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**SCHOOL OF GRADUATE STUDIES
COLLEGE OF DEVELOPMENTAL STUDIES
CENTER FOR ENVIRONMENT AND DEVELOPMENT STUDIES**

Practice and Challenges of Solid Waste Segregation in Addis Ababa City

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**A THESIS SUBMITTED TO ADDISABABA UNIVERSITY, COLLEGE OF
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Declaration

I, Worku Adefris, declare that the thesis entitled “**Practice and Challenges of Solid Waste Segregation in Addis Ababa City**” here by submitted to Addis Ababa University for the partial fulfillment of the requirements for Master of Arts in Environment and Sustainable Development is my original work and not submitted earlier for any degree either at this or any other University and all source of material used herein has been duly acknowledged.

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Abstract

Solid waste segregation has a critical role for effective waste management; however its implementation level in cities of developing countries including Ethiopia still remained at low level. Therefore, the main purpose of this study was to analyze the practices and challenges of solid waste segregation in Addis Ababa city. To achieve the planned study objective data was generated through household survey, focus group discussions and key informant interviews. The collected quantitative data were cleaned, encoded and statistically analyzed using a descriptive statistics method using SPSS while thematic analysis method was used to analyze and describe the qualitative data. The data analysis revealed that only 21.3% respondents reported that they segregate the solid waste frequently and about half 45.5% segregate solid waste rarely. Conversely, a considerable proportion 28.7% of the respondents reported that they don't segregate the solid waste and the rest 4.5% respondents reported that they were not sure. This result implies that the solid waste segregation at household level was implemented through almost one-fifth percent of the total sampled of respondents that was correctly practiced while the majority of respondents were somehow practicing rarely on segregating the solid waste which could be considered as an opportunity to encourage the practice in the city. Moreover, the study finding also showed that the practice has been challenged by different factors like social, institutional and contextual aspects that can further be classified as negligence, budget scarcity and lack of training, and lack of guidelines, respectively. These all challenges have negative and statistically significant effects (chi-square test, $P < 0.05$) on solid waste segregation. The Chi-square test showed that respondent's sex, monthly income, marital status, home type, willingness, collecting materials availability, awareness and accesses to guideline of survey respondents were statistically significant ($P < 0.05$) associated with solid waste segregation practice. Therefore, this tells that there should be a broad awareness creation to the general public to improve knowledge and attitude of dwellers, training program for dominant stakeholders and waste collectors for proper waste segregation practice, and allocating sufficient budget to support the practices with appropriate basic warnings, tools and equipments so as to improve solid waste segregation practice at the city level.

Key words: Solid waste segregation, waste management, public awareness, recycling industries, Addis Ababa

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Solid waste management has been recognized to be a worldwide issue, which affects every person and government (Nyampundu et al., 2020). The quantity of solid waste generated has been increasing as a result of population density, urbanization, economic growth, and industrialization (Xiao, 2020). It is estimated that an average of 1.9 billion tons of solid waste is generated per annum from cities at global scale (Kasozi and Blottnitz, 2010). As a result, effective solid waste management plays a major role in minimizing the health and environmental aspects as urbanized cities particularly sub-Saharan African countries suffer from the problem (Hoornweg, 2012; Amuda et al., 2014; Xiao, 2020). In this regard, waste generation from sub-Saharan Africa cities to be estimated about 62 million tons per year (Hoornweg and Bhada-Tata, 2012). Therefore, effective and well-organized solid waste management is the main challenge for local government authorities, especially in urban settings in these regions (Firdaus, 2010). The problems with household waste have increased through time, which is estimated to be equivalent to the growth of consumer society. Both consumption and generated wastes are increasing parallel in quantity and diversity, which also result in depletion of resources and causes environmental problems such as global warming unless sustainably well managed. In this view, Roustia and Ekström, (2013) underlined that these environmental problems have significant impact on social and economic issues.

Increasing population, urbanization, industrialization, and altering consumption patterns results in increasing amounts and diversity of solid waste generation. It is clearly known that solid waste comprises all the wastes that are arising from human activities which normally solid in physical property, discarded as useless or unwanted by-products of process lines or materials and they may be required to be disposed of. It has become a chronic feature in the urban environment and it is the most noticeable environmental difficulty among many in urban areas (Gelan, 2021).

