ADDIS ABABA UNIVERSITY COLLEGE OF DEVELOPMENT STUDIES CENTER FOR ENVIRONMENT & SUSTAINABLE DEVELOPMENT

ASSSESSING THE CHALLENGES OF URBAN SOLID WASTE COLLECTORS PERFORMANCE IN FOUR SELECTED SUB-CITIES OF ADDIS ABABA: ETHIOPIA

BY: ANTIGEGN GUDAY

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ADDIS ABABA, ETHIOPIA

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A THESIS SUBMITTED TO CENTER FOR ENVIRONMENT & SUSTAINABLE DEVELOPMENT OF ADDISABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

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DECLARATION

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

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Abstract

In most of the developing countries, it is common to observe, solid wastes uncollected simply dumped in open areas, road sides, river courses, gullies, the disposal method that the town used is also open dumping type which widely practiced in the sub-cities which has hazardous effect on health and the environment. The main purpose of this study is to know assessing the challenges of solid waste collection practice on the selected four subs-cities of Addis Ababa. In this study, survey research strategy was applied using structure questionnaires, the primary data collected from 55 sample solid waste collecting enterprises selected purposively from the study areas. Data collection tools like questionnaires, key informant- interview and observation were arranged with solid waste enterprises, sub-cities solid waste disposal administrator and team leaders to generate additional information. The finding revealed that Socio-economic characteristics such as (sex, age, educational level, income and work experience), Socio-economic factors such as (access to collectors, inadequate service coverage, operational insufficiency), solid waste disposal mechanisms (open burning, open dumping, incinerator mechanism) were significantly influence effective collections on' solid waste disposal practices in the study sub-cities. Similarly, short term Training, sex of collector's group chairperson, educational attainment of the collections group chairperson and collection frequency of solid waste collectors were recognized as factors affecting effective solid waste collection performance. Based on the multinomial logit regression model factors contributed solid waste collection performance for the improvement of environmental cleaning was determined a significant impact on dependent or outcome variable. These the likelihood ratio chi-square test to test whether there is a significant improvement in fit of the final model relative to the intercept only model. In this case, we see a significance improvement in fit of the final model over the null model ($x^2(4) = 72.992$, $P=.000$) (see table 4.14-4.16).This indicates that each independent variable can play a significant role in shaping effective solid waste collection for environmental cleaning. Therefore, the study recommended that municipal administration has to encourage the residents on effective ways to solid waste disposal practice; extend collectors' awareness with provision of training and provide more solid waste collection facilities and equipment of the collectors would be changed.

Keywords: Solid waste collection practice and performance for environmental cleaning

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LIST OF ACRONYM

AU----------African Union

EPA ----------Environmental Protection Agency

EWM----------Enhanced Waste Management

HHW ----------Household Hazardous Wastes

HHWD----------Household Waste Disposal

HW----------House holed waste

HW----------Household Waste

ISWM----------Integrated Sustainable Waste Management

MOW----------Municipal Organic Waste

MSW ----------Municipal solid Waste

RQ---------- Research question

SSF---------- Solid State Fermentation

SSWDP----------Sustainable Solid Waste Disposal Practices

SWC----------Solid Waste Characteristics

SWC----------Solid Waste Collection

SWD----------Solid Waste Disposal

SWE ----------Solid Waste Enterprises

SWG ----------Solid Waste Generation

SWM----------Solid Waste Management

UNEP----------United Nation Environmental program

CHAPTER ONE

1. INTRODUCTION

The main interest of this thesis was to assess the challenges of solid waste collection and its effective performance. This chapter presents the introduction and is inclusive as follows: Research background, problem statement, research objectives, research questions significance of the study, Limitations, the scope and organizations of the paper.

1.1Background of the Study

According to Boya (2017) most developed countries have addressed environmental problems systematically, with higher levels of ability to dispose of solid waste than developing countries this indicated that lack of effective solid waste disposal practice of in developing countries still. Solid waste management is the complex manner in the worldwide concern at different levels in the various parts of the world. These magnitudes of the challenges are driven by the amount of effort put in by different countries to contain the solid waste problems (Elison 2017; Bournay 2006). Solid waste management is a universal issue affecting every single person in the world, Individuals and governments make decisions about consumption and waste management that affect the daily health, productivity and cleanliness of communities (World Bank 2018).Solid waste is the useless, unwanted and discarded material resulting from day to day activities in the community (Ashish et al., 2014). The term solid waste as used in this text is all- inclusive, encompassing the heterogeneous mass of throwaways from the urban community as well as the more homogeneous accumulation of agricultural, industrial, and mineral wastes (Takele, 2004). Solid waste management protocols and system dynamic modeling support policy development as it uses waste prevention to explain the complex waste management systems and suggests methods for effective management. However, creating an effective waste system goes beyond the formulation of policies and legislation; it involves financial and technological proficiency, skilled human capacity, technical, social, resource recycling, educational awareness programs, and active public participation(Victor et al.,2020).

According to Vital (2015), Solid waste management practices are essential component of environmental infrastructure in human settlements. These practices encompass all activities undertaken from the point of waste generation up to the final disposal. In most of African urban areas, solid waste management is ultimately a responsibility of Municipal Councils while most cases of rural areas the wastes are handled and disposed at the household level (Frank, 2006). Solid Waste Management (SWM) is major environmental issues particularly in municipalities of many developing countries that have been suffering from environmental problems. Alamgir; Donald; Roehl and Ahsan (2005) assert that urban population growth and economic development should be considered key issues for Municipal Solid Waste (MSW) generation. Increasing unplanned urbanization along with user's mind set of 'out of sight out of mind' of wastes is one of the factors that make the production of solid waste to increase and though intensifying environmental pressures including unorganized waste disposal in many municipalities. In many cases, the, SWM is found to be a major concern for the municipalities and towns of many countries (ADB, 2012).

According toTesfaye (2015) Solid waste management is one of the critical concerns facing the developing countries, because of the social, economic and environmental implications once not properly managed The only 30-50% of the waste generated in developing countries is collected and managed properly, The rest is either burned or left to decompose in open space or dumped in unregulated landfills, which is damaging the environment. In Ethiopia like developing countries, the increase of solid waste generation is resulted from rapid urbanization and population blooming. The amount of solid waste in Addis Ababa and other fast growing areas in the country has been increasing over time, largely attributed to rapid population growth rate (BmelakuTegegn; 2008). Therefore May studding is to conducting to fill on the gap of these problems.

1.2 Statement of the Problem

The achieving of environmental sustainability was understood as managed the handling of waste materials from source through recovery processes to disposal of it**.** Several studies showed that collection, storage, transportation and final disposal of solid wastes are a major problem and issue within the biggest challenge to the authorities of both small and large cities' in developing countries (Hussein et al.,2018). This is true in Ethiopia from the capital city of the country (like Addis Ababa), Improper dumping of waste is increasing from time to time as a result of human population growths, which is automatically lift different waste types that includes potentially harmful waste to the

environment. We have to the awareness of the community as well as governmental commitments towards contesting the problems are insignificant on the practices of solid waste disposal effectiveness.

The reported of their authors with on the title of solid waste management practice and problems issues states that "Solid waste management in developing countries has been given less attention from policy makers and academics than that of other environmental problems" such as air pollution, polluted water treatment (Martin 2004; Solomon2018).Solid waste management remains a serious problem in most developing nations, even though it consumes a larger portion of the municipal budget, as a result of, participation of urban households, micro and small enterprises, governmental and non-governmental organizations plays a great role to upgrade the existing low status of solid waste management services(Kassahun; Birara 2017). On the following perspectives also, Solid waste, which is a consequence of day-to-day activity that is the major issues of human kind, needs to be managed properly, Due to rapid increase in urbanization and population (Alamudin et al., 2019). Solid waste management is a growing public concern in Ethiopia, in many cities of the country waste management is poor and solid wastes are dumped along roadsides and into open areas (NaolSoboksa; 2018). Solid waste problem is visible in most parts of the districts' urban centers; on the roads, within the neighborhoods and around residential buildings and in different places of the urban areas. Failure to address waste management related issues is expected to lead to numerous social and environmental contaminations (Vital; 2013).

Ethiopia is facing rapid urbanization leading to overcrowding and the development of slums and informal settlements with poor waste management practices, Although urban dwellers generally consume more resources than rural dwellers and so generate huge quantities of solid wastes (Mohammed, 2015) .On the same manner in Addis Ababa town, the miss- management municipal solid waste practices were considered as mutual activities, Most of the solid wastes that are generated in the town remain uncollected and simply dumped in open areas, road sides, gorges and river courses. These practices led to the deterioration of the town environment and also reinforce incorrect disposal habits to the people. Solid waste, which is a consequence of day-to-day activity of human kind, needs to be managed properly. Addis Ababa, like other cities in developing countries, faces problems associated with poorly managed solid waste operation (Nigatu et al., 2011).

Therefore, on the problem of solid waste disposal practice, Ethiopia is one of the indicated countries; spatially in the cities have the biggest problem with improper solid waste collection disposal. As this

problem has theme to the rapid population growth of Addis Ababa has been putting tremendous pressures on the city not least in terms of environmental degradation for instance; 35 percent of the solid waste generated by the city is not collected (Mulumebet; 2018). Most of solid wastes that are generated in the town remain uncollected and simply dumped in open areas, road sides, river courses, gullies, the disposal method that the town used is also open dumping type which widely practiced in the sub-cities and has hazardous effect on health and the environment (Mohammed 2015). In addition to the articles report based on the researcher observation the city of Addis Ababa is one of the first crises occurred and which has ten sub-cities with the problems of such issues to indicate by the previous articles. So, the main purpose of studied to analyze the challenges of urban solid waste collectors performance on the selected four Sub-cities which is characterized by improper practice of solid waste disposal: Moreover, the amount and type of solid wastes generating is now a day is induced time to time and Solid waste management practice of the sub cities are poorly organized. The above mentioned researchers were reported almost the same results about solid waste disposal in the urban city. This study focused only on analyzed the challenges of urban solid waste collectors' performance in the study area.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of this study was to analyze the challenges of current solid waste collectors performance among four selected sub-cites in Addis Ababa, Ethiopia

The following specific objectives are spelt outs.

- To identify the type of solid waste collection methods of collectors practices in the four sub-cities.
- To assess socio-economic factors of solid waste collectors in the four sub-cities.
- To assess group characteristics of solid waste collectors performance.
- To determine the factors of solid waste collectors in the study area.

1.4 Research questions

So as to achieving the intending objectives stating above, the following research questions are formulating:

- What are the current solid waste collection methods in the four selected sub-cities?
- What are the socio-economic challenges of solid waste collection performance in the study area?
- What does the group characteristics of solid waste collectors look like?
- Which factors are to influence on poor solid waste collection performance in the four sub-cities?

1.5 Significance of the study

This study would be contributed on the current solid waste practice and its factors the improvement of collectors solid waste collection performance on the selected sub-cities of Addis Ababa. Accordingly, this study would be involved the following significances; on the waste disposal practice focusing on the regular collection, transportation as well as processing and disposal or recycling and monitoring of different types of waste materials. These services can save our business a considerable amount of money, and can also prevent the environment from being harmed and as citizens of a society we have a responsibility to manage our waste sustainably and also improve environmental cleaning as well as environmental safety. the researcher believed that, this thesis finding might have a great contribution to make aware the stakeholders regarding the root causes that determining the effective management of

solid waste collection on environmental sanitation, This indicates the existence of determinant factors of on the effective of solid waste disposal practices gap, and this study will play a prominent role in filling that discrepancy. By elaborating upon the factors influencing the improvement of solid waste collection performances in the context of solid waste collectors, this study adds to the scanty body of knowledge about sustainable solid waste management strategies in the city. Therefore, this research can be a baseline or just inspirational for other deep and further investigation.

1.6 Limitation of the study

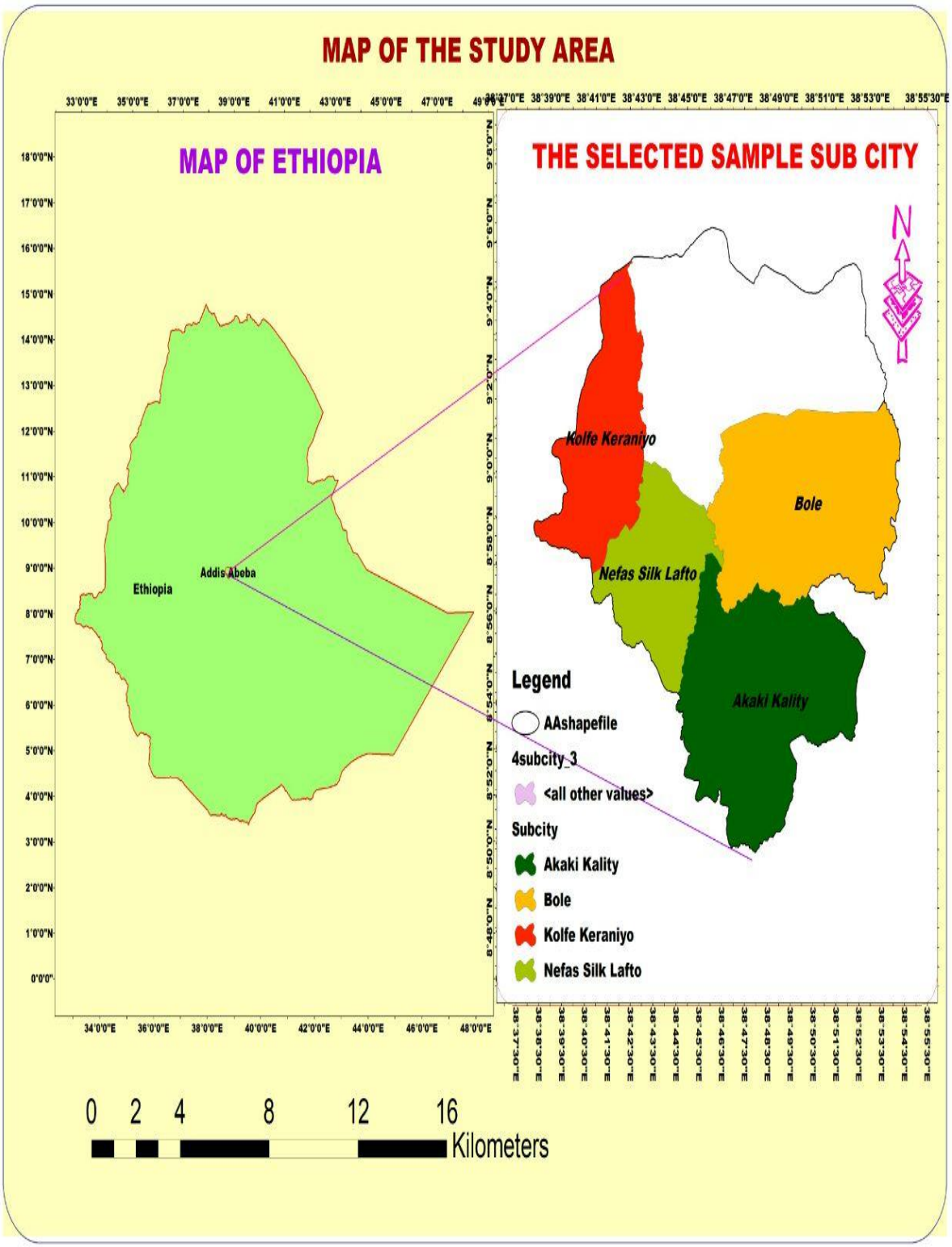
Some of limitations of this study would lack of secondary data, shortage of time, and financial shortage during data collection and respondents refusal to provide detailed information. But, the researcher will be tried to minimize these problems and come up with reasonable findings.

1.7 Scope of the study

Municipal solid waste management includes all waste streams from various sources such as households, commercials, institutional, non hazardous industrial wastes and street sweeping wastes. It also comprises of all activities including waste generation rate, characterization and composition identification, to waste collection, storage, transfer, waste processing, transportation, and disposal.

Therefore, this study draws more of its attention on the practical level that the management and residents of four selected Sub-cities. This contributes to the solid waste collection challenges that influence the performance of collectors in solid waste collection activities in the selected Sub-cities. These study is confined that have occupied total number of solid waste collectors are 3535 (sub cities solid waste manager 2021), The choice of the study area is driven by the researcher fact that the sub cities have more high area coverage and more improper solid waste disposal in the city of Addis Ababa.

Figure 1.1 Map of the study area



Sources: By Goggle earth GIS on the researcher, 2021

1.8 Organization of the paper

This thesis was organized in to five chapters. Chapter one encompasses introduction ranging from background to limitation of the study. Chapter two deals with reviewing different theoretical and empirical literatures related with the subject under investigation, chapter three covers research design and methodology including research design, data source and data gathering method, sampling design and techniques of data collection, chapter four data analysis, interpretation, Discussion, Chapter five conclusions and recommendation.

CHAPTER TWO

2. LITERATURE REVIEW

2. 1 Introduction

This chapter consists of definition of terms; Theoretical Literature reviewed conceptual framework literatures related with the issue under study i.e. the effectiveness of current solid waste collection practice for urban environment was reviewed. Talking the objective due to consideration theories said to the method of solid waste disposal practices and characterization of solid waste disposal practice.

2.2 Conceptual definitions of terms

Waste characterization: Solid waste streams should be characterized by their sources, by the types of wastes produced, as well as by generation rates and composition, accurate information in these three areas is necessary in order to monitor and control existing waste management systems and to make regulatory, financial, and institutional decisions (World Bank, 1999).

Solid waste management: A systematic administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment and disposal of solid waste (Alemayehu , 2004).

Waste generation: encompasses those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal. What is important in waste generation is to note that there is an identification step and that this step varies with each individual. Waste generation is, at present, an activity that is not very controllable (FrankKreith Boulder, CO,2002).

