toward waste issues and low GDP per capita are contributing factors that cause unwillingness to participate in public management matters. The combination of all these factors together with the sub city officials weaknesses that cause management failures can lead some times to the accumulation of wastes in neighborhoods leading to environmental degradation and threat of disease epidemics such as cholera, diarrhea and parasites. The major problems identified during the interview are summarized as follows:

-  High volume of solid waste is generated from households
-  The accumulation of solid waste that is difficult to separate
-  Lack of temporary storage areas
-  Solid waste is not collected quickly
-  Collected solid waste is not transported timely to the waste disposal site
-  Not using modern technologies to facilitate waste disposal
-  Lack of qualified manpower, engaged in the sector
-  Insufficient allocation of resources to the sector
-  Not changing the implementation guides into action

STRATEGIES TO IMPROVE WASTE MANAGEMENT IN AKAKI-KALITY SUB CITY

One of the strategies is community awareness to solid waste which the government of Ethiopia has not been doing in Addis Ababa City, including Akaki-kality sub city. The study indicated that the contributors of the general public had to be mobilized and educated in matters concerning waste management such as sorting/ separation of waste in step with their categories of natural and inorganic, efficient use of skips, waste recycling, home composting, waste minimization and adherence to environmental and waste management laws. The study also denoted that community based organizations (CBOs) have a huge role in solid waste control practices and mobilization of the community works and has to be carried out monthly. The government and

CBOs have to accomplish the work of socio-cultural and attitude problems in waste control may be addressed also regularly through public schooling to conscious the residents, at the same time as financial troubles may be resolved by way of offering employment possibilities within the waste management activities.

The study found that Solid Waste Reduce, Reuse and Recycling mechanisms has to put in place by the Government through CBOs and waste collectors. This has to be done by recognizing the initiative as a formal waste reduction strategy by the Akaki-kality sub city. Organizing the local community into groups based on enterprise (scrap, plastics, art and craft), building the capacity of the community (in value addition, collection of solid waste and business skill), support the community with working capital to collect and purchase the waste in bulk and provide market information and linkages where such collected materials and finished products are sold for money to be reused for poly fibers and Crest tanks for plastic materials while others sold to artisans to make finished products like students suitcases, charcoal stoves, metal works to mention but a few.

The government has also to put up plans for land use and management which is meant to be followed by all citizens in the country. This came after realizing that land in Addis Ababa is insufficiency yet the solid waste production is rising day to day as the city is becoming populated. They had done a plan of putting incinerators that will be used to burn wastes instead of dumping them but the implementation is still at the starting step due to financial means, yet the solid wastes are daily dumped.

Associations have to be identified which collect solid waste from homes, and this has been eased by decentralization where each Sector has the autonomy to collect and dispose the waste from their area. On the municipality level Association, mainly in Akaki-kality sub city, have been engaged to collect the waste from the sub city.

In addition to these strategies, the provision of establishment of a waste treatment and recycling plant will offer an appropriate alternative to using landfill which is not convenient and this plant will be used for commercial purposes.

An overall master plan which is being designed will resolve and address issues and challenges related to poor planning including those of waste management.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

This chapter involves summary of findings, conclusion and recommendations. The summary is based on the findings on the study objectives and the recommendations are based on the discussion of the findings and analysis as well as interpretation of the findings addressing the research questions that the study aimed to answer.

SUMMARY OF RESEARCH FINDINGS

Solid waste management is not a new activity to the municipal effort and the administration. It is not a one day activity rather it has evolved with man. Imperatively, since immemorial man has been on the road to clean and dispose solid waste from near his environment and his attempt to do so has increased methods to modern methods of collecting and disposing solid waste. Using the findings from this study, it can be ascertained that collecting, transporting and disposing solid waste is not only the work of the government of Addis Ababa in the jurisdiction of Akaki-kality sub city but also individual households if the Capital is to be clean. This calls for increased efforts by the government, different organizations and bodies, communities and well-wishers to be vigilant to the road making Addis Ababa clean. Despite this call, this study found impediments such as dumping solid wastes besides the road and weak law implementation among others.

STATUS OF THE EXISTING SOLID WASTE COLLECTION, TRANSPORTATION AND DISPOSAL PRACTICES

The study indicated various ways of the solid waste collection, transportation and disposal practices. It was found that solid wastes are not collected regularly. This is done by men and women who normally move from place to another using the vehicles that were meant for the purpose. The findings from this study were found similar to the study by Hayal, Hailu and Aramde (2014) who noted that most African cities and urban centers solid waste accumulation is estimated at 0.5 kg per capita/day and are either collected by males and females to the collecting centers. They also noted that almost each day, hotels and households in the urban centers accumulate solid waste that needs collection to the disposable centers. Palczynski (2002) noted that the generation of solid waste in Africa is among households, commercial centers, institutions, hotels and health facilities are the most sources of solid waste.