The understanding of the importance of waste segregation and recycling improving as part of solid waste management, many countries have put in place strategies to improve this practice; however its implementation still remains backward. The strategies may involve policy development, revising governance structures and improving public awareness. In developed countries for example, the 3R strategies (i.e., Reduce, Reuse, and Recycle) has been promoted through development of policies and legislation, regional coordination across local jurisdictions and innovative governance structures. Some of the real examples are recycling of wood and electronic materials in the United

States (Falk and Mc Keever, 2004; Kang and Schoenung, 2005; Kumar et al., 2017) and the reuse of plastics and packaging and demolition of waste in Europe (Jeffrey, 2011; Da Cruz et al., 2014; Bing et al., 2016). Conversely in Africa, for instance the case of Tanzania, waste segregation is poorly reinforced at all stages starting from the household and collection to disposal. The major issues given to justify the problem that need critical attention include inefficient coordination among various actors, financial constraints, lack of capacity, poor accessibility and governance (Kihila et al., 2021).

In connection to solid waste recycling, De Vega et al. (2008) and Donnini Mancini et al. (2007) argued that the principle of Reduce, Reuse, and Recycle can potentially reduce waste accumulation, if well planned and managed. The authors added that the practice can reduce the quantity of total waste generated by 65%. Similarly, various literatures indicates that waste recovery and reuse also yield direct economic benefits (e.g., Batool et al., 2008; Zhang et al., 2012; Li et al., 2015; Kumar et al., 2017) beside its role in protection of public health and environment (Saphores et al., 2012; Kumar et al., 2017). The literature added that proper and an effective recycling process significantly reduce the volumes of waste generated from the source. Electronic waste recycling for example is currently among the fastest growing events to significantly reduce the volumes of the waste (Saphores et al., 2012; Li et al., 2015). Likewise, plastics wastes recycling, which is the other huge waste stream, is also mentioned to reduce waste volume (Al-Salem et al., 2009). Waste reuse and recycling can have a major contribution for income generation and also can assist to reduce complications in handling and disposing of a big amount of solid wastes (Wilson et al., 2006; Matter et al., 2013). Incorporating waste segregation at the initial point of solid waste generation, collection and disposal stages can promote reuse and recycle of the waste and at the same time guide to economic and environmental benefits.

Unlike low-income nations, developed countries where there is public and societal awareness of solid waste segregation, the activities at the household level in developing countries, some of which are MENA (Middle East and North Africa) region countries, are still limited and almost non-existent in some countries. Therefore, municipal solid waste management generally consists of mixed waste containing food and other types of waste. Thus, solid waste segregation is usually performed by poor families or the so-called informal sector in order to earn additional income from selling recyclable materials (Hemidat et al, 2022).

It is well known that Ethiopia is among developing countries that have been facing rapid urbanization, where the urbanization has been leading to overcrowding and development of

informal settlements with poor waste management practices. Therefore, solid waste management is becoming the main public health and environmental issue in urban areas of Ethiopia, as only two percent of the population receives solid waste collection services (Nebiyou, 2020). Moreover, due to the lack of proper waste management, waste becomes a development barrier particularly in newly emerging cities, since they don't have a well established system to overcome the problem. Thus, innovative methods of solid waste handling, disposal, and smart management are important to reduce the amount of waste, and bring a sustainable solid waste management system for the city.

The problem is very difficult in Addis Ababa compared to other cities of the country related to the problems mentioned above. Addis Ababa, similar to other cities in developing countries, faces problems connected with poorly managed solid waste operations. The city has been generating an ever-increasing amount of waste, coupled with less effective solid waste collection, and disposal systems (Gelan, 2021). The poor solid waste management practice as a whole and very weak segregation practices became a major health and environmental issue in the city. The underlying causes of the problem include insufficient space allocation to manage and handle the wastes, lack of working materials, warnings and tools and limited awareness of the community (Abebe, 2017). Zemena (2016) also related these factors with institutional, social, economical and contextual aspects for waste segregations as the context of urban solid waste management in Addis Ababa. Therefore, this study aimed at analyzing the current practices and challenges of solid waste segregation in the city, Addis Ababa.