Collection: It includes both the gathering of solid wastes and recyclable materials and the transport of these materials, after collection, to the location where the collection vehicle is emptied, such as a materials-processing facility, a transfer station, or a landfill (Frank KreithBoulder,CO, 2002).

Solid waste disposal: Waste management is also dependent on safe and reliable disposal system. This system can be effectively achieved when disposal site is on accessible landfill near to collection points, closed and protected from animals and which has no bad smell to the community (Getinet, 2016).

Solid waste: may be defined as all discarded solid materials resulting from households, industrial, healthcare, constructional, agricultural, commercial, and institutional sources (Ziraba et al. Archives of Public Health, 2016, 74:55).

Waste processing and recovery: refer to the facilities, equipment, and techniques employed both to recover reusable or recyclable materials from the waste stream and to improve the effectiveness of other functional elements of waste management (Besha, 2019)

Effectiveness: the extent to which the service objectives have been met/fulfilled in practice. The waste management model adopted should be able to remove all the waste generated in a given area.

2.3 Theoretical Literature Review

Concepts, theoretical framework and empirical frameworks that support under investigation will be discuss bellow.

2.3.1The basic issues of solid waste collection disposal practice

The world has experienced unprecedented urban growth in recent decades, In 2008, for the first time, the world population was evenly split between urban and rural areas, More developed nations were about 74 percent urban, while 44 percent of residents of less developed countries lived in urban areas, However, urbanization is occurring rapidly in many less developed countries, It is expected that 70 percent of the world population will be urban by 2050 and most urban growth will occur in less developed countries (Satterthwar, 2009).

Globalization has been identified as playing a negative role in solid waste management in developing cities, Impacts include the transfer of urbanizations or internationalized waste management methods and ideologies together with an increased volume and variety of waste, resulting from increased flows of goods and services, and changed life style and consumption patterns; conflicting involvement of multi-national companies with local initiative groups, city and national government in waste management problems and other issues which directly or indirectly affect the waste sector (Affrican conference, 2003).

2.3.2 Solid waste collection disposal practices in urban areas

Solid waste can be defined as no liquid material that no longer has any value to the person who is responsible for it. The words rubbish, garbage, trash, or refuse are often used as synonyms when talking about solid waste. In urban areas, solid waste is generated by domestic households, commercial and industrial enterprises, and health care and institutional activities, as well as on the streets. Street refuse contains a mixture of refuse from many sources, because streets are used as dumping grounds by all generators of waste. Where sanitation Facilities are lacking and a large animal population roams the streets, street refuse contains a lot of human fecal matter and manure. Streets are also often used for extensive dumping of construction and demolition debris attracting further dumping of solid waste (WB, 2008).Solid waste collection and disposal is one of the major problems of urban environment in most countries worldwide today. Solid waste management solutions must be financially sustainable, technically feasible, socially, legally acceptable and environmentally friendly.)This is mainly due to the increasing generation of such solid waste and the burden posed on the municipal budget. In addition to the high costs, the solid waste management is associated lack of understanding over different factors that affect the entire handling and collection system.

2.3.2.1 Characterization of solid waste sources and composition

The improper solid waste collection practices, collection, transfer and/or transport systems have great effect on the characteristics of the solid wastes and good knowledge of the solid wastes characterization before disposal is important for the management of MSW. During the management of solid wastes some problems could be arisen due to their possible heterogeneous structure. The physical features of solid wastes are important for selecting the method of collection, transportation, recoverable matter, and energy transformation as well as selecting and designing of the proper disposal methods. They have to provide an effective and efficient system to the inhabitants. Nevertheless, they are; often; facing with many problems beyond the ability of the municipal authority to handle the municipal solid waste (Waste Manage. 200), This is essentially due to financial resources, lack of organization and complexity. The composition of municipal solid waste varies significantly from one municipality to another and from country to country significantly. Such variation depends mainly on the life style, economic situation, waste management regulations and industrial structure Household or municipal wastes are usually generated from variable sources where different human activities are encountered.

2.3.2.2 Municipal solid waste disposal

One of the major environmental problems is the collection, management and disposal of the municipal solid waste in the urban areas. Lack of MSW management and disposal is leading to significant environmental problems. This includes soil, air water, and aesthetic pollution. Such environmental problems are associated with human health disorder; due to the increase in greenhouse gas emissions (Cagliari (2003).solid waste streams originating from industrial sources are different than the hazardous substances in household waste. The household hazardous wastes (HHW) are disposed of in landfills along with general household waste (HW). The amounts, quality and significance of such disposal are poorly understood. It is generally assumed that the amount of HHW's are small thus, risks of disposal are negligible. Nevertheless, the separate disposal of industrial, MSW, and other wastes raises the importance of the toxic and hazardous element contained in such wastes. There are great concerns about the presence of several chemicals in the household products. The consequences and the impact to the environment resulted from the disposal of HHW are also of concern. Thus the disposal of such HHW to landfill should, therefore cope with the current legislation in order to decrease the risk to the environment (Total Environ., 2005)

Globally, about 71% of municipal solid wastes are disposed of landfills. these contains mostly hazardous substances including some batteries, paints, mercury-containing waste, pharmaceuticals, vehicle maintenance products, and many other products. On the other hands, more than 53% of the land filled wastes consist of hard board paper, yard waste, papers and food that are biodegradable by the anaerobic bacteria (Wiley-Blackwell, Hoboken, 2010).

Table 2.1 Functional elements of solid waste

Functional element	Description
Waste generation	Those activities in which materials are identified as no longer being of value and are either through away or gathered together for disposal.
On-site handling , storage and processing	Those activities associated with the handling, storage, and Processing of solid wastes at near the point of generation.
Collection	Those activities associated with the gathering of solid wastes And the hauling of wastes after collection to the location Where the collection vehicle is emptied.

Transfer and transport	Those activities associated with: The transfer of wastes from the smaller collection vehicle to the larger transport equipment. The subsequent transport of the wastes, usually over long Distance to the Disposal site.
Processing a recovery	Those techniques, equipment and facilities used both to improve The efficiency Of functional elements and to recovery usable Materials, conversion produce. cts, or energy from solid wastes.
Disposal	Those activities associated with ultimate disposal of solid wastes Including those wastes collected and transported directly to a Landfill site, semi-solid wastes (sludge) from was water treatment plants incinerator residue compost, or other substance from the Wires solid waste processing plants that are no further use.

2.3.3 Integrated strategy for solid waste management

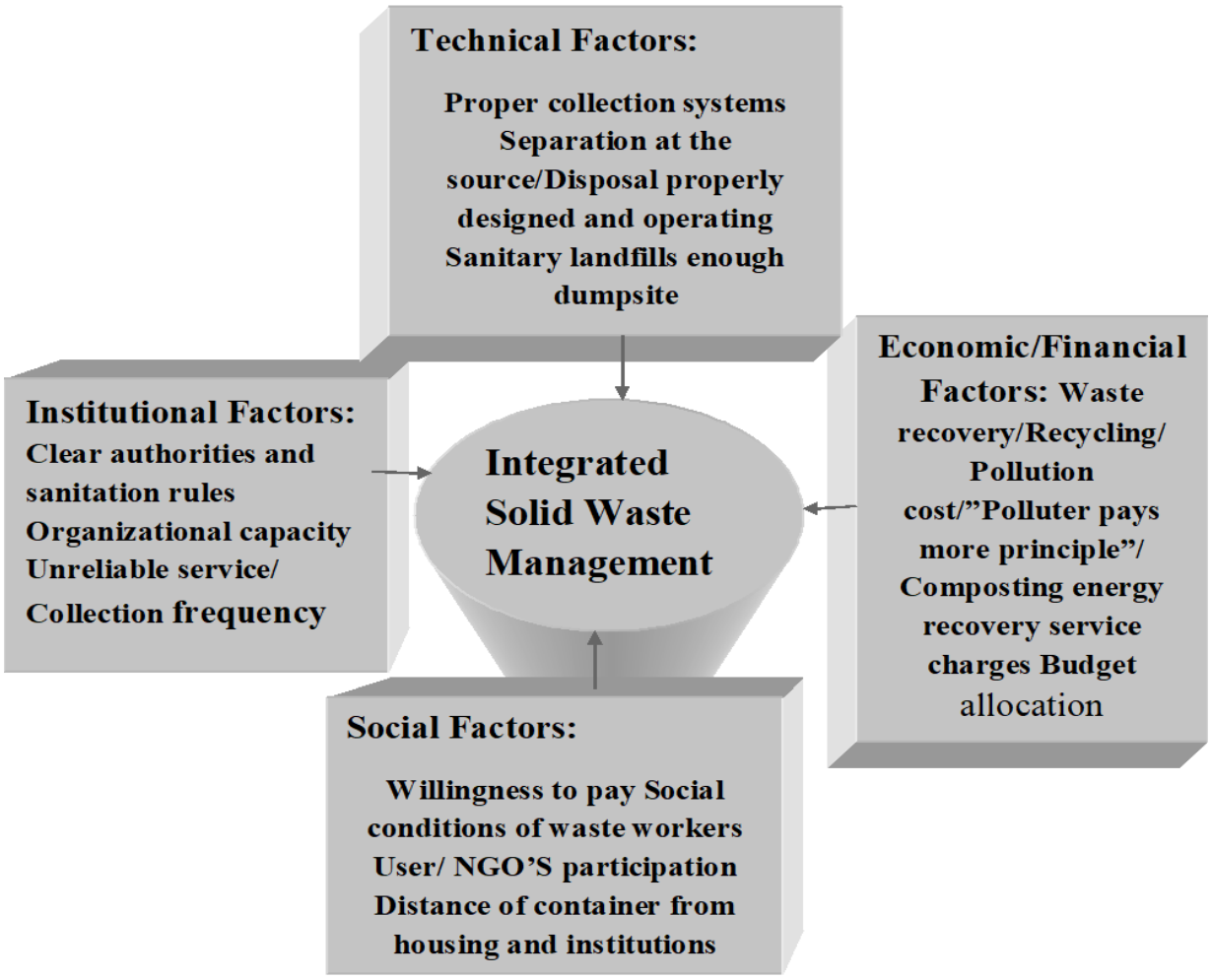
Integrated solid waste management(ISWM) theory recognizes three key components: the stakeholders affected by or engaged in waste management, physical or practical elements of the waste management system and an array of 'aspects' that directly affect waste management including political, Environmental and cultural influences (Nachalida, et al, 2018).

Waste reduction and recycling play a crucial role in the modern solid waste management hierarchy, on one hand they reduce the waste diverted to the landfills and on the other hand reduce the waste to be treated reducing the revenue required, This have entered an era in which global prosperity increasingly depends on effective resource utilization and reducing consumption level the interaction between the human and the environment is a complex phenomenon (Ammaiyappan ; Jonathan 2018).

Reduce, Reuse, Recycle (3R): Methods of waste reduction, waste reuse and recycling are the preferred options when managing waste. There are many environmental benefits that can be derived from the use of these methods. They reduce or prevent greenhouse gas emissions, reduce the release of pollutants, conserve resources, save energy and reduce the demand for waste treatment technology and landfill 26 spaces (Hui et al., 2006). The "Waste management hierarchy" is an internationally recognized strategy for management of municipal solid wastes and it is a key element of integrated solid waste management. It also places greatest emphasis on strategies and programs for avoiding and reducing

waste, with treatment and disposal being the least favored options. The purpose of the waste management hierarchy is to make waste management practices as environmentally sound as possible. It has been adopted in various forms by most industrialized countries (Besha, 2019).The hierarchy is a useful policy tool for conserving resources, for dealing with landfill shortages, for minimizing air and water pollution, and for protecting public health and safety. In many developing countries, some aspects of this hierarchy are already in place, since traditional practices revolving around waste prevention reuse, and recycling are prevalent (UNEP, 2005).

Figure 2.1 integrated sustainable waste management



Sources: Kamla-Raj (2011) Challenges and Opportunities in Municipal Solid

2.3.4 Types and sources of solid waste

According to Feleke,(2015) states that, Knowledge of the sources and types of solid wastes, along with the data on composition and rate of generation, it is basic to the design and operation of the functional elements associated with the management of solid wastes. However, the source of solid wastes is dependent on the socio-economic and technological levels of the society (Monroe, 1997). Solid waste (SW) or urban solid waste is normally comprised of food wastes, rubbish, demolition and construction wastes, street sweepings, garden wastes, abandoned vehicles and appliances, and treatment plant residues, which factors influencing the characteristics of SWs are climate, social customs, per capita income, and degree of urbanization and industrialization, therefore Solid waste collection and transport involves storage at the generation and pick-up points, pick up by the crew, trucks driving around the neighborhood, and truck transport to a transfer station or disposal points. (Gaurav, 2014).

Table 2.2 Sources of solid waste and typical generators

Source	Typical waste generators	Types of solid wastes
Residential	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), an household hazardous wastes.).
Industrial	Light and heavy manufacturi fabrication, construction sites, power a chemical plants.	Housekeeping wastes, packaging, food wast construction and demolition materials, hazardo wastes, ashes, special wastes.
Commercial	Stores, hotels, restaurants, markets, off buildings, etc.	Paper, cardboard, plastics, wood, food wast glass, metals, special wastes, hazardous wastes.
Institutional	Schools, hospitals, prisons, governmen centers.	Same as commercial.
Construction a demolition	New construction sites, road repa renovation sites, demolition of building	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, landscaping, par beaches, other recreational areas, wa and wastewater treatment plants.	Street sweepings; landscape and tree trimmin general wastes from parks, beaches, and oth recreational areas; sludge.

Process (manufacturing etc.)	Heavy and light manufacturi refineries, chemical plants, power plan mineral extraction and processing.	Industrial process wastes, scrap materials, o specification products, slay tailings.
Agriculture	Crops, orchards, vineyards, dairi feedlots, farms.	Spoiled food wastes, agricultural wast hazardous wastes (e.g., pesticides).

Sources: Hoornweg, et al. (1999), types and sources of solid waste materials

2.3.5 Storage of solid waste

As Khan; Ahsan (2002) noted, solid waste is initially stored within the household, but may at some stage be transformed to a communal container prior to eventual collection and removal. Accordingly, primary solid waste storage is carried out in two important things, within at household level and at the community level.

2.3.5.1 Household storage

Household wastes are stored in bins by the affluent and in sacks, plastic bags, cut jerry cans, cardboard boxes by the low-income households, and a large percentage of domestic waste storage containers (e.g. sacks, polythene bags, and boxes) used by the poorer urban community are dumped with the wastes. Ideally, household waste should be stored in a study container of sufficient capacity which is easy to empty and clean and has a well-fitting lid. Accordingly, galvanized steel and plastic bins can satisfy these criteria; however, they are not affordable in most low-income countries. Therefore, the recommended container to segregate waste is of two categories and stores the segregated waste in two different containers: Biodegradable waste (Green color storage) and this waste include: Kitchen waste including food waste of all kinds, cooked and uncooked, including egg shells and bones, flower and fruit waste including juice peels and house-plant waste, garden sweeping or yard waste consisting of green/dry leaves, sanitary wastes, green waste from vegetable & fruit vendors/shops and waste from food & tea stalls/shops etc. Non-biodegradable waste colored through (Blue storage) includes: all kinds of paper and plastic, cardboard and cartons, containers of all kinds excluding those containing hazardous material, packaging of all kinds, glass of all kinds, metals of all kinds, rags and rubber, house sweeping (dust etc.), ashes, foils, wrappings, pouches, sachets and tetra packs (rinsed), discarded electronic items from offices, colonies viz. cassettes, computer diskettes, printer cartridges and electronic parts and discarded clothing, furniture and equipment and etc. (Khan ;Ahsan 2002).

2.3.5.2 Communal storage container (skip-point)

The use of communal storage containers (skip-points) to which householders carry their waste is widespread and seems likely to remain a common option for low-income communities. These points can consist of street corners, several locations on densely populated streets, or at the edge of neighborhoods or villages accessible to generators or primary collectors and collection vehicles. One of the main advantages of communal skip-points is that they allow a household to potentially have continual access to a disposal point. Conversely, if a communal skip-point receives little attention, containers may overflow and cause problems such as odors and insects. In some cases, residents near communal skip-points have started fires to minimize odors or insects. This, in turn, increases the health impacts of improper solid waste management to an even larger number of people as a result of the smoke from the fires. Sound practice in communal collection design requires that solid waste managers understand the potential conflict that exists between the need to accomplish public convenience and the strategies required to maintain cleanliness and sanitary conditions around communal containers. They must also strategize how to control waste pickers, odors, animals and vectors who affect conditions around communal containers. Sound practice requires that there are an adequate number of containers distributed at appropriately located skip-points. These containers must be easy to use even for children who are mostly called upon by their parents to bring solid waste to the communal skip point. The sound practice also requires that program managers commit to carrying out the frequent collection and cleanup overflows as they occur for whatever reason (Khan and Ahsan, 2002).

2.4 Theoretical framework of solid waste collection disposal

The theory of solid Waste Management represents a more in-depth account of the domain and contains conceptual analyses of solid waste; However, The Theory is founded on the expectation that waste management is to prevent waste causing harm to human health and the environment (Pongrácz, et al, 2004). An extended theory of planned behavior (TRB) can be applied to investigate the main factors affecting the intention and self-reported behavior on recycling of packaging waste and printed paper. That theory was used in psychology to link beliefs, attitudes and behaviors, on the findings could be utilized for the development of better recycling schemes and communication campaigns (Ioannou et al., 2013).

According to Hiriya (2003) and Amelia (2015) the functional elements of Municipal Solid Wastes are as follows: 1) Waste generation: Waste generation encompasses activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal. 2) Waste handling and separation, storage and processing at the source: Waste handling and separation involves the activities associated with management of waste until they are placed in storage container for collection.