These normally have dangerous solid waste that needs immediate attention from the municipal administration, the government and other authorities that are meant for the collection, transportation and disposal. In the road to collect solid waste, this study established that sucks are used by different households while hotels and commercial centers have got different areas for the accumulation of solid waste. In a study by Henry, Yongsheng, Jun (2006), it was found that different places of cities normally have different places for frequent collection systems such as door – door, curbside, set out, the block collection system and the sweeping of street. These have been used in the process of collection and disposing solid waste in Akaki-kality sub city.

The study also established that transportation of solid waste in Akaki-kality sub city is done by the government and private associations. In this approach, it was found that private companies are employed by the government or municipalities to keep the area clean. It was also established that transportation is done by inappropriate equipment and these include Lorries for the collection of the solid waste to the disposable centers. Gombya and Mukunya (2004) remarked that various areas among cities in developing nations still have too much of wastes that stand a challenge to transportation. Accordingly, solid waste is dumped near the road and behind buildings that becomes major challenges to collection and transportation. This study also found that at times wastes are dumped near the roads; there were more challenges in Akaki-kality sub city to transportation. Sharholyet *al* (2008) noticed that despite different methods used in transportation of the solid wastes, cities in low-income countries often lack sufficient transportation and equipment to collect wastes and transport such waste in proper manner. This situation has been identified among the Sub-Saharan Counties.

THE MAGNITUDE OF THE SOLID WASTE MANAGEMENT PROBLEMS

According to the findings of the study, the magnitude to the problem of solid waste management in Akaki-kality sub city has been worsening due to shortage of expertise, financial resources, legal and administrative enforcement of environmental regulations. Together with these issues, this study established the lack of public awareness and environmental ethics that result in uncontrolled solid waste disposal. This was found cutting across all areas in Akaki-kality sub city; rather than a small area or place. Due to the weakness of the law and little financial resources; the study established that the collection of solid waste has not been an issue of the

municipality rather than the people themselves. In order to understand well the danger of solid waste management, the study established that in the outskirts of the sub city centers or kebelecenters; solid waste hardly is collected. The findings are in congruence to the findings from the study by Blaser and Schluep (2012), where the magnitude to which the solid waste is a problem can be found in the outskirts of the cities, towns, urban areas and municipalities, from which this study found that solid waste are found on outskirts of the sub city areas, turning into the residents causes of contamination because fertilization of flies, and mosquitoes; that, in turn, are disease transmitters that affect the health of the residents. Respondents also impinged diseases and suffering among the people in Akaki-kality sub city to solid waste, the study found that there is bad ordure arising from the accumulation of solid waste if not collected within a short period of time. These attract dogs, cats and much more street children scavenging food around Akaki-kality sub city. Besides, solid waste dumping was associated with incubation and proliferation of flies mosquitoes and rodents; in turn, transmit diseases that affect population's health such as malaria, diarrhea and cholera.

STRATEGIES TO OVERCOME WASTE MANAGEMENT CHALLENGES

Community awareness to solid waste has been identified as one of the strategies the government of Ethiopia has to enforce to override challenges emanating from the solid wastes. The effort has been supported by Community Based Organizations (CBOs) while Reuse and Recycling mechanisms are being put in place by the Government through CBOs and waste collectors. These strategies among others have increased the cleanliness of the Akaki-kality sub city. According to Wang and Huisman (2012), there are specific and efficient techniques used in managing solid wastes in small and large quantities. Tukahirwa (2011) notes that plastic waste generated from polyolefin sources have been effectively managed by four routes: primary route which is the re-extrusion that yields material analogous; secondary route which is the reduction of waste by compression (mechanical) and the tertiary route which is the thermo-chemical methods that yield fuel or petrochemical stock. Although these were not used in Akaki-kality sub city, the approach that is put in place was found partly effective for the clean environment.

CONCLUSION

Therefore, solid waste in Akaki-kality sub city is a cause for all groups of people living in and outskirts of the sub city. It needs to be noted that as the sub city expands, dire-consequences are obvious and it is the duty of the Addis Ababa city government and the people themselves to ensure effective collection of the solid waste at all point. Neither the CBOs nor community can work infuse all areas to reduce solid waste; instead it needs a concerted effort from all sides.