1.2 Statement of the Problem

Studies have been conducted on solid waste segregation as it has a vital role for effective waste management (Oberlin, 2013; Rousta and Ekström, 2013; Abebe, 2017). In this regard, it is well known that effective policies on solid waste segregation have a critical role for continued and sustainable waste management and environmental health (Matsumoto, 2011). However, in the case of developing countries, solid waste segregation has not received critical attention both by policy makers and waste management authorities as a result it has been practiced in an informal way (Wilson et al., 2006; Chi et al., 2011). Different literatures attributed this issue to different factors like low level of awareness and limited financing (Kumar et al., 2017; Babazadeh et al., 2020), lack of households willingness (Gyimah et al., 2021), weak regulatory frameworks (Yu et al., 2010), lack of economic incentives to people engaged on the activity (Suttibak and Nitivattanan on, 2008) and lack of priority in planning processes and enforcement (Darby and Obara, 2005; Skinner et al., 2010; Al-Maaded et al., 2012). Literature from developing countries especially from sub- Saharan

Africa is still insufficient with related to best models for implementing solid waste segregation practices, strategies for behavioral change and the feasible technologies for waste Reduce, Reuse, and Recycle (Kihila et al., 2021).

According to The Ethiopian Herald (2021) report, even if the amount of solid waste generated in Africa is small compared to developed countries, less than half of the solid waste produced is collected, and 95 percent of that amount is either indiscriminately thrown away at various dumping sites on the margin of urban centers, or at several so-called temporary sites, typically empty lots scattered all over the city. This shows that solid waste collection services are challenging in most areas of developing cities; an estimated 30-50 percent of solid waste generation within urban centers is left uncollected. As part of the low-income countries, Ethiopia is facing the consequence of inappropriate solid waste management which reported that 20 to 30 percent of the waste generated in Addis Ababa.

In this perspective, a study by Agbefe et al. (2019) which was conducted on solid waste management practices indicated that solid waste segregation in many developing countries is not properly implemented but instead waste is all mixed up. Lema et al. (2019) described that Ethiopia is facing the consequence of improper solid waste management. Poor solid waste management is the leading problem in Ethiopia (Gelan, 2021) as of which indicates limited solid waste segregation practice and very limited number of studies on the subject in the country. In Ethiopia, as part of solid waste management, the studies don't sufficiently address the issue of solid waste segregation so as to recommend possible strategies for enhancing solid waste segregation practice in the country (Hirpe and Yeom, 2021).

Addis Ababa, like cities of other developing countries, faces problems associated with very poor management of solid waste operations. The cities are generating an ever-increasing the amount of waste with poor and ineffective solid waste collection and disposal systems. As a result, a large proportion of the solid wastes left uncollected or disposed of in open spaces, ditches, and rivers. This is mostly due to insufficient waste collection techniques (Beka and Meng, 2021), and a lack of public awareness (Abebe, 2017). Therefore, collection and disposal of solid waste remained a persistent problem for the city as confirmed by different studies (Mekonnen, 2012 and Dagneu et al, 2013). A similar studies conducted in Addis Ababa reported various problems, in connection to this Regassa, (2011) reported low performance of solid waste management where the poorly managed solid waste disposal site has been impacting the groundwater and public health (Zewdie, 2007). Tsegaye, (2007) assessed the characteristics of solid waste generated at the household level

with its impact on the environment and Dijik and Tilay, (2014) focused on collection and disposal problems of solid waste.

According to the explanation given from Addis Ababa City Solid Waste Cleansing Management Agency and the selected sub-cities of solid waste cleansing management team leaders and experts, the low practice of solid waste segregation at the initial point and other stages of solid waste management have been considered to be as the main challenge in most sub- cities of Addis Ababa. May be in Addis Ababa, there is same attempts of solid waste segregating practice at the outdoor for materials with market demand which has been linked with recycling systems. For example, for some materials like water plastic bottles, different metal scraps and cardboard, waste collectors (emerging associations) or partnerships have a considerable market linkage that depend on the governmental support in terms of financial subsidy to encourage the associations. In the other way, there are also waste pickers that are informally called “*koralewo*” that could have market linkage with the recycling industries or *Merkato Minalesh Tera* in the city. Hence, the legal associations or partnerships collect these materials from households, open areas and temporary and permanent waste collection sites to sell to the industries as means of strengthening their capital or livelihood.