2.4.1 Basics of solid waste management system

The basis of modern waste management is to maximize environmentally sound waste diversion to minimize the quantity of municipal solid waste and associated/ compatible waste) disposed to landfill. This is accomplished by reducing the quantity of waste initially produced; and diverting waste material to beneficial reuse, recycling, composting or energy production. Engineered lined landfill systems are constructed to contain the residual waste material in an environmentally secure manner. The standards address the siting, design, construction, operation, and decommissioning of waste management facilities, to substantially reduce and mitigate adverse environmental impacts associated with management of waste material. These impacts may include: dust, odor or impaired air quality, noise, unsightly conditions, litter, nuisance vectors, rodents, leach ate and surface water run-off; and hazardous materials spills, explosions or fire. Effective operations management and good housekeeping practices are always required, in addition to properly trained staff, and current Operations Management/Maintenance manuals/plans, and Environmental Health and Safety Contingency Plans UNEP (2005).

2.4.2 Functional elements of solid waste disposal practices

As Tchobanoglous and Kreith (2002), described the management of municipal solid wastes are shown up from the point of generation to final disposal, and they have been grouped into six functional elements. These are waste generation, on-site handling, storage and processing, collection, transfer and transport; processing recovery and disposal.

2.4.3 Waste generation

Waste generation encompasses activities in which materials are identified as valueless and either thrown away or gathered together for disposal. What is important in waste generation is to note that

there is an identification step that varies with each individual. Currently, waste generation is an activity that is not controllable. So, this functional element is a vital stage for acquiring accurate information that is necessary to monitor existing management system and to make regulatory, financial and institutional decisions (Tchobanoglous and Kreith, 2002).

According to the report released by Addis Ababa Sanitation, Beautification and Park Development Agency (2003) the daily waste generation of Addis Ababa city is 0.252kg/capita/day and daily waste production of the city was 2,297 m3 or 851 tones. By the same authority, of the daily solid waste generated in Addis Ababa, 65% (1,482 m3) is collected, 5% recycled and 5% composted. The remaining 25% is simply dumped on open sites, drainage channels, rivers and valleys as well as on the streets. Adequate knowledge on the types of solid waste generated in the towns provides the waste management department a clear idea about the appropriate method for waste management (Chati, 2012). This knowledge of components of waste stream would enable to know whether to use integrated waste management model comparing reduce, recycle and reuse combined with incineration and some levels of land filling or source separate and composting. While the quantity of solid waste generated by society is increasing, the composition of waste is becoming more and more diversified, with increasing use of packaging materials made of both paper and plastic. A study by (Kalpana, 2002) indicated that thirty years ago, the composition of solid waste generated by the Indian farmer was characterized by one-fifth non-biodegradable waste and four fifths biodegradable waste. At present, this ratio is about to reverse; today, a mere 40 percent of all solid waste is biodegradable while 60 percent is non-bio-degradable. Findings reveal that unprecedented waste generation in Kaduna Metropolis was spurred by emergent historical population growth. The major municipal wastes identified include; biodegradables, non-biodegradables, recyclables and inert materials. These were household and industrially generated. Wastes are derelict at open spaces within and between the neighborhoods; roadsides and channels of river Kaduna, very insignificant area takes their waste to designated dump sites (Ajibua and Tardos, 2013).

2.4.4 Waste handling, separation, storage and sorting at the source

According to Tchobanoglous and Kreith (2002), waste handling and separation involves the activities associated with managing wastes until they are placed in communal storage containers for collection. As part of solid waste management, handling also encompasses the movement of loaded containers to the point of collection. Separation of waste components is an important step in the handling and storage

of solid waste at the source. The other activity is on-site storage, which has high importance because of the consideration of solid wastes include (1) the type of container to be used, (2) the container location, (3) public health and aesthetics, and (4) the collection method to be used. Hence, waste storage ensures the use of proper containers to store wastes and efficient transport of them without any spillage to transfer stations/disposal sites. In spite of this, there are two types of storage activities at the source. The first one is temporary storage which is done at the household level as a part of their hygiene. The second type is communal solid waste storage system on public solid waste containers prepared by the municipality. Waste processing at source involves activities such as waste composting and sorting of solid wastes for reuse and recycling. All of these components are important for the protection of public health and aesthetics and environment. As a result, effective waste management needs a commitment from both the local people and the Keble authorities. Accordingly, the people should use the communal waste containers in the correct way and avoid littering (Open Wash, 2016).

2.4.5 Waste collection

Waste Collection involves the process of picking up wastes from collection points, loading them into a vehicle, and transporting them to the processing facilities, transfer stations or disposal site. The waste collection plays an important role in waste management processes. In most municipal solid waste management systems, the cost of collection accounts a significant portion of total cost. For instance, in industrialized countries waste collection accounts about 60-70% of total cost, and 70-90% in developing and transition countries (World Bank, 2012). The collection is structurally similar in developing, transition, and industrialized countries, but there are important technical and institutional differences in implementation. In most cases, industrialized countries have more efficiency and effectiveness than developing ones in terms of their approach to collection, the role of municipal governments, private-sector participation, demographic and social factors relevant to the collection. Currently, a little of solid waste from cities in developing countries remains uncollected and ends up on the street or disposed of through open burning and the management is also poor. And, in developing countries, a collection often involves a face to face transaction between generator and collector. The level of service is low, and generators often have to bring their wastes long distances and place it in containers (Open Wash, 2016).

2.4.6 Transfer and Transport

The other functional element is transfer and transport which involves two steps: (1) the transfer of wastes from the smaller collection vehicle to the larger transport equipment, and (2) the subsequent transport of the wastes, usually over long distances, to a processing or disposal site. The transfer usually takes place at a transfer station. When the location of final disposal site is at a long distance from points of collection, transfer stations may be used. With respect to transfer stations, there are two basic modes of operation: direct discharge and storage discharge. In storage discharge, refuse is first emptied from collection trucks into a storage pit or to a large platform. Additionally, indirect discharge station, each refuse struck empties directly into larger transport vehicles (Meenakshi, 2005). Transportation, on the other hand, covers all types of vehicles under operation to transport solid waste from its generation point to transfer station and then to treatment or disposal site.

2.4.7 Separation, processing and recovery

The means and facilities that are now used for the recovery of waste materials have been separated at the source. The separation and processing of wastes that have been separated at the source and the separation of commingled wastes usually occur at materials recovery facilities, transfer stations, combustion facilities, and disposal sites. This functional element includes all techniques, equipment, and facilities used both to improve the efficiency of other functional elements and to recover usable materials, conversion products, produce energy, and compost from solid wastes. In addition to this, it also provides several advantages. First, it can serve to reduce total volume and weight of waste material that requires collection and final disposal. Volume reduction also helps to conserve land resources since land is the ultimate sink for most waste materials. On the other side, it also reduces total transportation cost of waste to its final disposal site. Moreover, after proper segregation, selected wastes are entered into small and large scale industries for recovery activities. For example, organic fraction of MSW can be transformed by a variety of biological and thermal processes. The most commonly used biological transformation process is aerobic composting, and the most commonly used thermal transformation process is incineration (Uriarte and Filemon, 2008).

2.4.8 Disposal

This is the final functional element in the solid waste management system. There are two types of solid waste disposal site (UNEP, 2009), these are: Non-engineered disposal: This is the most common

method of disposal in low-income countries, which have no control, or with only slight or moderate controls. They tend to remain for a longer time and environmental degradation could be high, such as a mosquito, rodent and water pollution, and degradation of the land.

Additionally, Sanitary Landfill - is a fully engineered disposal option, which avoids harmful effects of uncontrolled dumping by spreading, compacting and covering the wasteland that has been carefully engineered for use. The four minimum requirements for setting up a sanitary landfill, which are full or partial hydrological isolation, formal engineering preparation, permanent control and planned waste placement and covering. Land filling relies on containment rather than treatment (for control) of wastes. Appropriate lines for the protection of the groundwater, leach ate collection, and treatment, monitoring wells and appropriate final cover design are integral components of an environmentally sound sanitary landfill.

Today, disposal of wastes by land filling or land spreading is the ultimate fate of all solid wastes whether they are residential wastes or residual materials from materials recovery facilities. However, in most developed countries, this method is officially banned except sanitary landfill for final disposal. Because according to the above explanation, the sanitary landfill is not a dump it is an engineered facility used for disposing of solid wastes on land without creating nuisances or hazards to public health and environment (Tchobanoglous and Kreith, 2002).

2.8.1 Sustainable solid waste collection disposal practice

The numerous cities have increased their efforts, over the past few decades, to find sustainable solution in the solid waste management problem. Particular focus was to develop integrated solid waste management strategies, including construction, operation and maintenance of sanitary landfills and the related problems (Hussein, et al, 2018).

Developing cities have historically looked to developed cities as exemplary models for waste management systems and practices without considering the consequent resource requirements or the key characteristics of the local setting Urbanization, rapid economic growth and increasing urban populations have resulted in a marked escalation in quantities of waste generated, heterogeneity and complexity (Mukhtar, et al, 2016). Municipal solid waste is a significant problem, particularly in developing countries that lack sufficient infrastructure and useable land mass to process it in an

appropriate manner. Some developing nations are experiencing a combination of issues that prevent proper management of solid waste (Nachalida, et al, 2018).

According to the reports of "Navarro, et al,(2019),''Environmental contamination due to solid waste mismanagement is a global issue, Open dumping and open burning are the main implemented waste treatment and final disposal systems, mainly visible in low-income countries. Those authors' investigations the reviews of the main impacts due to waste mismanagement in developing countries, focusing on environmental contamination and social issues, Their activity of the informal sector in developing cities was also reviewed, focusing on the main health risks due to waste scavenging. The examination of the relationship of household waste disposal with environmental concerns, citizens' awareness, and the satisfaction level for the local existing capacities, can contribute to decision making on solid waste management sustainability (Al-Khatib et al., 2015).For policy makers, convenience, charges and communication are reported to be significant attributes of intervention to stimulate household cooperation in waste management (Briguglio 2016). Furthermore, decision-making often requires the encouragement of the participation of multiple stakeholders in the society such stakeholders are government, municipalities, industries, experts, and certainly public (Soltani et al., 2015).

2.4.8 Composition of solid waste

2.4.8.1 Physical composition

Information and data on the physical composition of solid waste are important in the selection and operation of equipment and facilities, in assessing the feasibility of resources and energy recovery, and in the analysis and design of disposal facilities (Tchobanoglous., et al., 1977).The composition of solid waste is the prime consideration before considering any process for its disposal or combustion or recycling.

According to Hall et al., (1993) solid waste composition analysis is important because the nature of the waste influences the mode of collection. The lives of landfill sites can only be estimated. Since changes in composition, density and output per person per week affect site life of landfill. The design and operation of waste disposal plant (e.g. incinerators) and waste derived fuel plants is controlled by the nature of the waste. An assessment can be made of the materials available for recycling or reuse and an estimate can be made of heavy metals or other biologically active substances that may affect the future

use of reclaimed land of which waste has been deposited or which may need to be legislated for in the future.

2.4.8.2 On-site handling and storage of solid waste

According to (Tchobanoglous et al., 1977 cited in Samuel, 2006) on site handling refers to the activities associated with the handling of solid waste until they are placed in the containers used for their storage before collection. Factors that must be considered in the onsite storage of solid wastes include (1) the type of container to be used, (2) the container location, (3) public health and aesthetics, and (4) the collection method to be used.

2.4.9 Sustainable solid waste disposal practice in developing countries

The numerous cities have increased their efforts, over the past few decades, to find sustainable solution in the solid waste management problem. Particular focus was to develop integrated solid waste management strategies, including construction, operation and maintenance of sanitary landfills and the related problems (Hussein, et al, 2018).

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awareness, and the satisfaction level for the local existing capacities, can contribute to decision making on solid waste management sustainability (Al-Khatib et al., 2015).For policy makers, convenience, charges and communication are reported to be significant attributes of intervention to stimulate household cooperation in waste management (Briguglio 2016). Furthermore, decision-making often requires the encouragement of the participation of multiple stakeholders in the society such stakeholders are government, municipalities, industries, experts, and certainly public (Soltani et al., 2015)

Box 1. Measurable variables of solid waste collection performance practice:

Technical Factors of solid waste disposal mechanisms:

- Collection practices
- The implementation of reducing, reuse &recycling strategy on the city
- Solid waste collection by open dumping and open burning outside on the compound
- Sorting the separating container with the practices of Solid waste disposal

The socio-economic factors of the collectors:

- poor community participation
- Operational inefficiency of services and Inadequate service coverage
- The organization have adequate and modern waste management equipment
- The sub city is well planned with appropriate infrastructure to collect and transport waste

The characteristics of solid waste collection performance:

- the distance to permitted dumpsite and disposes of its solid wastes at common points
- sustainable residential area of solid waste disposal practices
- Knowledge and experience with 3R on the effective practices
- Personnel safety such as protective gloves and clothing on the work site

Factors of solid waste collection performance:

- The materials recycles on the way of separated from solid waste management practices
- The existing disposal site is far-away from the collection point
- solid waste disposal is influenced by the people's attitudes and patterns of waste handling

Sources: On the researcher, 2021

2.5 solid waste management in developing countries

Many municipalities in developing countries are incapable of meeting the demand for services, resulting in both direct and indirect negative effects. About 20% to 30% of the waste generated in

Addis Ababa remained uncollected and made the city environment aesthetically unpleasant and affected the city's public health. Local initiatives play a key role in creating sustainable urban solid waste management (Tilay and van Dijk, 2014). Countries with developing economies often experience exhaustive waste collection services that require large amount of human labor and less technology and inadequately managed and uncontrolled dumpsites. The problems are worsening. Problems with governance complicate the situation. Waste management in these countries and cities is an ongoing challenge due to weak institutions, chronic under-resourcing and rapid urbanization. All of these challenges, along with the lack of understanding of different factors that contribute to the hierarchy of waste management, affect the treatment of waste (Wikipedia).

A typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities. These public health, environmental, and management problems are caused by various factors which constrain the development of effective solid waste management systems (Ogawa, 1996).

2.5.1 Current solid waste disposal practice of Ethiopia

According to Kibralem, (2017), the author was investigated "Assessment of Solid Waste Management Practices: A Case of Masha Town'',the municipal solid waste causes substantial harm to the environment and human health if mismanaged. However, with a rapidly expanding human population and growing trend of urbanization, problems related to the management of municipal solid waste have become of considerable importance in Ethiopia from both environment and human safety.

According to Sheinberg (2010) and Matthew (2015),the implementation of effective waste management practices has been identified as essential for economic development in low-income countries in particular. In large number of Ethiopian urban areas solid waste management services are either absent or insufficient this in general, unauthorized and most of the authorized dump sites are poorly managed causing significant environmental impacts, (.Megersa, 2018).The solid waste collection and disposal in Addis Ababa, therefore, have formal and informal approaches; The formal approach is the sole responsibility of the city government. This is handled in two ways: door-to-door collection for

households along accessible streets, and the container system under which residents are expected to carry and dump their waste in containers located at accessible sites. (Kassa Teshager; Alemu (2017)

2.5.2 Factors of solid waste collection disposal in Addis Ababa

Based on the investigations of Tobias et al., (2015) Addis Ababa is the capital of Ethiopia and the country's biggest city with an estimated 4 million inhabitants. It is located in the central Ethiopian highlands at 2,700 m above sea-level and both, the country's political and economic centre. The city also hosts the African Union (AU) and several UN offices, thus signaling the city's regional and global political importance. Furthermore, Addis Ababa is host to embassies from most foreign governments, as well as offices of many development agencies and NGOs (Manhart et al. 2013).

According to Piter Van, Mesfin (2013) and Tilaye M, et al., (2014) solid waste collection in Addis Ababa was a sector open to all who have an interest in engaging in it and often operated by both organized and unorganized groups or individuals, whose main source of income came from other activities: for example daily workers, shoeshine boys, and street children. Beside Collection of waste by the informal sector was carried out in accordance with the needs of households and commercial institutions without any fixed schedule. However, there was no concern or even awareness from the side of the users about where and how the collected waste was disposed of. This decision was up to the waste collectors. The city council distinguishes recognizes six major sources of solid waste: households, street, commercial institutes, industries, hotels and hospitals. From total generated solid waste households' account for 71%, street 10%, commercial institutions, 9%, industries 6%, hotels 3% and hospitals. Most of the solid waste materials produced by households are disposed without adequate care. A study made by the Addis Ababa City Administration shows that, the collection coverage has been constantly increasing from 38 per cent in 2000 to 40 in 2001, 53% in 2002, 53.9% in 2004 and 78% in 2005 (AASBPDA, 2005).

2.5.2.1 Solid waste collectors and technical constraints

In developing countries like Ethiopia, this problem is exacerbated by an influx of people moving to urban centers. Sustainability of cities in the developing 14 countries has become a big question and has rightly been placed as the focal point of the Sustainable Development Goals. Since the Rio Summit in 1992, the concept of sustainability extends to basic services such as solid waste management (SWM). In most developing countries, typically there is a lack of collection resources at both the national and local

levels with technical expertise necessary for solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management. Without adequately trained personnel, a project initiated by external consultants could not be sustainable. Therefore, the development of human resources in the recipient 17 country of external support is essential for the sustainability of the collaborative project Zebenay Kassa (2010).

Another technical constraint in developing countries is the lack of overall plans or system for solid waste management at the local and national levels. As a result, a solid waste technology is often selected without due consideration to its appropriateness in the overall solid waste management system. In some cases, foreign assistance is given to a component of a solid waste management system for which the use of resources may not be most cost-effective. For instance, an external support agency provided its support to improve a general disposal site. However, the coverage of solid waste collection service is so low that solid waste generated is dumped at many undesignated sites (e.g., open areas, water channels, streets, etc.). As a result, improving the disposal site, although it may not be a bad project, would have little impact on the overall solid waste management effectiveness. In such a case, the low collection coverage is a bottleneck in the overall solid waste management system in the city, and it would be most cost -effective to provide resources to upgrade the collection service Tadesse kume (2004).