RECOMMENDATIONS

A good way to lessen the quantity of solid waste and improve on solid waste management practices:

- ✚ There is a need to increase public awareness and capability constructing on proper solid waste management. This can be accomplished through radio programmes, development and distribution of printed materials and additionally project public sensitization conferences concerning solid waste management within the area of Akaki-kality sub city officials and non-governmental organizations.
- ✚ There is a need to discover the possibilities for the 4Rs (lessen/reduce, Reuse, Recycle and reconsider/Rethink) and composting in city waste control among urban communities to minimize wastewhile on the same time providing social (smooth and healthful neighborhood) and economic (sale of recycled or recyclable substances) blessings.
- ✚ To effectively undertake sustainable techniques of waste control by way of the communities, it may be carried out through making awareness programmes simple and accessible to change the mind-set of city residents to think waste as beneficial material rather than something as useless.
- ✚ Incorporated waste management approach that employs decentralized community based structures regarding NGOs/CBOs focused on the semi-urban poor and the greater centralised city municipality and private operator systems that target the applicable business areas and the rich and middle magnificence estates should be explored with the resource of the urban administration. Such systems can be promoted through residents' participation and awareness creation requiring CBOs and the private sector. There should also government support for such activities of waste management programmes to be successful.
- ✚ An integrated approach is needed from segregation at source and collection to resource recovery and final disposal. Resource recovery centers can be constructed at the way to or near the very

last disposal sites so that residual wastes from recovery centers may be brought effectively for disposal. Smaller solid waste offices may gradually improve their final disposal method from open dumping to controlled dumping (with soil cover and controlled access), engineered landfill (including careful site selection, waste compaction, and surface and groundwater monitoring), and finally full-fledged sanitary landfill (including an impermeable liner, and leachate collection and treatment), as financial and technical capacity constraints permit.

- ✚ Awareness creation on how to reduce solid waste from the source, methods, and its benefits to the residents.
- ✚ Raising awareness and remind the public on how to handle and Manage implementation process of solid waste
- ✚ Determining areas for temporary storage based on the volume of solid waste for disposal.
- ✚ Create a system of accountability for unions who collect solid waste in accordance with the timetable and criteria set, if not are held accountable. Prepare these guidelines to make this apply
- ✚ Providing staff, vehicles and other inputs to those collecting and transporting solid waste from the temporary solid waste storage spaces to the point for final disposal.
- ✚ Promoting the most effective and viable technologies for the country, and strengthening research and inventions that can be carried out in the field by conducting studies.
- ✚ Providing complementary training to enhance the capacity of the service provider/staff and other members of the association/small and micro enterprises.
- ✚ Create common consensus to carry out the responsibilities of all stakeholders to implement the policies introduced into action
- ✚ Establish waste treatment and recycling plants...

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APPENDICES

APPENDIX-I

ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF PUBLIC MANAGEMENT AND POLICY

QUESTIONNAIRE

This Dear Respondent,

I am a student of Addis Ababa University, Addis Ababa/Ethiopia, pursuing Masters in Public Management and Policy. As part of the academic requirements, I am carrying out a research on “**The Assessment of Municipal Solid Waste Management Practices and Problems in Addis Ababa; the case of Akaki-kality sub city**”. I am therefore requesting you to spare some time and fill this questionnaire. The information you give will be treated confidentially and will be anonymously used for purposes of writing the research report, and will not be used for any other purpose.

Thank you for your cooperation.

SECTION A:-

General information

1. Age range

- a) 18-30 ☐ c) 41-50 ☐ e) 61 and above ☐
b) 31-40 ☐ d) 51-60 ☐

2. Gender

- a) Male ☐ b)Female ☐

3. Your level of education

- a) Elementary ☐ c) Diploma ☐ e) other (specify).....
b) Secondary ☐ d) Degree ☐

4. Your experience in solid waste management

- a) Less or One year ☐ c) Three years ☐ e) Five years and above ☐

b) Two years ☐ d) Four ☐

SECTION B:-

5. How do you see the services related to solid waste management in Akaki-kality sub city?

a) Excellent ☐ c) Good ☐ d) Bad ☐

b) Very good ☐ d) Fair ☐

6. Which are main challenges of “Akaki-kality sub city” regarding waste collection?

(a) Unseparated waste (b) Stray dogs (c) Destruction of containers (d) Car parking in collection points (e) Other challenges

7. Which are main challenges of “Akaki-kality sub city” regarding waste transportation?

(a) Lack of transportation vehicles (b) High number of collection points

8. What are the percentage of doo-to-door waste collection and the percentage of collection through containers?

- Percentage of doo-to-door collection: _____

- Percentage of collection through containers: _____

9. List some of the common diseases that affect the community members (specify)

.....
.....
.....