On the other hand, other solid materials like plastic bags (in Amharic *festal*) are mixed and collected with biodegradable solid wastes. Mixing of these solid wastes can make both handling and separation of the recyclable materials difficult (Hoornweg and Bhada-Tata, 2012). In connection to this, Reppi-waste incineration plant and Addis Ababa sub-cities experts engaged on waste management and administration indicated that absence/low practice of solid waste segregation at household and outdoor level have been severely affecting the environment, incinerating machine (burner) and car’s compactor machine in such a way that there is a frequent malfunctioning/failure of the machine as the result of poor practice of solid waste segregation in the city. Plastic bags thrown into drainage systems are also blocking water flow, which in some areas particularly along river side creates flooding. Abebe, (2017) primarily attributed the problem with lack of community awareness and low status of segregation, which has been retarding the waste management effort of Addis Ababa.

With regard to the price of segregated materials, Addis Ababa Solid Waste management Agency annual report (2020/2021) indicated that with a little practice of segregation on specific material like paper and cardboard waste 689,552 kg segregated materials generated 2,535,849 Birr annually. This data indicates that if the segregation practices in the city well practiced the economic benefit of segregation is a vital role for income generation and job creation alternatives for unemployed

residents in the city. Conversely, a study conducted from 2016 to 2020 the municipal solid waste generation in the city indicated that total amount of solid waste generated on average is 2,933,247m³ annually (Gelan, 2021). If this amount of solid waste generated was properly segregated, a greater amount of income were generated. Even though the city has still a potential to generate an income for the community through solid waste segregation practice, the city loses a millions of birr annually.

Although the problem of solid waste management, particularly segregation practice, remained behind related to environmental, health and social issues of Addis Ababa, other towns and cities in the country and beyond, no sufficient empirical research has been done so far to provide policy and strategic advice. Therefore, this research is aimed at analyzing practice and challenges of solid waste segregation in Addis Ababa city.

1.3 Objectives of the study

General objective

The general objective of the study was to analyze the practices and challenges of solid waste segregation in Addis Ababa City.

Specific Objectives

1. To assess the practices of solid waste segregation at household and outdoor level.
2. To identify the challenge of the solid waste segregation at household and outdoor level
3. To analyze effectiveness of the linkage of waste collectors/legal associations or partnerships with waste recycling industries.

1.4 Research Questions

- How is the current practice of solid waste segregation at household and outdoor level?
- What are the challenges related to solid waste segregation at household and outdoor level?
- How waste collectors/legal associations or partnerships are effective on linkage with waste recycling industries for income generation?

1.5 Significance of the study

This study plays a significant role in solving the problem issues related to solid waste segregation in Addis Ababa city through creating awareness at the source of waste. It is expected that the results from this study will be used as a base for decision makers in formulating strategies towards improving solid waste segregation practices in cities and at national level by the community, Non-Governmental Organizations and government offices.

The research can show the level of practices and challenges on solid waste segregation in terms of social, institutional, contextual aspects along the value chain of solid waste management. It is expected that the findings of this study contributed to the implementation of rules and regulations among decision makers on sustainable solid waste segregation and contribute to knowledge development within which future research can be carried out.

1.6 Scope and Limitation of the Study

The study was limited to Addis Ababa on some selected sub-cities due to time and financial constraints. And the study is focused on the practice and challenge of solid waste segregation at the household and outdoor level along with the solid waste management system. However, the study did not cover the solid waste management related to practices and challenges after processing of waste incineration at a factory where electric power is generated.

1.7 Organization of the Thesis

This study covers five chapters. The first chapter is focused on introduction to the subject matter. In this part of the study detailed explanation is made on the themes of the research. This is done by presenting objectives of the study and defining the research questions.

The second chapter presents a review of related literature. In this regard, theoretical, empirical aspects and conceptual framework of the study is presented. Then it is followed by the third chapter which deals with the methods that are used to collect data from both primary and secondary sources. Empirical analysis of data collected through questionnaires and interviews as well as results and discussions are presented in the fourth chapter of the study. Lastly, conclusions and recommendations are made on chapter five of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical overview of solid waste segregation

2.1.1 Definitions of terms used in the thesis

Waste segregation refers to a solid waste management practice of separating and storing different materials found in solid waste to encourage recycling and reuse of resources and to minimize the volume of waste for collection and disposal. Waste recycling at the household level refers to resource recovery activities such as recovering wastes from the waste stream to reuse, sell, give away or compost in the case of food wastes (Bennagen et al., 2002).