2.5.2.2 Institutional constraints of solid waste collection

Though the sub city is in charge of managing solid waste, several agencies at the national level are usually involved at least partially in solid waste management. However, there are often no clear roles/functions of the various national agencies defined in relation to solid waste management and also no single agency or committee designated to coordinate their projects and activities Solomon Cheru (2011). The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programs. The lack of effective legislation for solid waste management, which is a norm in most developing countries, is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of coordination among them.

2.5.2.3 Economic constraints of solid waste collection

Economic and industrial development plays key roles in solid waste management. Obviously, an enhanced economy enables more funds to be allocated for solid waste management, providing a more sustainable financial basis. However, by definition, developing countries have weak economic bases and, hence, insufficient funds for sustainable development of solid waste management systems Takele Tadesse, (August 2004). Local industry is producing relatively cheap solid waste equipment and vehicles, will reduce or in some cases could totally eliminate the need for importing expensive foreign equipment/vehicles and save foreign exchange. Such local industry can also supply associated spare parts, lack of which is often responsible for irregular and insufficient solid waste collection and disposal services. However, lack of manufacturing industry for solid waste management equipment and spare parts and a limited foreign exchange for importing such equipment/spare parts are the major problem in many of developing countries UNEP (2005). Also in small developing countries, waste recycling activities are affected by the availability of industry to receive and process recycled materials. For instance, the recycling of waste paper is possible only when there is a paper mill within a distance for which the transportation of waste paper is economical. The weak industry base for recycling activities is a common constraint for the improvement of solid waste management in developing countries, such as those in the Pacific region where a large volume of package waste is generated Addis Ababa City Administration (AACA), (2008). 19 In general, solid waste management is given a very low priority in developing countries, except perhaps in capital and large cities. As a result, very limited funds are provided to the solid waste management sector by the governments, and the levels of services required for protection of public health and the environment are not attained.

The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak. This weak financial basis of local governments can be supplemented by the collection of user service charges. However, users' ability to pay for the services is very limited in poorer developing countries, and their willingness to pay for the services which are irregular and ineffective is not high either. An effective strategy for raising funds needs to be searched in any collaborative project to ensure its sustainability UNEP (2005). In addition to the limited funds, many local governments in developing countries lack good financial management and planning. For instance, in a town in a developing country, over 90% of the annual budget provided for solid waste management was used up within the

first six months. The lack of financial management and planning, particularly cost accounting, depletes the limited resources available for the sector even more quickly, and causes the solid waste management services to halt for some periods, thus losing the trust of service users.

2.6. Conceptual Frameworks

The Conceptual Framework provides brief definitions of the main concepts of solid waste management and identifies the goals and principles that normally guide solid waste management system development. It discusses key objectives and issues which should be addressed by solid waste disposal practices strategies with regard to disposal mechanism, collective action, social, financial, economic and technical aspects (Peter et al., 1996).

2.6.1 Influencing factors

According to Jessica (2015), states that on the conceptual issues of influencing factors as follows several factors will influence the selection, operation and effectiveness of any waste management scheme and need to be considered when planning successful integrated solid waste management programmers. They include:

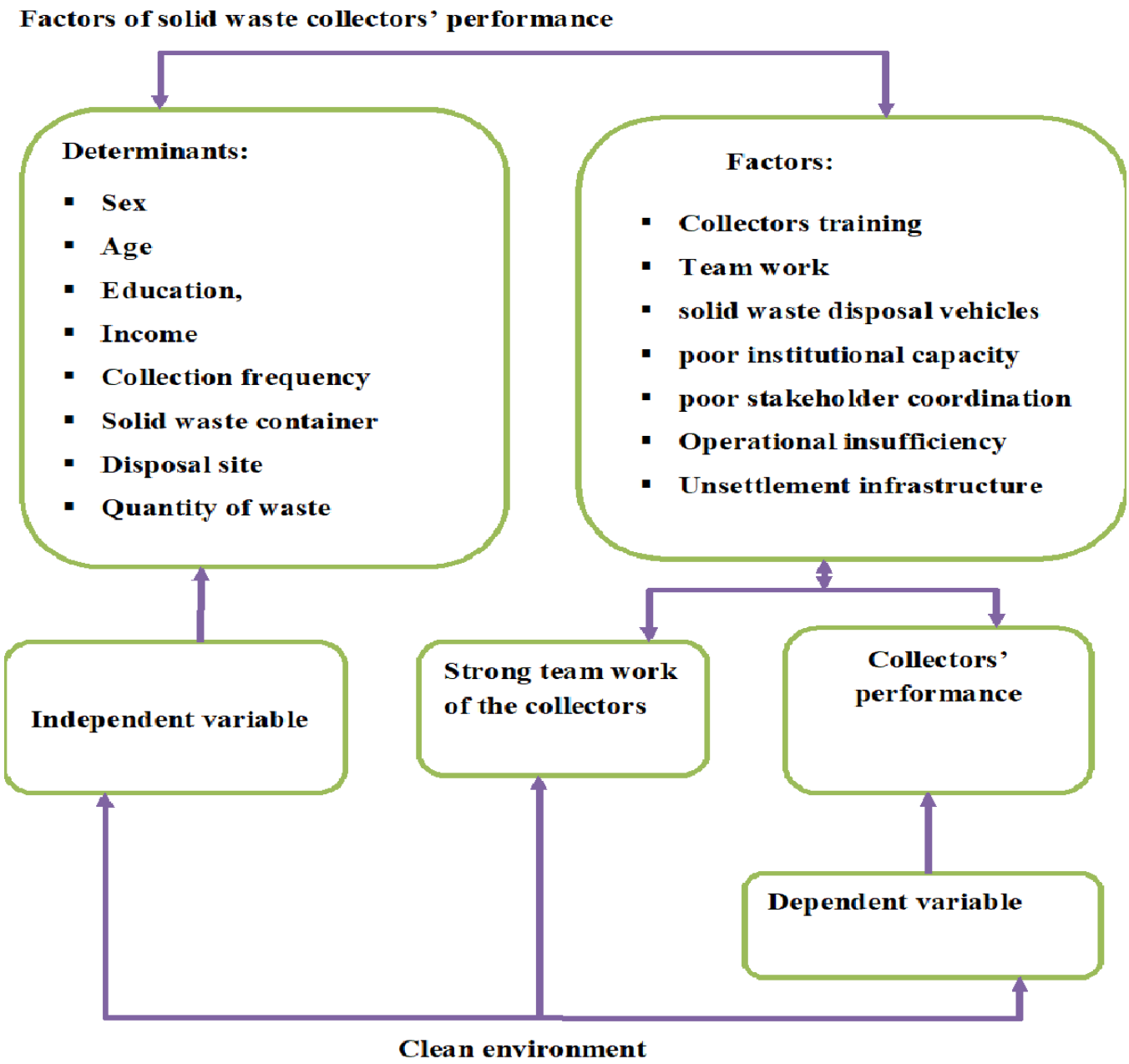
Technical factors/knowledge – refer to the selection of technologies that are available and will function with the quantities and composition of the waste produced. For example, the technology designed to compost one ton of waste a day will not be suitable for processing 50 tons per day. The reliability of the technology needs to be taken into account; it must operate under Ethiopian climate conditions and be repairable using locally available materials and people.

Economic factors – are aspects that deal with budgeting and cost of the waste management system. Some of the most important issues to consider are the effect of private sector involvement and recovering the cost of the system from residents, businesses and government. The impact of the market prices of recovered materials, the amount and source of any subsidy to cover collecting wastes from those who cannot pay, and any other income-generation schemes also need to be considered.

Environmental factors – focus on the effects of waste management on land, water and air, the need for conservation of non-renewable resources. **Political and legal factors** – refer to the administrative context in which the waste management system exists; the determination of roles and responsibilities; the existing or planned legal and regulatory framework and the decision-making processes. **Socio-**

cultural factors – include the influence of culture on waste generation and management in the household and in businesses and institutions, the community and its involvement in waste management; the relations between people in the community of different age, sex and ethnicity; and the social conditions of waste workers.

Figure 2.2 Conceptual frameworks:



Sources: Based on the researcher, 2021

CHAPTER THREE

3. METHODOLOGY AND DESCRIPTION OF THE STUDY AREA

3. 1 Introduction

This research will be accomplished in a plan manner following research method procedures. However, The research design and approach were pre-determine and other methodology including sampling data gathering tools data presentation and analysis techniques are selected to implemented based on research questions i.e.; descriptive research questions.

3.2. Description of the study areas

This study would conducted at the selected four sub cities (Akaki Kality, NefasSlkLafto, Bole and Kolffee Sub -city) these are parts of the 11 sub cities of Addis Ababa Ethiopia and have composed of total population of These Sub -cities have been established its own administration, The topographic characteristic of the targeting areas are made up of dissect by a number of improper solid waste management by the researcher observation. However the research boundary is used to demarcate the research so that it will be conducting in a given time frame and also meet the objective by answering research questions. There might be complaints from local people especially such as availability of solid waste disposal equipment, technologies and resources allocation problems and further inquiries from management bodies that will fall beyond the scope of this research.

The selected criteria were depending on area coverage (size). The larger the area coverage and size assumed the more the variety of the challenges as well as purposively selected for the prevalence of the problem and being the interest of the researcher. The researcher observation also discovered that the sub-cities solid waste collection areas are associated with their environmental safety problems .This has rapid urbanization rate. Moreover, the city has image of to improve safe environment. Thus, urban solid waste management is an important planning issue that needs to be research in order to assess the solid waste collectors of status and factors for the environment and management of this area. It was convenient for the researcher to gather reliable and sufficient data from these sub-cities.

3. 3 Research design

The research strategy was survey research strategy and Different sampling methods like the study employed a range of sampling techniques including, purposive sampling .The researcher used statistical packages for Social Science to analyze the data. That involves various data gathering instruments and quantitative and qualitative data considering from the sample size. And the research design was descriptive. This research prefers descriptive research design as indicated earlier the purpose of the study is to assessing the challenges of solid waste collection practice in the case of the sub cities.

3.4. Methods of data collection

A mixed research method, which combines both quantitative and qualitative data gathering methods, would be employed to gather both primary and secondary data but the quantitative approach would be predominant. The primary data would be collected using survey questionnaire and interviews with key informants, whereas secondary data would be obtained from both published and unpublished documents. Descriptive statistics would be used to analyze the data collected from the sample of solid waste collectors chairperson using percentage, frequency, minimum, maximum, mean standard deviation, cross tabulation and multinomial logit regression to describe the present progress of their solid waste collection associations with solid waste disposal practices in the study sub cities. The data analysis would be conducted using the Statistical Package for Social Sciences (SPSS) version 26.0. This research has the number of solid waste collection enterprises in Addis Ababa i.e. which were the fifty five **(55)** targeting groups of the four sub cities solid waste collection enterprises from which representative sample need to be taken makes the sample size considerably Theme. In addition, the researcher has collect in-depth information through interview from team leaders and managers working in government institutions i.e., City Government of Addis Ababa and the four Sub City Administration solid waste managers which are expecting to have a great role in guiding and controlling the effectiveness of solid waste disposal practices and environmental cleaning activity. Besides, secondary data was gathered through document review.

3.5 Sampling design

3.5.1 The target population

The total populations of Waste collectors' number of enterprises in 4 sub cities are as shown on the table below 3.1

In the four (4) selected sub cities in solid waste disposal enterprises which have 55 enterprise in the sub cities.

Table 3.1 Number of solid waste collector's enterprises in the sub cities

No	Sub Cities	Total number solid waste collection Enterprise	Total number of collectors
1	Kolfekoranio	15	920
2	NefasSlkiLafto	13	885
3	Akaki kality	13	840
4	BolleSub city	14	890
Tota		55	3535

Source: Sub-Cities solid waste Administrations (2021).

Key formant interview participants

List of participants	participan	Sampling
Kolfekeranio Sub-City Solid waste management Administration and team leader	**5**	purposive
Bole sub-City solid waste management administration and team leader	**4**	purposive
Akaki kality subs city solid waste management administration and team leader	**4**	purposive
Nefasilk-lafto Sub-city Solid waste management administration and team leader	**5**	purposive
Total number of participants	**14**	

The target population of this study was consists of the four selected sub-cities of solid waste collection enterprises (see table 3.1) which has by random selected, They categories in to fifty five (55) solid waste collection enterprises residing around these sub cities which were living in the sub cities were 3535 total number of collectors/ solid waste collector workers (solid waste managers' office of their sub-cities 2021). Therefore, they would be valuable sources of information they were working in and living around the sub-cities and also concerning on solid waste collection practices performance and its relation to environment and sustainable development.

3.6 Instrument of data collection

To obtain sufficient and reliable information required for the achievement of the intended objectives of this study from both primary sources and secondary sources, the following data collection tools were employed.

3.6.1 Questionnaire

In this study, to gather firsthand information from sample solid waste collector/respondents, the questionnaire would be on with close ended questions are prepared. Then, the questionnaire would be distributed to purposive sample to gather the relevant information require for the study to achieved its general and specific objectives.

3.6.2 Interview

Interview aim with supporting and strengthening to first hand information obtained from the response of sample solid waste/respondents using both open and close ended questionnaires and target to examine the response of the sample in relation to the response of key informants, would be conducted with purposively select key informants of the municipality and solid waste office of the sub city administrations.

3.6.3 Field observation

In view of supporting and realizing the information obtained from the sample solid waste collection enterprise respondents using close ended questionnaire, and form purposively selected key informants using semi structure interview and with the aim of examining and assessing the existing condition of the study area in favoring and affecting the issue under study we have to conducted also field observation using check list.

3.7 Ethical considerations

When conducting this thesis involving by participating of the volunteer solid waste collectors, it is very important to make sure that the subjects are well informed about the research, what it is about and that their participation is by free willingness. What this actually means is that the subjects have the opportunity to leave the study if they do not want to continue. Based on this, the information on those who participate was confidential; therefore all information collected that can identify a participant is well protected. Names did not appear in the written report.

CHAPTER FOUR

4. DATA ANALYSIS AND DISCUSSION

4.1 Introduction

In this chapter data gathered through questionnaire, key format interview, Observation and document review were presented, analyzed and interpreted. Results that were found to elicit more relevant information on the determinants of effective current solid waste collection practices are presented and discussed in this chapter. The chapter in detail addressed current solid waste disposal mechanisms, socio-economic situation of solid waste collectors, group characteristics of solid waste collectors and the performance of current solid waste collection practices were analyzed and discussed in the study area of Addis Ababa City Administration. The data collected from 55 solid waste collection enterprises were presented and summarized using tables, graphs, cross-tabulation, and descriptive statistics. Finally, the discussion section interprets the statistical expression and narrative explanation in to meaningful synopsis.

4.2 Data Analysis

This section we have to show the out puts of the survey data, the narrations to implement of descriptive statistics out puts, the researcher used various statistical tools in order to test the multinomial logit regression model applied to determine relationship between independent variables with (Collection frequency, short term Training based on collection**,** educational attainment of collector group chairperson, sex of collectors group chairperson) and the dependent variable with (performance of solid waste collection for environmental cleaning). Since some of the determinant factors are qualitative such as collector's group administration characteristics and waste collection facilities, they are discussed or analyzed qualitatively. Therefore, by the data collected from the site of solid waste disposal enterprises are analyzed using both qualitative and quantitative methods of analyses.

4.2.1 Demographic characteristics of the solid waste collection groups

Profile of the Study Area and the Respondents The study was conducted in Addis Ababa city conducted four Sub-cities (Akaki Kality, Nefas silk lafto, Bole and Kolfie).The distribution of the respondents

was based on the heads of the solid waste collector's association's with55 representative samples for solid waste disposal enterprises respondents were selected purposively.

4.2.1.1 Sex of the group level members

The table 4.1 below shows that sex of the group level collectors found in solid waste collector enterprise on the study area as indicated the number of collectors with1909 are male while female collectors in found in solid waste enterprises are1626.This shows that the type of group characteristics with sex /gender of collectors from the selected study area are dominantly female which means female collector are doubled from their counterpart. Thus the minimum number of male which are 12 and maximum numbers are 64 and the mean and standard deviations of male collectors are 29.56 and 11.69 respectively. On the other hand the minimum numbers of female collectors are 14 and maximum numbers are 82. The mean and standard deviation values are 34.71 and 15.27respectively. This higher mean and standard deviation values indicated that female collectors are significance on solid waste collective effectiveness.

Table 4.1 by sex category (N=55) N=Total solid waste collector Enterprises

Sex category	Minimum	Maximum	Sum	Mean	Std. Deviation
member of male collectors	12	64	1626	29.56	11.599
Member of female collectors	14	82	1909	34.71	15.27

Source: own survey (2021)

4.2.1.2 Religion of the group level members

Religion of the collectors as illustrated below table 4.2, the group characteristics with on the religion of solid waste collectors.