10. Are you aware of some of the common problems associated with improper refuse management within the community? Write down the problem

.....
.....
.....

11. Is land available for proper refuse dump site?

a. Yes []

b. No []

12. Where do residents dispose of their refuse?

- a. On the road to farm []
- b. On the road to dump site []
- c. Into a river/stream/pond/gutter (underline that which applies)
- d. At the refuse dump []
- e. Into the nearby bush []
- f. Onto a weedy house plot nearby []

13. What method do you use to transport your refuse to the dump site?

- a. Door to door method []
- b. Communal method []
- c. Wheelbarrow system []
- d. Others (specify).....

14. Presence of community storage receptacle

- a. Yes []
- b. No []

15. What do you have to say on the distance to the dump site?

- a. Too far (250m or more) []
- b. Far (200-250m) []
- c. Quite far (150-200m) []
- d. Close (100-150m) []
- e. Too close (less than 100m) []

16. In which sites around Akaki-kality sub city door-to-doo waste collection is higher than

collection through containers?

.....

.....

.....

17. What is the total number of containers in Akaki-kality sub city?

.....

.....

.....

18. What is the average number of containers per site in Akaki-kality sub city and how is this number determined?

.....

.....

.....

19. How many times and at what part of the day does your company collect waste (door-to- door and through containers) in the sub city?

i. Door-to-door collection:

ii. Through containers:

20. How are the collected waste transported from containers to the landfills?

.....

.....

.....

21. How many waste transportation vehicles do you have and of what type are they?

.....

.....

.....

22. Do you think you have enough waste transportation vehicles and appropriate number of workers engaged in this activity?

.....

.....

.....

23. How appropriate is the urban planning of the city for the efficiency of your company in collection and transportation of the waste? What are the actual problems?

.....
.....
.....

24. Should apartment construction companies consult with your sub city for identifying appropriate collection points for the new owners of the apartments?

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25. What is the percentage of the collected fees for Akaki-kality sub city? Is this situation satisfactory?

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26. State the problems associated with collection of solid waste in Akaki-kality sub city.

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27. How frequently are wastes collected?

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28. What are the problems associated with transportation.

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29. How frequently are wastes transported?

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30. What challenges are associated with the disposable points?

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31. Is there any other problem associated with solid waste management in Akaki-Kality?

a) Yes b) No If yes, mention them

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32. Suggest strategies to be used in overcoming challenges of waste management in Akaki-kality sub city.

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33. Please indicate the extent to which you agree with the statements where (1 = strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = strongly agree).

	Statement	1	2	3	4	5
35	Solid waste is regularly collected in Akaki-kality sub city.					
36	Citizens use sacks to collect solid waste.					
37	Solid waste is collected from generation to the transfer/storage sites.					
38	Curbside collection is used for solid waste in Akaki-kality sub-city.					
39	Setout collection system is used in Akaki-kality sub city.					
40	Recycling and composting is commonly used in Akaki-kality sub city.					
41	Transportation is done by a private company.					
42	Transportation of solid waste is done using appropriate equipments.					

43	Open dumping spaces are commonly used as final disposal facilities.					
44	Landfilling is used in the solid waste management.					
45	Dumpsites emit obnoxious odours and smoke.					

APPENDIX-II

INTERVIEW GUIDES

1. Introduction, your profession and your experience.
2. How do you rate the services related to solid waste management in Akaki-kality sub city?
3. How frequently are wastes collected?
4. Which method of solid waste disposal practiced in Akaki-kality sub city?
5. What are the problems associated with solid waste management in Akaki-kality sub city?
6. Suggest strategies to adopt for related challenges in the waste management sector in Akaki-kality sub city for the future.
7. What types of solid waste collection methods does your department adopt?
8. Mention the types and total number of equipments that your department used for collection, transportation and disposal of municipal solid waste of the sub city?
9. Is there a mismatch between the amounts of municipal solid waste that regularly generated and, total quantity of solid waste that is collected and disposed by your department? If there, please discuss the major reasons of a mismatch.
10. Explain the major reasons of why your department didn't place public solid waste containers and street bins at the major roads of the sub city?
11. Does Akaki-kality sub city sanitation, beautification and parks development 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?
12. Explain the overall institutional structure, mandate and functions of sanitation, beautification and parks development department and, the major positive and negative impact of these arrangement on the existing performance municipal solid waste management of the sub city.
13. Briefly discuss Policies, Strategic plans, and its Implementation and monitoring mechanisms that have been proposed by your department for efficient practice of municipal solid waste management in Akaki-kality sub city.
14. Describe the total budget and revenue of municipal solid waste management related with their sources and the major challenges that faced your department about it?
15. Does your department collect charge from the residents of the sub city for its municipal solid

waste management service delivery?