Source segregation refers to the separation of the proposed useful materials from the waste stream at the point of generation. Segregation of waste can save valuable resources in the form of saved hours necessary to deal with the non-segregated waste. With the segregation of waste at the source point, the amount of waste going to the landfill is greatly reduced (Otitojuand Seng, 2014). Moreover, segregation is the process of separation of biodegradable waste from non-biodegradable so that the waste material can be disposed of properly or recycled (Tarun et al., 2019).

Waste management refers to the collection, transport, recovery, and disposal of waste, including the supervision of such operations and after-care of disposal sites (Jerie and Tevera, 2014). Solid Waste Management (SWM) is very important in a community mainly because it will prevent our household from getting the hazardous outcomes of solid waste material. Even though minimizing the hazardous waste materials by using different methods for example by segregating practices, it is possible to protect our environment and reduce cost at different phases of solid waste management. However, for successful management there is a growing interest for waste minimization through reuse and recycling which necessitates incorporation of waste segregation in the waste management stream (Oberlin, 2013).

Reduce, Reuse, and Recycle (3R) are waste prevention, circular economy establishment, cleaner productions, and valorization of the waste by transformation into a source of energy and materials (Abdel-Shafy and Mansour, 2018). They are also a waste hierarchy in order of significance classifying waste management strategies as per their desirability. This idea denotes reducing waste, reusing, and recycling resources and products. Reducing connotes choosing to use items with care to the reduction of the amount of waste produced. Reusing means repeated use of waste itself

having usable aspects. Recycling denotes the use of waste itself as resources helpful to the people (Yousuf, 2014).

Biodegradable are materials that can be decomposed by bacteria or microbes and abiotic elements such as temperature, ultraviolet, oxygen, etc (Pushpakalambiga and Jasmine, 2019).

Non-Biodegradable are materials that cannot be decomposed by the natural organism like metals, plastic, glass, poly bags, etc but as these readily available, convenient to use and low cost they are toxic, pollution causing and are not considered as eco-friendly to the environment (Bharadwaj et al., 2015).

2.1.2 Concepts of solid waste management

The theory of waste management is based on the considerations that waste management is to prevent waste causing harm to human health and the environment, and application of waste management leads to conservation of resources (Pongrácz et al, 2004). The development of a waste management theory is a tool meant for implementing .waste management, which is: to control waste-related activities by using a proper methodology (Pongrácz & Pohjola 1997.).

According to Pongrácz(2002), Theory of Waste Management consists of the following hypotheses:

- a) Sustainable waste management depends greatly upon how waste is defined.
- b) Waste can be represented as an object without a Purpose and/or without an owner.
- c) Ownership over a thing is having the right and responsibility to act upon the thing that is to manipulate the properties of the thing.
- d) The role of waste management is to give a new Purpose and/or owner to waste objects.
- e) A sustainable process can be specified as such, where no object is created without a specified purpose and every product is produced for an owner.
- f) Consumer awareness can be enhanced by educating consumers about their responsibilities as owners.

In connection to this, Municipal solid waste management (MSWM) is a multidisciplinary activity that includes administrative activities and solid waste management practices such as the control of waste generation, storage, collection, transfer and transport, processing, and disposal of solid waste (Rada et al,2013). Its overall goal is to reduce and eliminate the adverse impacts of waste on human health and the environment and to support economic development and quality of life (USEPA, 2020). Hence, effective MSWM plays a significant role in improving the quality of the environment, human health, and socioeconomic activities of local communities.

A) Solid Waste Management practices

Total urban waste generation is around 2 billion tons per year globally, with a per-capita generation expected to increase by approximately 20% until the year 2100. Municipal Solid waste is globally considered as one of the important issues as waste management has been set as goals within the Sustainable Development Goals particularly in Goals 11 and 12th aiming to promote sustainable cities and to ensure sustainable consumption and production patterns. If properly managed, the waste management sector can potentially decrease global greenhouse gasses emissions in the range of 10 to 15% and can substantially increase to 20% if waste prevention was applied (Wilson, 2015).