Table 4.2 Religion of The group level members (N=55)

Religion category	Minimum	Maximum	Sum	Mean	Std. Deviation
Orthodox	10	60	1530	27.82	12.79
Muslim	5	30	806	14.65	5.535
protestant	5	32	897	16.31	7.411
Catholic	0	15	261	4.75	3.497
Other religion	0	5	20	.36	1.095

Source: Own survey (2021)

According to the table 4.2 above, the number of solid waste collectors followed by Orthodox religion including in minimum numbers which are 10 and the maximum is 60 with the total numbers of collectors followed by this religion are 1530. The average number is 27.82, while the standard division is 12.79. The next group characteristics religion is Muslim, 806 total numbers of collectors are followed by this religion which is found in solid waste disposal enterprises. Thus, minimum and maximum numbers are 5 and 30 respectively; this, average and standard division are 14.65 and 5.54, respectively. The following religion is Protestantism; According to this belief, the minimum number of solid waste collectors is 5 and the maximum is 32. Total numbers of solid waste collectors are 897 followed by this religion which found in the solid waste disposal association, the average and standard division are 16.31 and 7.41 respectively. Another type of religion is Catholicism; the minimum number of solid waste collectors in this category is 0, and the maximum is 15. The total number of solid waste collectors found in the solid waste association is 261, and the average and standard divisions are 4.75 and 3.49 respectively. It is understood that; the minimum number of solid waste collectors in solid waste associations of other religions is 0 and the maximum is 5. Overall, the total number of solid waste collectors in the solid waste association is 20, with average and standard divisions of 0.36 and 1.09 respectively. Based on the result, the researchers conclude that on the characteristics of collectors with their religious orthodox followers' are dominated with compared to others.

4.2.1.3 Age Category of the collectors on group level members

On the table below 4.3, show the age of the solid waste collectors found in the solid waste association has a significant impact on the effective collection of solid waste disposal.

Table 4.3 Age category of the collectors on group level (N=55)

Age category of collectors	Minimum	Maximum	Sum	Mean	Std. Deviation
18-30 years of collectors	3	35	676	12.29	6.559
31-40 years of collectors	12	50	1621	29.47	10.286
41-50 years of collectors	3	70	1088	19.78	11.583
Above 51 years of collectors	0	6	100	1.82	2.118

Source: Own survey (2021)

According to the above table 4.3, the total of 676 solid waste collectors are between the ages of 18 and 30, the average is 12.29, and the standard division is 6.56. On the other hand, the minimum number of

solid waste collectors aged 31-40 is 12 and the maximum is 50. The total numbers of solid waste collectors in this age group are 1621. The average and standard deviation is 29.47 and 10.29, respectively. The next group characteristics with age; the minimum number is 3 and the maximum number is 70. The total number of solid waste collectors in this age group is 1088. The average and standard division in this age group is 19.78 and 11.58 respectively. Based on the age category of 31-40 show that the highest numbers of were respondents. This results indicated that the highest numbers of respondents were between the age of 31-40 years The result also shows that the age distribution of respondents were encouraged all age category of the productive age.

4.2.1.4 Educational Level of the group level members

The group characteristics with educational level of collectors indicated from table 4.4 below. Educational levels for solid waste collectors with solid waste collection community have a significant impact on the efficiency and modernization of the solid waste collection.

Table 4.4 Educational Level of the collectors (N=55)

Educational Level	Minimum	Maximum	Sum	Mean	Std. Deviation
Below grade 10	18	68	2213	40.24	12.896
Grade 10- Grade 1	5	40	1093	19.87	7.787
Diploma	0	6	110	2.00	1.401
Degree	0	2	18	.33	.610

Source: Own survey (2021)

According to the table above 4.4, on the educational levels categories that have bellow grade 10, the minimum number is 18 and the maximum is 68, with a total of 2213 solid waste collector's found in solid waste disposal enterprises. The average is 40.24 and the standard division is 12.89. The other educational level categories are 10-12. At this level, the minimum number is 5 and the maximum number is 40. The total numbers of solid waste collectors found in the solid waste disposal enterprise at these categories are 1093, with an average and standard division of 19.87 and 7.79, respectively. The next group characteristics with educational level is diploma categories, The total number of solid waste collectors found in the solid waste disposal enterprises at this categories are 110; the average and standard division are 2.00 and 1.4, respectively. The following is the degree of education: The total numbers of solid waste collectors found in the solid waste disposal enterprise, at these categories are

18; the average and standard division are 0.33 and 0.61, respectively. Based on The result shows that the enterprises have not a room for well-educated and encourages those who completed both primary and secondary schools.

4.2.1.5 Category by work experiences on group level members

Length of work experiences of the respondents was measured as one of the variable that might influence an individual to participate and practice for the effectiveness of solid waste disposal. So group characteristics of work experience with collection of solid waste collectors found in solid waste disposal enterprise has a significant impact on the effective collection of solid waste and the reduction of environmental pollution.

Table 4.5 category of collectors by work experience on group level

work experience category	Minimum	Maximum	Sum	Mean	Std. Deviation
1-3 years Work experiences	4	29	713	12.96	5.178
>3-5 years work experiences	10	68	1523	27.69	14.494
>5-7 years of work experiences	1	24	733	13.33	4.914
>7 years work experiences	3	19	539	9.80	3.217

Source: own survey (2021) Note; > =Greater than.

By using descriptive statistics as shown in the table 4.5 above, the work experience on the categories with (1-3 years work experiences) of, the minimum number is 4 and the maximum is 29. In total, 713 solid waste collectors have 1-3 years of work experience. The average number is 12.96 and the standard division is 5.19.The other categories of experience are >3-5 (three and a half to five years). The minimum number of solid waste collectors is 10 and the maximum is 68. The total numbers of solid waste collectors found in the solid waste disposal enterprise are 1523. The average and standard division is 27.69 and 14.49, respectively.)The next group characteristics of collectors is on the category of >5-7 years, In this practice, the minimum number of solid waste collectors is 1 and the maximum is 24.Thus, in total, the numbers of solid waste collectors found in solid waste disposal enterprise are 733. The average and standard division are 13.33 and 4.91 respectively. The other groups characteristic on work experience are by the category of above 7years work experience, therefore, the minimum number

of solid waste collectors in this category is 3 and the maximum is 19.The total number of solid waste collectors that found solid waste disposal enterprise are 539. The mean and standard deviations are 9.80 and 3.21 respectively. As the result indicates the work experience categories that are >3-5 years of stay on work experiences have the higher the maximum value of the given categorical variable the mean value also increasing.

4.2.1.6 Marital Status of group level of members

The tables 4.6 below show that the group characteristics based on marital status those solid waste collectors with the significant impacts on effective solid waste disposal practices.

Table 4.6 Marital status of the collectors (N=55)

Marital status category	Minimum	Maximum	sum	Mean	Std. Deviation
Single	15	81	2664	48.44	16.755
Married	4	32	771	14.02	5.681
Divorced	0	5	40	.73	1.044
Widowed	0	0	0	.00	.000

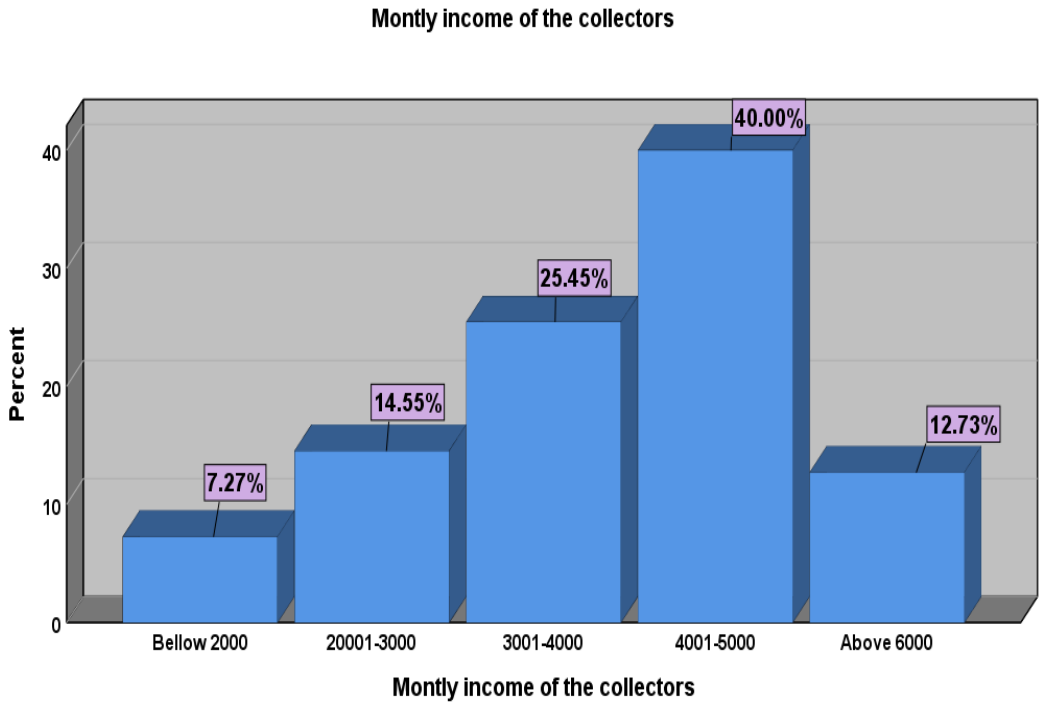
Source: Own survey (2021)

Based on the tables 4.6 above the group characteristics based on marital status more of single collectors found in solid waste disposal enterprises which are 2664 collectors. Thus the minimum number of this category is 15 and maximum number is 81.The mean and standard deviations are 48.44 and 6.76 respectively. On the next followed by married with the number of 771 collectors in this category the minimum and maximum numbers are 4 and 32 respectively. Thus mean and standard deviation measurements are 14.02 and 5.68 respectively. The other marital status category is the numbers of divorce which are 40 collectors. The minimum and maximum numbers are 0 and 5 respectively Thus with the mean and standard deviation which are 0.7 and 1.04 respectively. From the result of marital status of the respondents, the researcher could conclude that most of the collectors in solid waste disposal enterprises were single as their counterpart because more than of the collectors were single.

4.2.1.7 Monthly income of the collectors on group level

As shown in the figure 4.7 bellow, the monthly income of solid waste disposal associations in all four sub-cities included and analyzed by as following.

Figure 4.1 Monthly incomes of the collectors



Source: own survey (2021)

The survey and the researchers field observation that monthly income of respondents in the study area was significant impacts with effective solid waste disposal practices. As this indicated that The number of associations with monthly income found bellow 2,000 birr are 4 (7.3%); enterprise; the number of associations with found between2001-3000 birr are8 (14.6%); enterprises; the other the number of associations with the income that found 3001-4000 birr are14 (25.5%) enterprises. The number of associations that found with fondbetween the income of between4001-5,000 birr is 22(40.0%) Enterprises and the number of associations that found between the income of more than 6,000 birr are 7 (12.7%).Therefore the income category of 26 enterprises that found there collectors are found 2001-3000 and 3001-4000 birr which represents the smallest number that eared of monthly income. As the result shows that the enterprises did not pay good monthly salary for collectors and did not encourage the well-educated professional.

4.2.1.8 Educational level of solid waste collectors group level performance on cross-tabulation

According to the table 4.7 below, the educational level of collector group leader range from below elementary school graduate to degree level. Generally 55 collectors from the total group head respondents. 9.1 percent are below elementary school graduate, 60 percent are 10-12 grade level, 18.2 percent are diploma graduated, 12.7 percent are first degree graduate when the educational status of the collectors group heads is compared with group head sex, males are better educated than females (see on the table below 4.3).

Moreover, the researcher made a comparison between the group head education level and its solid waste collection for environmental cleaning. As clearly depicted in the table below 4.3, when the collector's group head educational level improves, the effectiveness of solid waste collection practices on environmental cleaning effectiveness level also improves. The result shows from the total samples who manage its solid waste collection effectively, 16.2% and 5.6% of collectors group head is illiterate and first degree holders respectively, whereas, from the collectors group who experienced in effective solid waste collection practices, 8.1% male head group leader and 11.1% female head group leader are below high school graduate, 54.1% male head group leaders and 72.2% female head group leaders are10-12 grade education and 21.6% male head group leaders and 11.1% female head group leaders are Diploma holders. Overall, the trends of solid waste collector's group head educational level and the effectiveness of solid waste collection for environmental cleaning at solid waste collector's group level have a positive relationship (see below table 4.7)

Table 4.7 Education of solid waste collector's group level with collection performance by cross-tabulation

Gender types of collector group chairpersons	Percent of performance on effective collection	Educational level of collector group chairpersons			
		Below grade 1	Grade 10- Gra 12	Diploma	Degree
Male team leaders	Count	3	20	8	6
	% within Sex of the effectiveness	8.1%	54.1%	21.6%	16.2%
	% within Educational	60.0%	60.6%	80.0%	85.7%

	level of the collector				
	% of Total	5.5%	36.4%	14.5%	10.9%
Female team leader	Count	2	13	2	1
	% within Sex of the effectiveness	11.1%	72.2%	11.1%	5.6%
	% within Educational level of the groups	40.0%	39.4%	20.0%	14.3%
	% of Total	3.6%	23.6%	3.6%	1.8%
Total	Count	5	33	10	7
	% within Sex of the effectiveness	9.1%	60.0%	18.2%	12.7%
	% within Educational lev of the groups	100.0%	100.0%	100.0%	100.0%

Sources: own survey (2021)

4.2.1.9 Monthly income of solid waste collectors group level performance by cross-tabulation

The researcher investigated the influence of the group level income on the effectiveness of solid wastes collections in the study area. This have the output in table 4.8 below illustrated that the average income of the collector group levels with the monthly income and sanitation effectiveness of the solid waste collection and disposal associations are analyzed as follows on the Cross tabulation Table. As a result, some of the best solid waste collection sanitation associations have a monthly income of less than 2,000 birr and 2001-3000 birr the efficiency of environmental cleaning, while 3001-4000 are at an efficiency of tasks on 18.2%. on the other solid waste collectors group associations with a monthly income of 4001-5000 birr have an efficiency of tasks with 22.7%.in addition, associations with a monthly income of more than 6,000 birr have a cleanliness rate of 50.0%.As the results of this analysis indicate that high-income solid waste collectors group associations have a very clean environment, while low-income solid waste collectors group associations have a very low level of effective solid waste collection for environmental cleaning (see table 4.8 below).

Table 4.2 collection performance based on Income by cross tabulation

Observa	Percent of	Monthly income of the enterprises				
on valu	performance by	Bellow 2000	2001-30	3001-4000	4001-5000	Above

	collection					6000
Very Good	%within Environmental cleaning	4.5%	4.5%	18.2%	22.7%	50.0%
	% within Month income of t enterprises	25.0%$_a$	12.5%	35.7%	50.0%	57.1%$_a$
Good	% with Environmental cleaning	9.5%	9.5%	23.8%	28.6%	28.6%
	% within Month income of t enterprises	50.0%$_a$	75.0%	35.7%	27.3%	28.6%$_a$
Poor	%within Environmental cleaning	55.6%	33.3%	11.1%		
	% within Month income of t enterprises	0%	0%	21.4%	22.7%	14.3%$_a$
very poo	% with Environmental cleaning	35.3%	33.3%	23.3%		
	% within Month income of t enterprises	25.0%$_a$	12.5%	7.1%	0%	0%

Sources: own survey (2021)

4.2.2 Solid waste collection methods on collectors performance

The observation results on the researcher revealed that in the town, by the waste management (or waste disposal) includes the activities and actions required to manage of solid waste from its inception to its final disposal. This includes the door to door collection, transport, treatment and disposal of waste,

together with monitoring and regulation of the waste management process and implementation of solid waste, collection mechanisms, economic mechanisms(solid waste management World Bank, 2020). So the following cases to answer the first objective of solid waste disposal mechanism by the method of descriptive statistics. By using statistical package for social science (spss).As we interpreted the following cases:

Table 4.9 solid waste disposal mechanism (N=55)

Variables	mean	Sd.D	S.A	AR	NEU	D.A	S.DA
Communities practices solid waste disposal mechanisms	2.47	1.412	15 (27.3%)	22 (40.0%)	9(16.6%)	5 (9.5%)	4(7.3)
The implementation of reducing, Reuse &Recycling strategy o the sub city	1.95	1.026	21 (38.2%)	24(43.6%)	1(1.8%)	3(5.5%)	6(10.6%)
The implementation of reducing, Reuse &Recycling strategy o the sub city	1.95	1.026	21 (38.2%)	24(43.6%)	1(1.8%)	3(5.5%)	6(10.6%)
practices of solid waste disposal on Sorting container	3.05	1.268	12(21.8%)	19 (34.5%)	6(10.9%)	8(14.5%)	10(18.2)
the experiences of Soli waste collection by ope dumping outside on the compound	1.65	.799	2(3.6%)	3(5.5%)	0	23(41.8%)	27(49.1%)
Solid waste collection open burning on	1.84	1.050	2(3.6%)	6(10.9%)	1(1.8%)	20(36.4%)	26(47.3%)
solid waste classificatio experience with communities	1.64	.868	29(52.7%)	21(38.2%)	3(5.5%)	2(3.6%)	2(3.6%)
The experience to disposed of solid waste in specified collection places	1.62	.828	29(52.7%)	21(38.2%)	1(1.8%)	1(1.8%)	3(5.5%)

Source: Own survey (2021)

Based on the above table 4.9, To answer the question regarding the solid waste disposal method based on the following indicators: such as (Communities practices solid waste disposal mechanisms on the road & the ditch) It was analyzed as follows: on the participatory of 15 (27.3%) respondents with strongly agreed, The peoples of 22 (40.0%) would be on the statement with agreed, 9 (16.6%) respondents with neutral and 5 (9.5%) and 4 (7.3%) the respondent replied with disagreed and strongly disagreed." in response to the questionnaire respectively. On the other hand the mean and standard deviation values are 2.47 and 1.41 respectively; this indicates a reaction to the medium according to the Liker scale, which has an impact on solid waste disposal. On the next indicators (The implementation of reducing, Reuse & Recycling strategy on the sub cities) in which of the respondents, 21 (38.2%) with strongly agreed, 24 (43.6%) agreed and the participatory 3(5.5%) and 6 (10.6%) disagreed and strongly disagreed respectively. The remaining 1(1. 8%) Respondent showed neutral in respond to requests. In addition, the mean and the standard deviation of the respondents were 1.95 and 1.03 respectively. Therefore, the implementation strategy of solid waste indicates the impact on solid waste disposal methods.