16. Do you think that there is inadequacy of man power in your organization? If there is, what do you think the reason behind this?
17. Do employees leave your department frequently? If yes, please specify their number, major reasons and your department response for it.
18. Do you think that your organization has sufficient autonomy from other levels of government in its every day decision making.
19. 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.
20. Did your department give education to the community about solid waste management and prepared cleanup campaigns? If you did, for how many times and describe your method of delivery.

Thank you for your cooperation

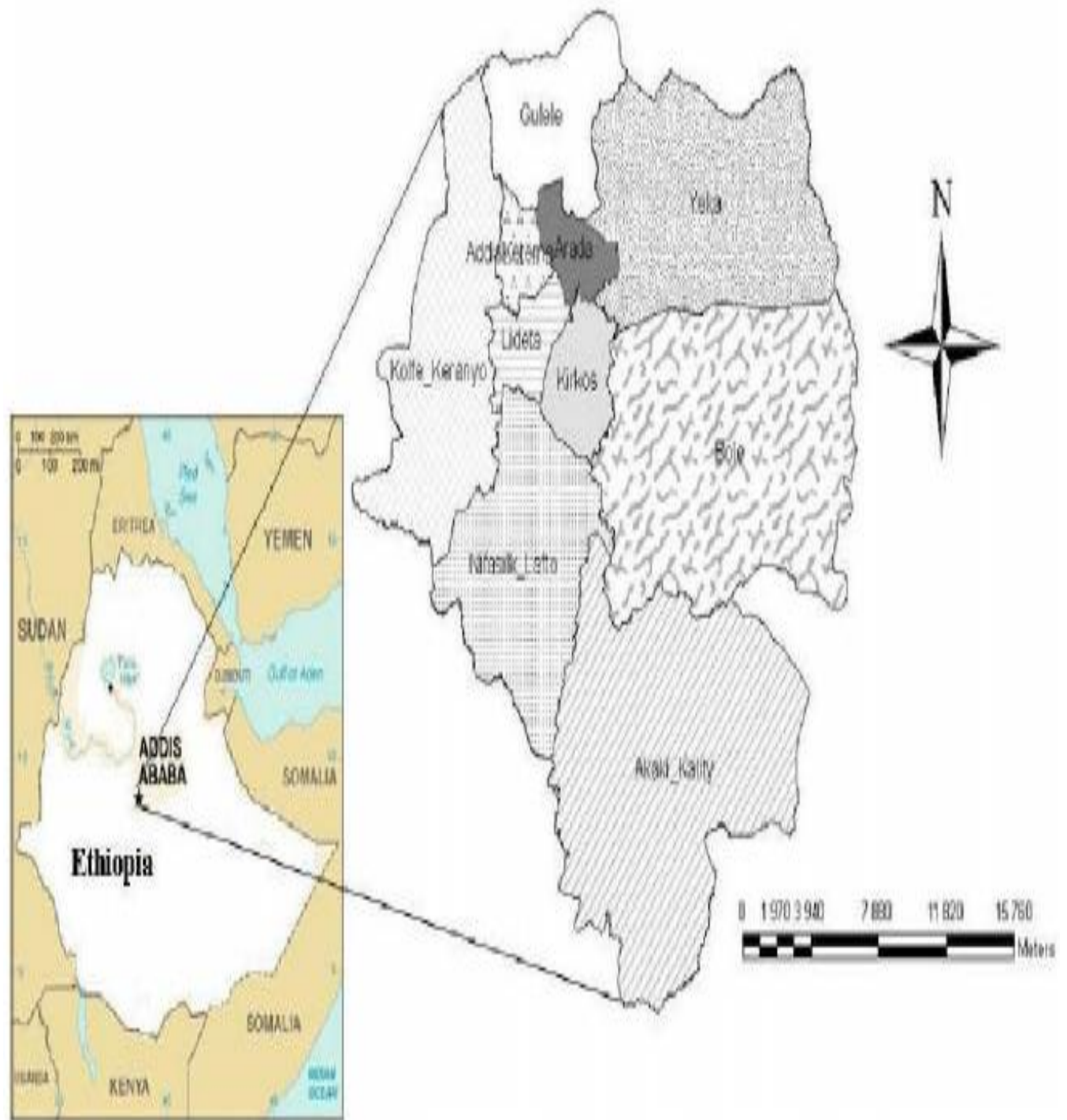
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APPENDIX-III

MAP OF THE AKAKI-KALITY SUB CITY



APPENDIX-IV
Map of addis Ababa city



APPENDIX-V
Map of Akaki-kality sub city