In the case of the waste management practice on plastic bags in the world for example, Giacobelli, (2018) revealed that since the 1950s, the production of plastic has outpaced that of almost every other material. Most of the plastic we manufactured is intended to be thrown away after being used only once. As a result, plastic packaging accounts for about half of the plastic waste in the world. Mostly this waste is generated in Asia, other countries and regions like America, Japan and the European Union are the largest producers of plastic packaging waste per capita in the world. Our ability to cope with plastic waste is already overwhelmed. Only 9% of the plastic waste in the world has ever produced has been recycled. Most ends up in, dumps, landfills or in the environment. If current use patterns and waste management practices continue, then by 2050 there will be around twelve billion tons of plastics waste in landfills and the environment. One of the most frequent single-use plastic found in the environment is plastic bags. These bags are the waste products of a throw away culture that treats plastic as a disposable material rather than a valuable resource to be harnessed. Moreover, Giacobelli, (2018) reported the challenge in such a way that plastic waste causes huge problems when it leaks into the environment. Plastic bags can block waterways and exacerbate natural disasters. By blockage sewers and providing reproduction grounds for mosquitoes and pests, plastic bags can raise the spread of vector-borne diseases like malaria. High concentrations of plastic materials, mainly plastic bags, have been found blocking the airways and stomachs of hundreds of species. The economic damage caused by plastic waste is huge. Plastic litter in the Asia-Pacific region alone expenses its tourism, fishing and shipping industries 1.3 billion dollar annually. Cleaning plastic waste from coasts and beaches costs about 630 million Euro annually in Europe. Studies put forward that the total economic damage to the world's aquatic ecosystem caused by plastic amounts to at least 13 billion dollar per year. The environmental, health and economic reasons to act are obvious. In a similar way Nyampundu (2020) described that the primary worldwide environmental issue in both developing and industrial countries is how to

best recognize and manage waste. Solid waste management has been well-known to be a global issue, which affects every person and government. As urbanization continues to grow and expand, managing solid wastes poses major environmental and public health problems especially in urban areas throughout the world.

Effective solid waste management is critical for achieving sustainable development in municipalities. In the last half century, urban cities around the world have grown significantly, and experts forecast that this trend will continue into the future. As the population number increased with rapid urbanization can put a huge stress on municipalities, particularly in developing countries. Without appropriate solid waste management practices and services, there is a slight chance of achieving the related Sustainable Development Goals (Hondo, 2020). Therefore, sustainable development has become a vital constituent for both countrywide and global companies. From this point of view the focus is much more on protecting the society and environment. And hence, waste management is an insightful area for organizations (Izverciana and Ivascua, 2015).

Solid waste varies in generation rates and compositions between localities due to socio-economic and climate seasons. This inconsistency makes solid waste data more complicated to achieve, but also most important for planning valuable waste management. According to Ngoc and Schnitzer (2009), it is fundamental in waste management to know the pattern of waste generation and their factors. Similarly, Beigl, Sandra and Stefan (2008) described that solid wastes data is applicable in estimating human resource, equipment and material recovery, physical and chemical; and thermal properties as potentials for policy decisions. Data is important in evaluating sizes and locating collection facilities and route design for waste disposals. The findings revealed by Ezeah and Robert (2012) indicated that from waste management in many parts of the world where a consistent database is used to recognize appropriate policies that go well with local conditions. Thus, a consistent database is essential to identify proper policies for capable of solid waste management in cities of developing countries.

Increasing in solid waste production where more than the capacity of the cities and municipalities, the municipal wastes is not well managed in developing countries. It was reported that waste collection rates are frequently lower than 70% in developing countries and more than 50% of the collected waste is mostly disposed of through uncontrolled land filling (UNDESA, 2012). Overall the African countries contribute about 5% of solid waste generated in the world, 44% by the Organization for Economic Co-operation and Development and twelve percent by Latin America and the Caribbean. Solid waste collection in developing countries is less than 50% compared to

about 98% in developed countries and in most cases disposal is at land fill or open dumpsites with inadequate organized recycling (Hoorweg and Bhada-Tata, 2012)

As a developing country, Ethiopia is one of the countries that faced the consequence of inappropriate solid waste management. It was reported about 20 % to 30 % of the waste generated in Addis Ababa leftovers uncollected (Dijk and Tilay, 2014)

B) Segregation at sources

In developed countries, solid waste management methods have developed in stages over many years. In Japan, for example, separated waste collection was first implemented in the 1970s. As time passed, waste segregation was gradually established among Japanese citizens as a daily practice (Africa Data Book, 2019). Furthermore, in developing countries waste separation is not commonly practiced (Hoorweg and Bhada-Tata, 2012). Segregating waste at source ensures that waste is less contaminated and can be collected and transported for further processing. Solid waste segregation also optimizes waste processing and treatment technologies. It results in high quantity of segregated material that could be recycled and reused, leading to less use of virgin material (Ministry of Indian Urban Development, 2016).