The following indicator measures (practices of solid waste disposal on Sorting container), according to the survey, 19 (34.5%) with agreed, on the respondent of 12 (21.8%) with strongly agreed, 10 (18.2%) respondents disagreed, 8 (14.5%) It also shows that they strongly disagreed. And that the remaining 6 (10.9%) were neutral. Subsequently: on the other indicator (the experiences of Solid waste collection by open dumping outside on the compound) in which 27 (49.1%) respondents disagreed strongly on the existence of the practice of collecting discarded solid waste and dumping it in an open area outside the compound. The other23 (41.8%) respondents disagreed. On the other hand, the remaining 2(3.6%) and 3(5.5%) participants responded by Saied that strongly agreed and agreed. It also shows participants' mean and standard deviation values of 1.65 and 0.8 respectively. It indicates that the practice of sorting containers with solid waste disposal practices was factors of solid waste disposal mechanism. The Participants were asked to that another indicator (Solid waste collection by open burning is the spatial methods of solid waste disposal), on the participation with 2(3.6%) respondents strongly agreed and 6(10.9%) agreed, on the other 26(47.3%) participants strongly disagreed and 20(36.4%) participants with disagreed. On the other hand, the remaining 1(1.8%) indicates neutral respondent. the participants with mean and standard deviation in respectively 1.84 and 1. 050. We can see from this that the majority of respondents responded that it was possible to implement a solid waste disposal method by

burning solid waste in a clear location and; Sub-city solid waste managers and team leaders added that this would affect the solid waste management system.

In addition, on the case of (solid waste classification experience with communities) which was related to the community's experience in the proper identification of solid waste? On the respondents of 29(52.7%) with strongly agreed.21 (38.2%) only agreed, with 2(3.6%) respondents Saied that strongly agreed and 3(5.5%) respondents were disagreed, while the remaining 3(5.5%) participants responded in an independent manner. The respondent's mean and standard deviation values were 1.64 and 0.87 respectively. Therefore, as a result of this, the community's solid waste collection experiences with factors of solid waste disposal mechanisms. Another indicator was(The experience to disposed of solid waste in specified collection places) which has the practice of dumping solid waste at the designated site, with 29 (52.7%) respondents strongly agreed, on the participatory of 21 (38.2%) respondents agreed, and 3(5.5%) and 2 (3.65%) strongly disagreed; the remaining 1 (1.8%) responded independently. This Indicates total respondents' mean and standard deviation scores of 1.62 and 0.83 respectively. Thus, dumping in a landfill indicates a significant impact on solid waste disposal mechanism.

4.2.3 Socio-economic factors of solid waste collection performance

On the given waste management practice is considered to be effective when a solid waste collector by economically goals is achieved, An effective solid waste collector can be recorded when companies, and other governmental and non-governmental organizations are able to facilitate enough work facilities to all beneficiaries, increase a frequency of waste pick up, avoid waste spill over and when waste personnel is fully and frequently trained (ZEMENA, 2016).

As we have to now the following variables with the indication of solid waste disposal practices based on economic situations to analyze and inter pretention by the method of regression model and descriptive statistics, statistical package for social science (spss).V26.

Table 4.10 Socio-economic factors of solid waste disposal practices (N=55)

Variables	mean	Sd.D	S.A	AR	NEU	D.A	S.DA
Inadequate service coverage is the major problem of solid waste disposal practice	2.35	1.350	36.4%	27.3%	4%	20.0%	9.1%
Implementation of solid waste disposal practic	1.62	.805	54.5%	32.7%	0%	3.6%	9.1%

poor cooperation of government agencies/stakeholders are the effects of improp solid waste disposal	1.76	1.036	50.9%	34.5%	3.6%	5.5%	5.5%
poor participation of solid waste collection in place lack of solid waste disposal practice	1.82	1.172	56.4%	23.6%	3.6%	10.9%	5.5%
shortage of equipment like vehicles is challeng of solid waste disposal practice	2.71	1.423	30.9%	43.6%	9.1%	12.7%	3.6%
income for solid waste handling services is insufficient	2.25	1.280	25.5%	34.5%	16.4%	16.4%	7.3%
Lack of quality and satisfactory solid waste container is the barriers to solid waste collecto	1.84	.996	43.6%	40.0%	3.6%	3.6%	9.1%
Operational inefficiency of services is the problem of properly solid waste collection	2.82	1.479	21.8%	30.9%	21.8%	12.7%	12.7%
The organization have adequate and modern waste management equipment	3.22	1.8%	.769	12.7%	1.8%	34.5%	47.3%
The sub city is well planned with appropriate infrastructure to collect and transport waste	3.15	.931	7.3%	7.3%	3.6%	45.5%	10.9%

Source: Own Survey (2021

The indicator as presented in table 4.10 above, all of the indicators were scored as(The barriers of Inadequate service coverage is the major problem of solid waste disposal practice), was recorded as agreed by the respondents with the mean value=2.35.This can be supported in percentile terms (63.7%) strongly agreed and agreed whereas (29.1%) strongly disagreed and disagreed and the remaining (4%) remain neutral. On the other hand, the case of (Strong socio economic status is to contributed the implementation of solid waste disposal practice) was scored by the respondents with mean value =1.62. This percentiles, (87.2%) with the statement of strongly agreed and agreed. On the following, (12.7%) strongly disagreed and disagreed. But, no respondent was rated as neutral. In addition to this respondents stated their opinion with a mean value =1.76 on the indicator (poor cooperation of government agencies/stakeholders are the effects of improper solid waste disposal). In percentiles,

(85.4%) expressed their opinion strongly agreed and agreed. However, (11%) strongly disagreed and disagreed, the remaining 3.6% neutral.

The other indicator (poor participation of solid waste collection in place lack of solid waste disposal practice), which was pointed with mean value=1.82.Which was percentiles, (80%) respondents receded with strongly agreed and agreed, and on the other hand, (16.4%) respondents had strongly disagreed and disagreed. The remaining percentiles, (3.6%) respondents recorded with neutral. The cases of (shortage of equipment like vehicles is challenge of solid waste disposal practice), on the mean value=2.71. In percentiles, (74.5%) respondents with strongly agreed and agreed, the percentiles, (16.3%) participated with strongly disagreed and disagreed. The rest percentiles, (9.1%) with neutral responded. The variable of (income for solid waste handling services is insufficient), this variable mean value =2.25. This percentile, (60%) respondents recorded with strongly agreed and agreed, on following percentiles, (23.7%) respondents with strongly disagreed and disagreed. The remaining percentiles, (16%) respondents were neutral. The variable (Lack of quality and satisfactory solid waste container is the barriers to solid waste collectors), The value of mean =1.84, On the following of this percentiles,(83.6%) respondents with strongly agreed and agreed, On the other hand the percentiles, (12.7 %) respondents recorded strongly disagreed and disagreed. But the remaining respondents neutral responded. The variable of (Operational inefficiency of services is the problem of properly solid waste collection), the mean value =2.82 and had represented the highest standard deviations, on the scored of percentiles, (52.4%) respondents with strongly agreed and agreed, as the other percentiles, (25.4%) with strongly disagreed and disagreed. The rest of this percentile, (21.8%) respondents were neutral. As presented in the case (The organization have adequate and modern waste management equipment), with the highest mean value=3.22 and the lowest standard deviation which was 0.77. Those scored as percentiles, (81.8. %) of the respondents answered with strongly agreed and disagreed, but percentiles, (14.5%) respondents which had the statement of strongly agreed and agreed and the remaining 1.8% answered neutral**.** on the Next case (The sub city is well planned with appropriate infrastructure to collect and transport waste), the men vale =3.15 the percentiles, (56.4%) expressed their view as disagreement (including strong disagreement), (14.6%) strongly agreed and agreed while on the percentile (3.6%) remain neutral. As the majority answered disagreement it seems to reveal that the working environments have weakness based on infrastructure situation this indicated that the factors of influencing solid waste collector activities. Those conclude that Addis Ababa city is not generally

well planned with appropriate infrastructure for solid waste collection and transportation. This finding was found to be consistent with what had been found by Zemena (2016).

4.2.4 Characteristics of solid waste collection on collector groups

The characteristics of solid waste collection activities associated with the gathering of solid wastes and the hauling wastes after collection to the location where the collection vehicle is emptied and those activities associated with the transfer of wastes from the smaller collection vehicle to the larger transport equipment and the subsequent transport of the wastes, usually over long distance to the disposal site. As we have to now the following variables with the indication of solid waste collection characteristics to analyze and inter pretention by descriptive statistics, the use of software which is statistical package for social science soft ware.

Table 4.11 characteristics of solid waste collection (N=55)

Variables	mean	Sd.D	S.A	AR	NEU	D.A	S.DA
The agreement that is sustainable residential ar of solid waste disposal practices	1.84	1.244	56.4%	25.5%	7.3%	7.3%	3.6%
Educational attainment of the collectors to determined the solid waste disposal practices	2.33	1.320	30.9%	40.0%	9.1%	16.4%	3.6%
Knowledge and experience with about influencing on the effective practices of so waste disposal	1.89	1.083	43.6%	40.0%	3.6%	9.1%	3.6%
Waste workers always wear safe and protecti gloves and clothing on the work site	3.04	1.261	14.5%	25.5%	7.3%	43.6%	9.1%
The organization carries out awareness-raisi programs on general public health a management of waste	2.58	1.212	12.7%	54.5%	9.1%	20.0%	3.6%
Each collectors collects, transfers, and disposes its solid wastes at common points	2.98	1.408	21.8%	18.2%	14.5%	30.9%	14.5%
the distance to permitted dumpsite is safe facilitate your work	2.85	1.253	23.6%	12.7%	1.8%	41.8%	20.0%
Separation of waste at source points in the wa collector is ensured help in waste management	1.91	1.175	45.5%	38.2%	7.3%	5.5%	3.6%
Waste disposal method is determined by the ty and nature of waste collected in by wa collector agency workers	2.24	1.333	32.7%	41.8%	14.5%	1.8%	9.1%

Source: Own survey (2021)

As shown in table 4.11 above, the case with (the distance to permitted dumpsite is safe to facilitate on collection activities) was scored as disagreed with mean value of 2.85 Again, more than half of the respondents (41.8%) responded that they disagreed with the existence of the distance to permitted dumpsite is safe to facilitate on collection activities for effective solid waste disposal, as opposed to only (36.3%) of respondents saying that there exists (agreed and strongly agreed in total), the rest of 1.8% respondents answered neutral. This has an indication that there is no safe to facilitate on collection activities so that solid waste disposal practice not effectively. On following variable, (the agreements that of sustainable residential area of solid waste disposal practices) those was scored as strongly agreed with 56.4% and the mean value of 1.84%, the next scored was the statement with agreed the percentiles (25.5%), The numbers of respondents that answered with strongly disagreed and disagreed were the percentiles, (3.6%) and 7.3% respectively, But the other 7.3% were answered with neutral responded. The next, variable (educational attainment of the collectors to be determined the solid waste disposal practices), The scored statement was agreed with percentiles,(40.00%), those mean value of 2.33, the next scored statement was strongly agreed with percentiles,(30.9%) respondents, the other respondents with percentiles,(3.6%) and (16.4%) statements of strongly disagreed and disagreed respectively. But the neutral respondents with the percentiles, (9.1%) responded.

The other case of (Knowledge and experience with about 3R influencing on the effective practices of solid waste collection), on the mean value of the given variable=1.89. The highest scored statement of the variable was strongly agreed and agreed with the percentiles, (43.6%) and (40.00%) respectively. The other respondents with strongly disagreed and disagreed on the percentiles, (3.6%) and (9.1%) Respectively have to respond. On the other indicators (Waste workers always wear safe and protective gloves and clothing on the work site), the highest mean value=3.04, the scored statement was disagreed with percentiles, (43.6%) respondents, the rest of others were 14.5% respondents with testament of agreed, 14.5% respondents answered with the statement of strongly agreed, 9.1% respondents with the statements of strongly disagreed and 7.3% participatory responded with neutral. This indication the most of solid waste collectors lack of their own safety prevention mechanisms and this also implies that influencing factors the effectiveness of solid waste disposal practices. On the other variable (The organization carries out awareness-raising programs on general public health and management of waste), we had the mean value of 2.85, The participatory of respondents on the variable 12.7%the statement with strongly agreed, the respondents of 54.5%the statement with agreed, 20.0%participatory

respondents the statement with disagreed, 3.6% respondent with strongly disagreed and the remaining 9.1% respondents were responded with neutral.

The next indicator (Each household collects, transfers, and disposes of its solid wastes at common points), the mean value which was 2.98, the participatory of this variable the percentiles, 30.9% respondents with disagreed, 14.5 % participatory with strongly disagreed, on the other hand 21.8% respondents with strongly agreed, 18.2% participatory of the variable with agreed and 14.5% of participatory responded with neutral responded. The higher percentiles of on the participatory respondents with disagreed indicates that lack of hose hold level solid waste practice at a common collection points. This implies that the challenges of collectors for effective solid waste disposal practices. The other indicator variable (Separation of waste at source points in the waste collector is ensured help in waste management), this mean values=1.91. The participatory respondent percentiles, (45.5%) scored with strongly agreed, on the other percentiles, (38.2%) with agreed, 3.6% respondents with strongly disagreed, 5.5% respondents with on the statement of disagreed responded and 7.3% with neutral answered. The other variable (Waste disposal method is determined by the type and nature of waste collected in by waste collector agency workers), this variable mean value=2.24. Were the percentiles, (41.8%) the statement of with agreed, 32.7% the statement of with strongly agreed, 9.1% and 1.8% with the statement of strongly disagreed and disagreed respectively, the remaining 14.5% were to reflected neutral ideas.

4.2.5 The factors of solid waste collectors performance

Due to improper solid waste collection and disposal systems, particularly by municipal waste management teams, wastes heap up and become a menace. While people clean their homes and places of work, which affect the environment and the community. Based on the report found that effective solid waste management is relatively expensive, usually comprising 20%–50% of municipal budgets. Operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported (solid waste management world bank 2020).Based on the view of respondents the following out puts to analyze the effectiveness of solid waste collection as such computed by descriptive statistics the use of statistical package of social science (spss) verssio26. As the result would be computed and analyzed on the next table. As well as to interpreted and based on statement /narration to discussion of the necessary results in findings.

Table 4.12 the factors of solid waste collectors' performance

Variables	mean	Sd.D	S.A	AR	NEU	D.A	S.DA
Solid waste disposal process is to isolate wastes fr people and environment in a manner that causes harm	1.96	.902	29.1%	54.5%	3.6%	1.8%	10.9%
Open dumping can be an effective way of isolati waste from people.	1.82	1.002	43.6%	41.8%	0%	5.5%	9.1%
Functioning of solid waste disposal is influenced the people's attitudes and patterns of waste handling	1.80	1.145	54.5%	27.3%	5.5%	5.5%	7.3%
Disposal in to open field away from residential areas is the way of solid waste management	2.98	1.269	18.2%	12.7%	12.7%	21.8%	34.5%
The materials to recycle is on the way of t components separated from solid waste management practices	3.36	1.419	9.1%	27.3%	32.7%	16.4%	14.5%
An incinerator being constructed in the best so waste separation alternatives for in the city.	2.69	1.275	21.8%	25.5%	9.1%	20.0%	23.6%
Solid waste collection for vehicle shortages	1.91	1.076	43.6%	36.4%	3.6%	7.3%	9.1%
Care about waste management (reduce, reuse, and recycle) .good for reducing solid waste	1.96	.981	30.9%	56.4%	3.6%	7.3%	1.8%
Putting solid wastes into the containers is the responsibility of everybody	3.16	1.463	7.3%	43.6%	32.7%	9.1%	7.3%
The existing disposal site is far-away from collectio point	2.42	1.031	12.7%	56.4%	3.6%	16.4%	10.9%
The collection frequencies of solid waste collation	3.13	1.045	34.6%	(30.9%	21.8%	7.8%	4.9%

Source: Own survey (2021)

As shown in table 4.12 above, (Solid waste disposal process is to isolate the wastes from people and the environment) with a mean value of 1.96. The respondents on percentiles (54.5%) responded with agreed and (29.1%) responded that they strongly agreed with the effectively isolation of solid waste disposal practice is no harm in their respective manner. (11.8%) of respondents saying that there exists (strongly disagreed and disagreed in total). The next variable (Open dumping can be an effective way of

isolating waste.) In which is the mean value of 1.82. The numbers of respondents that strongly agreed answered in percentiles (43.6%) and 41.8% responded with the statement of agreed. On the percentiles (5.5) %responded with disagreed and 9.1% answered with strongly disagreed.

The next variable (Functioning of solid waste disposal is influenced by the people's attitudes and patterns of waste handling), the mean value of 1.8. The percentiles of respondents with strongly agreed was 54.5%, the other statement of with agreed was percentiles (27.3%) responded. The remaining answered of strongly disagreed and disagreed statements with 5.5% were responded. As the next case (Disposal in to open field away from residential areas is the way of solid waste management), this was mean values of 2.98.the scored statement with strongly disagreed the percentiles (34.5%) and 21.8% respondents with disagreed. The other statements of strongly agreed with 18.2%respondents,, agreed and neutral respondents had to answered the same percentiles of 12.7%respondents.based on This variable respondents the higher percentiles scored as strongly agreed and agreed. This implies that solid waste disposal open areas poor solid waste management practices, so it indicates the influencing factors that practices of effective collective actions. The other case(The materials to recycle is on the way of the components separated from solid waste management practices), this scored mean value with 3.36.the given answered of the respondent said that 9.1% with strongly agreed, 27.3% with agreed statement, 32.7% respondents answered with disagreed, the remaining 16.4% and 14.5% respondents answered with neutral and strongly disagreed respectively. The next case is, (An incinerator being constructed in the best solid waste separation alternatives for the city), the mean value=2.69, the participated respondents said that 21.8%answerd with strongly agreed, 25.5% of the respondent was responded with agreed. On the other hand 23.6% of the respondents said that responded with strongly agreed, 20.00% of the respondent on the statement of disagreed. The remaining 9.1% of the respondents answered with neutral. On following variable, with (the performance of Solid waste collection effectiveness for environmental cleaning), the mean value was 1.9.The respondents on the statement of with strongly agreed on percentiles, (43.6%) respondents. On the other participated respondents 36.4% responded with agreed, 3.6% participatory responded with neutral and the rest of 7.3% and 9.1% respondents answered with disagreed and strongly disagreed.