To achieve sustainable municipal solid waste management, source separation for recycling has been recognized. However, most low income countries like Thailand have been facing with low level of source separation practice and lack of recycling facilities (Vassanadumrongdee and Kittipongvises, 2018).As part of waste management, segregation of municipal waste management at source is critical to ensure that the waste is separated into organic and dry recyclable fractions. Segregation of municipal waste management at source, by separating organic and dry recyclable fractions, is critical to avoid cross-contamination and to maintain the quality of the materials, which will lead to more effective recycling and divert waste from landfill. Further, segregated waste reduces health and safety related risks to waste pickers and to the ecosystems around the waste treatment and disposal sites. And also the high recycling rates in high-income countries are now almost all based on segregation at source, resulting in relatively clean fractions being collected for recycling (Wilson, 2015).

In Africa, for example, households indicated that they did not separate solid waste because they could not afford separate bins for separated waste (Banga, 2011).Since awareness and attitudes changes are very important to the success or failure of a solid waste management system, managing to mobilizing the community towards waste storage and separation, recycling, and collection frequency, amount of waste, willingness to pay for services, and resistance to locating treatment sit

is so fundamental (Asefa, 2017). Similarly in Egypt, there are no municipal waste management source separation practices implemented (Hemidat et al., 2022).

According to Abebe (2017), the findings of the study revealed that the solid waste management system of Addis Ababa is not practicing in consideration of source separation and resource recovery, especially the collection and transportation system following a mixed way of disposal even the separated solid wastes are collected and transported in a mixed way system.

2.2 Empirical review

2.2.1 Solid waste segregation practices at household and outdoor level

Waste separation or segregation before or during collection increases efficiency and reduces costs because it minimizes the labor and infrastructure costs required to segregate mixed waste. However, in most developing countries waste separation/segregation is not performed regularly by the users at source, making the segregated collection of waste difficult in the urban areas (Saja et al., 2021).

According to Kihila et al. (2021), there is still inadequate of implementing recycling programs in sub-Saharan African countries in terms of waste segregation, recycling, strategies for behavioral change as well as the use of limited technologies for reuse, recycle and recovery. Studies on waste management practices indicate that waste segregation in various low income countries is not properly implemented but instead waste is all mixed up.

In Ethiopia, the generated waste ranges between 0.25 to 0.49 kilogram per capita per day, even though the nature and amount of generated waste is different from each source: dwellers, institutions, commercials, industries, hotels, and street sweepings are the major sources of solid waste generation in the urban area of the country (Hirpe and Yeom, 2021). For instance, from the total volume of municipal solid waste generation of Addis Ababa, households account for 70 %, commercial institutions (9 %), industries (6 %), hotels (3 %), hospitals (1 %), street sweepings (10 %), and other sources (1%). Moreover, solid waste management strategies such as prevention(reduce), reuse and recycling (including solid waste collection, segregation, transportation and disposal) have been rarely adopted in Ethiopian cities .Solid waste separation at the source can encourage reuse and recycling practices that can also promote the informal private sectors to engage in such business (Tassie et al,2019).In line with this, World Bank report (2018) described that the Sub-Saharan African countries generated approximately 174 million tons of solid waste in 2016 at a rate of 0.46 kilograms per capita per day, which is expected to triple by 2050.

The Ethiopian solid waste management proclamation (513/2007) Act No 11(1) states that each household head shall ensure the non-decomposable solid wastes are segregated from those that are destined for final disposal and are taken to the collection site designated for such wastes. And also Addis Ababa City Administration revised integrated solid waste management regulation number 100/2018 Act (4) states that any individual that rents a house shall have the obligation to cause his renter to separate and collect solid wastes in this compound.

The Ethiopian Standard ES 6433:2021 on storage of segregated domestic solid waste at source revealed that separate storage of unmixed wastes at the source of waste generation is the first essential step towards waste management. Moreover, this standard describes the dry waste shall be segregated in to different categories and sub-categories such as paper, cardboard, plastics, glass, metals etc for further recovery and recycling.