The other indicator (Care about waste management (reduce, reuse, and recycle) .good for reducing solid waste), the mean value=1.96. On this variable 30.9% of the respondents answered with strongly agreed, 56.4% respondents with the statement of agreed, on the other hand 7.3% and 1.8% of the respondents with disagreed and strongly agreed statements. The remaining respondents of 3.6% answered with

neutral. The indicator (Putting solid wastes into the containers is the responsibility of everybody)The mean value=3.16 On this variable 7.3% of the respondents answered with strongly agreed, 43.6% respondents with the statement of agreed, on the other hand 7.3% and 9.1% of the respondents with the statements of strongly agreed and disagreed. The remaining respondents of 32.7% answered with neutral. Based on the respondents answered on this indicator 43.6% with the agreed statement it shows more awareness about solid waste disposal mechanisms, so this implies that the positive effects of solid waste collection practices. On the variable of solid waste disposal site (The existing disposal site is far-away from the collection point) the respondent who has answered that they have the agreed view on the statement were (56.4%) of the total, followed by those who said strongly agreed (12.7%) and strongly disagreed with (10.9%).The participatory who responded disagreed represents (18.4%) of the sample. with 3.7% responded neutral. On the existing disposal site had far from their collection points, as the respondents were more percentiles with agreed statements. This had the challenges of collectors to performing effective solid waste disposal practices. On the variable of effective sold waste collection method (The collection frequencies of solid waste collection) was scored as agreed with mean value of 3.13, In percentage terms, this group constitutes about (30.9%) of the total respondents were with agreed and the others 34.6% to when those who said strongly agreed are included. On following 12.7% with the statement of (total strongly disagreed and disagreed) the rest 21.8% were neutral responded.

4.2.6 The result of descriptive statistics with computed research objectives

On the g table 4.13 indicated as the use of statistical package for social sciences on descriptive statistics to transform of research objective variables we have to the out puts of the mean, std. and variance.

Table 4.13 Result of descriptive statistics with transform variables (N=55)

By transform variables to computed	Mean	Std. Deviation	Variance
Solid waste collection methods mechanism	1.9709	.42543	.181
Socio-economic factors of collections	2.3773	.43947	.193
Characteristics of collectors performance	2.4496	.45368	.206
solid waste collection performance factors	2.4727	.40255	.162

Source: Own survey (2021)

In the above table 4.13 indicated that Based on the survey results by computed of descriptive statistics of transform variable objectives which were solid waste disposal mechanism on the values have to the mean value which is 1.97standard deviation 0.425 and also the variances is 0.18, the next objective results have to socio-economic factors of solid waste disposal practices which have to 2.37 mean value, 0.439 standard deviation and 0.19 variances, The characteristics of solid waste collection practices this computed variables with 2.44 mean, 0.45 standard deviation and 0.206 variances and The other objective results have to the effectiveness of solid waste collection practices this transform variables also which have to the mean values with 2.47, the standard deviation with 0.402 and the variances with 0.16,Therefore According to the table above, the average research question of each study is to translate the objectives of the study using descriptive statistics that can answer the main objective of the study which have the value of mean, median and variance are analyzed and the results have obtained, This indicating that the higher standard deviation values most of the respondents view more spread out or dispersed that the other lower of standard deviation values. The questionnaire on the variables affecting the effectiveness of solid waste collection practices.

4.2.7 Solid waste collection performance by regression Analysis

On the table below 4.14 shows the summery of the finding. Therefore the problem was to investigate if Training for the collectors is an effective way of environmental cleaning has a significant impact on effective solid waste collection for environmental cleaning. By using multinomial logit regression model there is significance impact on the value of Pseudo R-Square which has depicts that the model explains 81% this indicated that the variance of in the dependent or outcome variable explained by the independent variable or predictor variable. The dependent variable which is effectiveness environmental cleaning regressed on the predicting variable such as (training, education attainment, collection frequency and sex of group chair person) for effective solid waste collection for environmental cleaning to test the Logit regression model (see below table 4.16). This model implies that significantly predicted on effectiveness of environmental cleaning, In this case, we see a significance improvement in fit of the final model over the null model ($x^2(4) = 72.992$, $P < .05$).which indicates that the given independent variable can play a significant role in shaping effective environmental cleaning.

More over The ‘’Goodness of fit ” table contains the Deviance and Pearson chi-square tests, Which are useful for determining whether a model exhibits good of fit to the data. These have been a significant test results are indicators that the model fits the data well, as in the case, we see here. So the results are somewhat mixed).In this analysis, we see that both the Pearson chi-square and test ($x^2(44)$ =273.765, P=000) and the deviance test ($x^2(44)$ =57.797, P=.043). Where both the Pearson and deviance test has been significances, the results suggest good model fit. These results clearly direct the positive effects that of effective solid waste collection for environmental cleaning. Therefore on the indicated shown the problem is to investigate if the independent variables such as (training, education, collection frequency and education) have for solid waste collection effectiveness has a significant impact on effective environmental cleaning.

Table 4.14 Model fitting information on multinomial Log it regression

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	130.789			
Final	57.797	72.992	4	.000

Link function: Logit. At 5% the significance level, Source: Own survey (2021**)**

The case processing summary tells you the proportion of case falling at each level of dependent variable (Inters level).The model fitting information contains the -2log likelihood an intercept only (or null) model & the full model (containing the full set of predictors).We also have likelihood ratio chi-square test to test whether there is a significant improvement in fit of the final model relative to the intercept only model. In this case, we see a significance improvement in fit of the final model over the null model ($x^2(4) = 72.992$, P <.05).

Table 4.15 Goodness of -Fit on multinomial log it regression

	Chi-Square	df	**Pseudo R-Square**	Sig.
Pearson	273.765	44	.810	.000
Deviance	57.797	44		.043

Link function: LogitAt 5% the significance level, Source: Own survey (2021**)**

The ‘’Goodness of fit ” table contains the Deviance and Pearson chi-square tests, Which are useful for determining whether a model exhibits good of fit to the data. These have been a significant test results are indicators that the model fits the data well, as in the case, we see here. So the results are somewhat

mixed).In this analysis, we see that both the Pearson chi-square test ($x^2(44) = 273.765$, P=000) and the deviance test ($x^2(44) = 57.797$, P=.043). Where both the Pearson and deviance test has significances, the results suggest Goodness model fit.

Here, we have the regression coefficients and significance tests for each of the independent variables in the model. The regression coefficient are literally interpreted as the predicted change in Log odds of being in a higher (as opposed to lower) group/ category on the dependent variable (controlling for the remaining independent variable) per unit increases on the independent variables. As such…We interpret appositive estimate the following way: For every one unit increases on an independent variable, there is a predicted increased (of a certain amount) in the log odds of falling at a higher level of the dependent variable. More general this indicates that as scores increases on an independent variable, there is an increase probability of falling at a higher level on the dependent variable.

Table 4.16 Parameter estimation on multinomial logit regression

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[Envclean = 1]	14.268	3.604	15.675	1	.000
	[Envclean = 2]	18.131	3.961	20.952	1	.000
	[Envclean = 3]	23.187	5.152	20.258	1	.000
Location	Training	1.611	.481	11.218	1	.001
	Education	2.529	.583	18.829	1	.001
	Collection frequency	1.585	.463	11.738	1	.000
	Sex of group chairperson	2.382	.874	7.430	1	.006

Link function: Logit At 5% the significance level, Source: Own survey (2021**)**

Multinomial logit Regression analysis generates an equation to describe the statistical relationship between two or more predictor variables and the response variable. In this post, I would show you how to interpret the p-values and coefficients that appear in the output for regression analysis. A low p-value (< 0.05) indicates that you can reject the null hypothesis. In other words, a predictor that has a low p-value is likely to be a meaningful addition to the model because changes in the predictor's value are related to changes in the response variable

Training: On the above table 4.18 indicates that training was significant positive predictors of solid waste collection effectiveness for environmental cleaning. For every one unit increases for training, there is a predicted increases of 1.611 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning(On the significance values P=001).

Education: Educational attainment was a significance positive predictor of environmental cleaning. For every one unit increases for education, there is a predicted increases of 2.529 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P=.001). The log odds of being in a higher level on environmental cleaning have been 2.529 points on average.

Collection frequency: Collection frequency was a significance positive predictor of environmental cleaning. . For every one unit increases for collection frequency, there is a predicted increases of 1.585 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P=.000).

Sex of group chairperson: The collectors' group chair person was a significance positive predictor of environmental cleaning. For every one unit increases for sex of group chairperson, there is a predicted increases of 2.382 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P=.006).These also have to the log odds of being in a higher level on environmental cleaning have been 2.385 points on average.

4.3 Discussion of the result

The broad objective of this study was to analyze the challenges of urban solid waste collectors performance: This study used multiple sources of data and analysis by descriptive statistics such as the survey method by using statistical package for social science (SPSS.VS.26), Document review, and qualitative key informant interview, we have to combined these different methods, so this section we have to discusses the result of the data analysis in the light of the main research questions se for the investigation:

4.3.1 RQ1: What are the current solid waste collection methods

Based on the above table 4.9, To answer the question regarding the solid waste disposal method based on the following indicators: such as (Communities practices solid waste disposal mechanisms on the road & the ditch) It was analyzed as follows: on the participatory of 15 (27.3%) respondents with strongly agreed, The peoples of 22 (40.0%) would be on the statement with agreed, 9 (16.6%) respondents with neutral and 5 (9.5%) and 4 (7.3%) the respondent replied with disagreed and strongly disagreed." in response to the questionnaire respectively. On the other hand the mean and standard deviation values are 2.47 and 1.41 respectively; this indicates a reaction to the medium according to the Liker scale, which has an impact on solid waste disposal. On the next indicators (The implementation of reducing, Reuse & Recycling strategy on the sub cities) in which of the respondents, 21 (38.2%) with strongly agreed, 24 (43.6%) agreed and the participatory 3(5.5%) and 6 (10.6%) disagreed and strongly disagreed respectively. The remaining 1(1. 8%) Respondent showed neutral in respond to requests. In addition, the mean and the standard deviation of the respondents were 1.95 and 1.03 respectively. Therefore, the implementation strategy of solid waste indicates the impact on solid waste disposal methods. There are clear issues in the experience of implementation, familiar with solid waste calcification system, and final disposal the house hold solid waste storage & disposed of in specified places (Narayana, 2009).

The following indicator measures (practices of solid waste disposal on Sorting container), according to the survey, 19 (34.5%) with agreed, on the respondent of 12 (21.8%) with strongly agreed, 10 (18.2%) respondents disagreed, 8 (14.5%) It also shows that they strongly disagreed. And that the remaining 6 (10.9%) were neutral. Subsequently: on the other indicator (the experiences of Solid waste collection by open dumping outside on the compound) in which 27 (49.1%) respondents disagreed strongly on the existence of the practice of collecting discarded solid waste and dumping it in an open area outside the compound. The other 23 (41.8%) respondents disagreed. On the other hand, the remaining 2(3.6%) and 3(5.5%) participants responded by Saied that strongly agreed and agreed. It also shows participants' mean and standard deviation values of 1.65 and 0.8 respectively. It indicates that the practice of sorting containers with solid waste disposal practices was factors of solid waste disposal mechanism. The Participants were asked to that another indicator (Solid waste collection by open burning is the spatial methods of solid waste disposal), on the participation with 2(3.6%) respondents strongly agreed and 6(10.9%) agreed, on the other 26(47.3%) participants strongly disagreed and 20(36.4%) participants with disagreed. On the other hand, the remaining 1(1.8%) indicates neutral respondent. the participants

with mean and standard deviation in respectively 1.84 and 1. 050. We can see from this that the majority of respondents responded that it was possible to implement a solid waste disposal method by burning solid waste in a clear location and; Sub-city solid waste managers and team leaders added that this would affect the solid waste management system. Open burning wastes produce many toxic chemicals and is one of the major problems of air pollutants from open burning it includes particular mater, sulfur dioxide, carbon monoxide, lead and other toxics. However open burning of household waste has become common place in area where collection is limited or non existence all of the residences interpreted also by (Narayana, 2009).

In addition, on the case of (solid waste classification experience with communities) which was related to the community's experience in the proper identification of solid waste? On the respondents of 29(52.7%) with strongly agreed.21 (38.2%) only agreed, with 2(3.6%) respondents Saied that strongly agreed and 3(5.5%) respondents were disagreed, while the remaining 3(5.5%) participants responded in an independent manner. The respondent's mean and standard deviation values were 1.64 and 0.87 respectively. Therefore, as a result of this, the community's solid waste collection experiences with factors of solid waste disposal mechanisms. Another indicator was(The experience to disposed of solid waste in specified collection places) which has the practice of dumping solid waste at the designated site, with 29 (52.7%) respondents strongly agreed, on the participatory of 21 (38.2%) respondents agreed, and 3(5.5%) and 2 (3.65%) strongly disagreed; the remaining 1 (1.8%) responded independently. This Indicates total respondents' mean and standard deviation scores of 1.62 and 0.83 respectively. Thus, dumping in a landfill indicates a significant impact on solid waste disposal mechanism. this supported by Andualem et al., (2019) In Addis Ababa city the number of population is rapidly increasing time to time in every year. This has many challenges on solid waste disposal practices on the city. The consideration of the population and how they relate themselves to the solid waste collector challenges is significant.

4.3.2 RQ2: What are socio-economic challenges of collectors' performance?

The level of economic development is closely linked not only to fiscal aspects, but also to the viability of proper waste management. Economic development is indispensable as an assurance of the establishment of a fiscal basis for waste management, and industrial development is very important for the procurement and maintenance of machinery and equipment for waste management (Tanaka et al., 2003). It is explained that solid waste collection problems were globally everywhere, collection and

handling of garbage is not adequately executed. It includes on the factors of lack of sufficient equipments Knowledge/poor community participation/, inadequate services coverage. According to (WB, 2008) by the title of improving municipal solid waste management in India Lack of financial resources and planning capacity to cope with increasing urban population growth affects the availability or sustainability of a waste collection service. Operational inefficiencies, inappropriate technologies, or deficient management capacity of the institutions involved also give rise to inadequate service levels. Based on survey and key-informant interviews, the major solid waste collector challenges were discussed n followings;

4.3.2.1 Solid waste collection vehicle

Another major problem affecting the city's domestic solid waste management system and solid waste collection and disposal is the lack of vehicles. According to key informant in-depth interviews in the sub-cities surveyed, the lack of adequate vehicles to take into account the size and population of the sub-city has not resulted in effective solid waste collection and poor sanitation; He said the other vehicle had been in use in the city for many years and could no longer be used. He also said that the city's solid waste service agency is not paying enough attention to the supply of solid waste collection and disposal association. This is because most of the time, the vehicle is taken to a garage and no container is placed in the city, but the responsible party does not take it as a big issue and is not instructed to find a solution to such a serious problem. The finding of this study was consistent with what had been found by Asheafni(2011).

4.3.2.3 Collection and Transport

By the observation of the researcher Solid waste collection and transport involves storage at the generation and pick-up points pick up by the crew, trucks driving around the neighborhood, and truck transport to a transfer station or disposal point. According to the researcher observation and key informant in-depth interviews one of the activities of solid waste associations is to collect and transport solid waste from house to house. So the collection is difficult to improve efficient and effectively. In this process, road closures, vehicle shortages, and lack of personal injury protection for the collectors are some of the problems in the field. Therefore, it has been found that the collection of solid waste in an accessible manner has a significant impact on ensuring effective environmental hygiene. The finding of this study was consistent with what had been found by Mohammed and Dijk (2017).

4.3.3 RQ 3: What does the group characteristics of solid waste collectors practices

They are different types of solid waste collations characteristics such as door to door collection, communal, Block collection, Organizations collection, the generation of solid waste is the inevitable consequence of all processes where materials are used. Extraction of raw materials, manufacture of products, consumption, and waste management all generate wastes. The rate of material use today is so large, both with regard to the total amounts and seen as a per capita average, that the waste generated will impact on the environmental quality and human health worldwide if it is not managed properly (Reith CC et al., 2009), so the respondents view shown on the following indicators with survey and key-informants:

4.3.3.1 Administrative characteristics of solid waste associations

There are a total of 55 solid waste associations in the selected sub-cities; the maximum number of members per group is 112; the minimum number of members is 30.The performance of effective solid waste collection based on field observation by the researcher and According to field observations, the number of associations that are effective in sanitation is 22 enterprises, and the number of cooperatives in the field of solid waste collection is 21 enterprises are moderately performance on solid waste collection effectiveness. The information taken from the field observation indicates that they are. In addition, 9 associations are at the lowest levels of poor sanitation, while 3 associations are at the lowest level of efficiency. Another is the associations of administrative characteristics such as the association's work-wear / personal injury protection and use during the field visit; the association's vehicle supply, the number of members of the association, the environment of the association, the area that the association can occupy. According to the key-in format interview request made by the team leaders and the sub-city solid waste officials to light the number of associations available in one woreda and the researcher's observation confirms that the listed administrative conditions affect the effectiveness of solid waste collection.

The researchers observed the following group characteristics of solid waste collectors: The site which is surrounded by residences is getting full; many collectors work continuously and obviously living nearby the site and interfering work operation at the site for collection of materials such as wood, scrap metals and discarded food. The groups are characterized by there is no personnel protection cloth, no accessibility of sufficient vehicles, poor awareness on the communities for sorting of solid waste on the

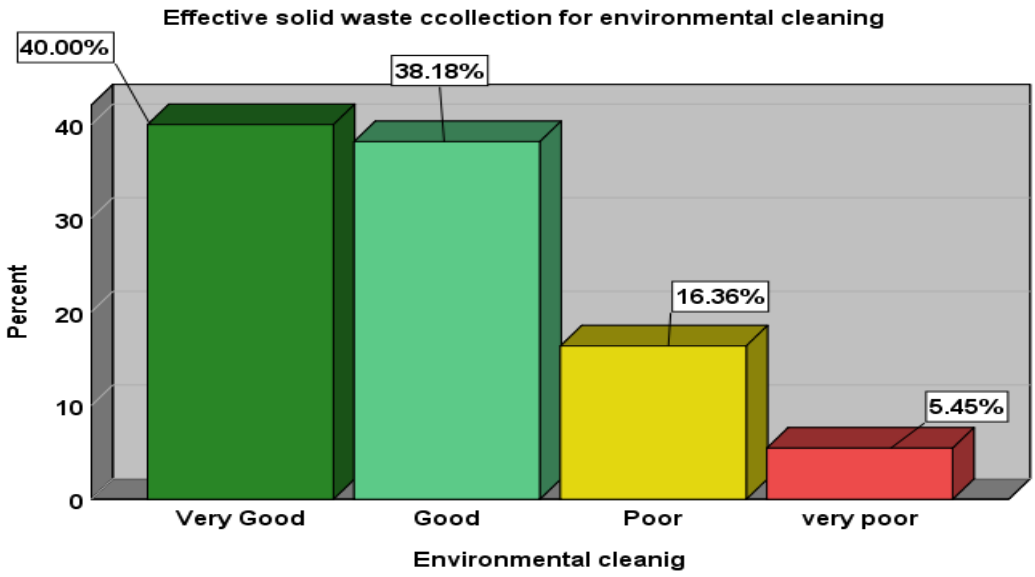
containers. Some solid waste collection site point area is unprotected area for children, women and scavengers and there is no large scale composting facility available as a disposal option. All of waste collected from the selected study sub-cites is dumped in this single place without separation of even organic waste. This survey finding using statistical value, interview and observation was further supported by literature on (Bharti et al; 2017, ZEMENA, 2016).

4.3.6 Performance of solid waste collection for environmental cleaning

In this section, the researcher applied both of quantitative and qualitative way of analysis in order to answer the third specific objective. Besides, more of the data that are necessary for this section were collected directly from sub-cities solid waste collector associations and sub-cities solid waste manager administrations through survey and key-informants interview, The task of local government rather for the purpose of efficient and effective service or disposal system the role of all stakeholders including the involvement of private enterprises are very important. In a similar fashion, private waste collectors have been established the performances or each movement of the collectors' participant to do their given assignment is also crucial.

Hence, it is necessary to examine the performance of these private solid waste collectors, Observation and survey results revealed that in the town, in response to interviews and field observations conducted by the study team leaders and officials of the study group, the association was established in several years and has its own organization, chairman and secretary. According to this study, 22 (40.0%) of the 55 associations selected in the four sub-cities of the four sub-cities were found to be very productive and that sanitation was effective.21 (38..2%) of the associations are in the middle of group performance.9 (16.4) and 3(5.5) were also found to be low and very low, respectively, from the researcher field observations and collected samples. Therefore, based on the field survey indicates that most of the solid waste collectors will ensure that the work of the solid waste associations in the city and sub-cities is kept clean and hygienic. As it turns out, the interview in the field observation is an indication of the response (see on the figure below 4.2).

Figure 4.2 Effective environmental cleaning based on field observation and key-informants



Sources: Own field observation (2021)

4.1.4 RQ 4: Which factors influence poor solid waste collection performance

Based on the researcher observation and key-informants interviewed of the sub-cities of administrations, one can be clearly understand from the above survey discussion, even though the selected sub-cities solid waste collectors have skill and are committed to serve the households with equal treatment of solid waste collections, they are not well organized and do not have adequate capacity to cover the whole areas of the town. It indicates that by one and/or the other problems these waste collectors cannot collect solid wastes from the whole households and their operation is inefficient. If this is the fact, from others, inadequate capacity and inefficient operations are the serious problems of solid waste collectors. This finding is in line with what had been stated by Ashenafi Haile (2013). He confirmed that inadequate service coverage and operational inefficiency of service is the main from Solid waste Management typical problem areas in developing countries.

According to the researcher observation and key-informants interviewed, they are interested to do more than what they are doing but they could not because of various reasons. The main reasons why they have covered only small area of the town and being operationally inefficient are: generally, lack of necessary facilities and lack of incentives. The detail explanation of each problem is stated as follows:

The first and the main reason is lack of facilities. The municipality did not provide adequate necessary facilities like transfer container, vehicle, job cloth (waste glove, eye glass and waste gown), shoe and others that are very important to deliver the service effectively. They further explained that this facility related problems like: because of lack of transfer container in the town, solid wastes collected from each home, as possible, and then should be disposed through push cart on the dump site, which is far from the center of the town. Since the road is concrete except the main road of the town, the distance from the center to dump site is so far, this is because it needs more time and more potential (manpower). It may results, with in regular or scheduled time, waste collectors could not serve most of the households; even difficult to properly covered households who live nearest to the main road. However, as per their response, if there are containers as a transfer station, solid wastes, which collected from each household, can be transferred to the container with in short period of time and can cover a number of households per day.

In addition, with regard to lack of facility they also indicate that there is no availability of the required track or vehicle which is one of the best means to dispose waste. Nevertheless in the study neither the existed car is properly functioning nor the effort made to replace as it is sufficient. As a result the role played tat insufficient which effect to lot of health and environment complications Moreover, the facility, specifically job cloth (waste glove, eye glass and waste gown) did not provide by the responsible body. It makes sense because when one observes the private solid waste collectors when they are serving the households in every morning, he/she could not see them with job cloth.

The second problem of solid waste collectors is lack of incentives (it includes providing training service and health security/guaranty to the waste collectors). Most of the time because of lack of incentives, which is given to the private enterprise from the city administration, the enterprises could not be encouraged to do well and even they want to shift their job. Due to this, the discussants were asked about incentives. Their response was the responsible body did not provide incentive including training with regard to their responsibility to these groups of waste collectors. Finally, door to door solid waste collectors strongly said or suggested that if the municipality fulfilled the above stated facility, at least transfer container, job cloth and vehicle, all of the members are ready to collect solid wastes from each household regularly. In addition, one can confirm this finding by Ashenafi Haile (2013).

4.3.5 Factors of solid waste collection performance by regression analysis

On the table below 4.13 shows the summery of the finding. Therefore the problem was to investigate if Training for the collectors is an effective way of environmental cleaning has a significant impact on effective solid waste collection for environmental cleaning. By using multinomial logit regression model there is significance impact on the value of Pseudo R-Square which has depicts that the model explains 81% this indicated that the variance of in the dependent or outcome variable explained by the independent variable or predictor variable. The dependent variable which is effectiveness environmental cleaning regressed on the predicting variable such as (training, education attainment, collection frequency and sex of group chair person) for effective solid waste collection for environmental cleaning to test the Logit regression model. This model implies that significantly predicted on performance of environmental cleaning, In this case, we see a significance improvement in fit of the final model over the null model ($x^2(4)=72.992$, $P <.05$).which indicates that the given independent variable can play a significant role in shaping effective environmental cleaning.

4.3.5.1 Short term training on collectors

Solid waste collection training within environmental cleaning are focused on core team members in the waste industry which include but are not limited to driver training, helper training, maintenance training and training for staff members those are part of training with environmental safety improvement. According to Andualem et al., (2019) In Addis Ababa city the number of population is rapidly increasing time to time in every year. This has many challenges on solid waste disposal practices on the city. The consideration of the population and how they relate themselves to the solid waste collection challenges is significant. To investigate on this main objective there are clear issues in the use of the next indicators to shown the interpretation results: Based on the above table 4.16, to answer the question regarding with performance of solid waste collection on solid waste collector training is the coming of best collection performances, So the training of solid waste collectors regarding solid waste has been shown to be effective in the effective management of solid waste collection through the above-mentioned multinomial logit regression model results. More specifically, the result of this variable can be interpreted as the level of collectors in group‟ training, the probability of effective solid waste management at group level. The model summery implies that significantly predicted on performance of environmental cleaning, The parameter explained For

every one unit increases for training, there is a predicted increases of 1.611 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P= 001).This indicates that trading can play a significant role in shaping effective environmental cleaning. These results clearly direct the positive effects that of effective solid waste collection for environmental cleaning. Therefore on the indicated shown the problem is to investigate if training for solid waste collectors has a significant impact on effective environmental cleaning. This finding supported with that was found to be consistent with what had been found by Allister (2015).

4.3.5.2 Educational attainment

Solid waste Associations Head /chairperson / Education Level has a significant Contribution effective solid waste collection performance, Doing so can be a significant contributor to effective sanitation, as shown in the above-mentioned multinomial regression model. Which implies that the parameter explained for every one unit increases for training, there is a predicted increases of 2.529 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P=.001). This is indicated that an educational attainment can play a significant role in shaping effective environmental cleaning moreover; the value of Pseudo R-Square is 81% which indicated that the variance of in the dependent or outcome variable explained by the independent variable or predictor variable that is the educational attainment of solid waste collectors on effective environmental cleaning. These results clearly direct the positive effects that of effective environmental cleaning.

4.3.5.3 Collection frequency

Observation results revealed that in the town, Solid waste collection and disposal associations for solid waste collection frequency effective solid waste management in sub-cities, they have a significant impact on effective sanitation by eliminating potential environmental impacts. Therefore, the effect can be seen in the results of the above model. Therefore the multinomial logit regression model parameters which implies that for every one unit increases for collection frequency, there is a predicted increases of 1.585 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P=.000).Based on the above table regression model summery there is

significance impact on Collection frequency of solid waste collectors with on the effectiveness of environmental cleaning in order to this the value of Pseudo R-Square is 81% which indicated that the variance of in the dependent or outcome variable explained by the independent variable or predictor variable that is the Collection frequency of solid waste collectors on effective environmental cleaning. The dependent variable effectiveness of environmental cleaning regressed on with the predicting variable on the collection frequency of solid waste collectors to test the multinomial lgit regression model on the table above indicated that to show significantly predicted effectiveness of environmental cleaning. Therefore, the collection frequency of solid waste collectors can play a significant role in shaping the effectiveness of environmental cleaning; these results clearly direct the positive effects that of effective environmental cleaning. The uses of related literatures were (ZEMENA 2016, WB, 2008,)

4.3.5.4 Sex of collection group chairperson

As stated in various literatures, solid waste collector's group chairperson sex is indicated as one of the main group characteristics that influence the status of solid waste collection management system. Due to this fact, this variable was hypothesized that women headed collector group have better chance to manage their solid waste effectively than men headed collector groups (see table 4.1 with gender based cross tabulation). As expected, more supported using in multinomial logit regression the coefficient for collector's group head sex was found to be positive and significant at 5% level. For every one unit increases for collection frequency, there is a predicted increases of 2.382 in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P= .006). It implies that sex of solid waste collector's group chair person is a significant impact for solid waste collection performance. Based on observation as well as key-informant interview Men and women generally had different perceptions about how frequently waste is disposed of, about the distance that must be travelled to dispose of waste and about the time spent disposing waste. Waste is considered more time consuming by men than by women. More women than men believed that a municipal waste collection system was more effective. This finding was found to be consistent with what had been found by Zimbabwe (2011).

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This study has been conducted to address assessing the performance of solid waste collection practice in Addis Ababa. The effective solid waste collection of Addis Ababa is characterized with unbalance solid waste disposal practices, Based on the survey results by computed of descriptive statistics of transform variable objectives which were solid waste disposal methods on the values have to the mean value which is 1.97 standard deviation 0.425 and also the variances is 0.18, the next objective results have to socio-economic factors of solid waste collection practices which have to 2.37 mean value, 0.439 standard deviation and 0.19 variances, The characteristics of solid waste collection practices this computed variables with 2.44 mean, 0.45 standard deviation and 0.206 variances and The other objective results have to the performance of solid waste collection practices this transform variables also which have to the mean values with 2.47, the standard deviation with 0.402 and the variances with 0.16,Therefore According to the computed result(see table 4.13), the average research question of each study is to translate the objectives of the study using descriptive statistics that can answer the main objective of the study which have the value of mean, standard deviation and Variance are analyzed and the results have obtained, This indicated that the standard deviation values most of the respondents view to the questionnaire on the variables affecting the performance of solid waste collection practices, so this result indicated that most of the respondents view with agreed on the appropriate manner of which is an obstacle of effective solid waste collection practices. Generally this finding indicated that the 18.4% of the variance explains on the variables can play a significant role in shaping the research questions.

More over the study found that key indicators of effective solid waste collection with (Collection frequency, short term Training based on collectors waste collection**,** educational attainment of collector group chairperson, Sex of Collectors Group chairperson, were significance impact on solid waste collection performance for effective environmental cleaning by the use of multinomial logit regression, the likelihood ratio chi-square test to test whether there is a significant improvement in

fit of the final model relative to the intercept only model. In this case, we see a significance improvement in fit of the final model over thee null model ($x^2(4) = 72.992$, $P < .05$).

Furthermore, The ‘’Goodness of fit ” table contains the Deviance and Pearson chi-square tests, Which are useful for determining whether a model exhibits good of fit to the data. These have been a significant test results are indicators that the model fits the data well, as in the case, we see here. So the results are somewhat mixed).In this analysis, we see that both the Pearson chi-square test (x^2 (44) =273.765, P=000) and the deviance test (x^2 (44) =57.797, P=.043). Where both the Pearson and deviance test has significances, the results suggest Goodness model fit.(see the above table 4.15).

We have the regression coefficients and significance tests for each of the independent variables in the model. The regression coefficient are literally interpreted as the predicted change in Log odds of being in a higher (as opposed to lower) group/ category on the dependent variable (controlling for the remaining independent variable) per unit increases on the independent variables. There measuring values Pseudo R-Square with 81%; which has indicated that the variance of in the dependent or outcome variable explained by the independent variable or predictor variable. On the above table 4.14 indicates that the given independent variables were significant positive predictors of solid waste collection performance for environmental cleaning. For every one unit increases for the independent variable, there is a predicted increases of in the log odds of the collector being in a higher (as opposed to lower) category on effective solid waste collection for environmental cleaning (On the significance values P= 001).As the results from the study indicate that, if waste collection is consistently and efficiently carried out the environmental, residents will be efficiently more for the service.

As indicated the researcher’s field observed and the key informant-interview on following group characteristics: The site which is surrounded by residences is getting full; many collectors work continuously and obviously living nearby the site and interfering work operation at the site for collection of materials such as wood, scrap metals and discarded food. The groups are characterized by there is no personnel protection cloth, no accessibility of sufficient vehicles, poor awareness on the communities for sorting of solid waste on the containers. Some solid waste collection site point area is unprotected area for children, women and scavengers and there is no large scale composting facility available as a disposal option. All of waste collected from the selected sub-cites is dumped in this single

place without separation of even organic waste. This survey finding using statistical value, interview and observation was further supported by literature on (Bharti et al; 2017, ZEMENA, 2016).

5.4 Recommendation

Based on the conducted of the study, the following recommendations were forwarded to relevant stakeholders and responsible bodies in the area.

- Among the findings of this study, most of the residents were ineffective solid waste disposal practice about waste handling, storage, separation, recycling, insufficient services coverage, improper open dumping and Operational inefficiency of services. Therefore, respective city government administrations and solid waste disposal Agency office should give frequent and timely awareness creating trainings to the residents.
- The results of the study indicate that the educational level of solid waste collection and disposal of the heads of solid waste collection associations is significant; therefore, the heads of solid waste collection and disposal associations should have an improved education.
- For solid waste disposal practice to be effective there should be proper solid waste collection systems with qualified personnel, availability of modern vehicle and equipment so as to reduce environmental pollution and prevent health hazards.
- The city government and solid waste disposal agencies should ensure better waste management through waste reduction, reuse, and recycling strategies.
- The municipality is less cooperative in giving different support systems. Therefore, the sub cities municipality, solid waste disposal agency other stakeholder offices should give necessary support on solid waste collectors.
- Training of solid waste collectors on solid waste collection has a significant impact on effective environmental clean-up collection and According to a study, providing similar training to solid waste collectors will ensure that the work and environment of the solid waste associations in the sub-cities is kept clean and hygienic, Therefore, it is important to understand that training is important to ensure effective hygiene by collecting solid waste.
- To monitor work safety awareness and supporting by training based on personnel protective equipment.
- To support and ensured the accessibility of solid waste collector equipments and to sustain the road infrastructures on the collectors site.

- It is now widely accepted that incorporating gender perspectives in development efforts is necessary for the successful implementation of effective solid waste collection for environmental safety. The focus on gender rather than women makes it critical to look not only at the category ‘women, but at women in relation to men.
- Too improve the efficiency and performance of solid waste collection i.e., the containers should help maximize the overall collection efficiency.

Therefore, the municipality is expected to eliminate this gap between both within the range of awareness creation through training and education program that any individual collectors are fully responsible to manage solid wastes and even protect its surrounding environment.

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