Moreover, in urban areas, solid waste separation at the source has a vital benefit in encouraging reuse and recycling strategies. The informal private sectors have promoted the reuse and recycling of solid waste; for example, individuals are known as “*koralewos*” who buy reusable jars, bottles, and other recyclable materials from households (HHs) and sell them to shopkeepers and other buyers. Sometimes, from the dumpsites, they collect reusable and recyclable solid wastes and sell them to private companies (Hirpe and Yeom, 2021).

2.2.2 Solid Waste Segregation Challenges at household and outdoor level

Currently the solid waste especially those which are plastic wastes pose human and environmental issues globally particularly from African countries which have a high proportion of mismanaged waste plastics and lack state of the art recycling facilities (Babayemi et al., 2019).

In the case of non-biodegradable polymeric/plastic wastes, nowadays there is a widespread in urbanization, growing in population density, and rise in living standards together with versatile use of polymers have caused non-biodegradable polymeric/plastic wastes disturbing the environment as a main problem. Currently, polymers are materials that are contributing primarily in our daily household tasks. Due to the huge applications of polymers in different sectors, their global production and disposal have been increased enormously over the years. However, the plastic wastes are bulkier than the organic residues and a large part of the wastes do not degrade. Therefore their permanent demand has caused non-biodegradable waste accumulation in the site where waste material has been buried, consuming massive space and contributing to environmental hazards (Dwivedi et al., 2019).

With regard to disposal of generated solid waste and its segregation, for attaining environmental protection and imposed health and well-being, low and middle income countries particularly face continuous challenges in providing sustainable waste management service to their population due to the lack of organization, financial resources and the systems complexities (Kalyanasundaram et al., 2021)

In Malaysia, the public contribution on solid waste segregation and recycling is still at the low level due to lack of awareness and exposure on the advantages of recycling in the long term (Malik et al., 2015). Similarly, in Vietnam, separation of waste from household is not practiced at sources. Households have their own plastic or metal trash bins, or bamboo baskets. However, most of the residents use plastic bags to store waste before putting them in trash bins. Residents take the bins or plastic bags out so that collectors can easily collect those materials (Loan et al., 2016).

Moreover, attitudes and perceptions toward waste segregation at source and rating of waste disposal issues in people's minds and in the scheme of official growth plans have not been sufficiently considered which has thus led to the recent increase in waste disposal problems in low income countries in such a way that communities in Malaysia, do not have the attitude as long as their wastes are collected, "I don't care about what comes out of the waste, where and how those wastes are disposed as long as they are collected from my surrounding" (Otitaju and Seng, 2014).

According to Rao (2018), there is no proper segregation of organic, inorganic and recyclable wastes at the household level. Inappropriately managed disposal of waste can cause significant risk to health and environment concerns. Improper waste management leads to substantial negative environmental impacts for instances pollutants of air, soil and water. The environmental problems are growing rapidly. Plastic bags; plastic thin sheets, plastic waste, and household are a major source of pollution. In day today activity, plastics are more unpreventable waste. A clean environment influences good health and improves the quality of human's life. Awareness and education are very essential for waste disposal for household level.

According to Abegaz et al. (2021), the study conducted in key towns and cities of Ethiopia have indicated that solid wastes are not properly handled and managed, mainly due to institutional, regulatory, financial/economical, and public participation problems mainly associated with institutional, social and contextual aspects.

Social Factors

The issue of social acceptability is often reduced to a lack of awareness (i.e., ignorance) of local residents (Abebe, 2017). However, environmental awareness or knowledge does not necessarily translate in environmentally friendly solid waste management practices, such as waste reduction, recycling or composting (Desa et al., 2011).

Contextual Factors

In organizational and operational problems, the lack of an effective policy enforcement system and technical standards represents a major constraint. The overall lack of environmental awareness and education of the public and policy-makers about the topic of waste management only perpetuates these unsustainable waste management systems. Communities will require to embrace contextually integrated, a strong participatory, complex, but adaptive solid waste management if real progress is to be made in the solid waste management practices of the developing countries (McAllister, 2015).

Institutional Factors

Schübeler, (1996) stated that “Institutional aspects concern the distribution of functions and responsibilities and correspond to organizational structures, procedures, methods, institutional capacities, and private sector involvement.” Inefficient institutional structure, inefficient organizational procedure, and deficient management capacity of the institution cause inefficient solid waste management service (Farah, 2019).

Economical Factors

Waste management (segregation) from waste sources is an effective way to increase the selling value of waste and reduce waste that dump into landfills (Nizar et al, 2019). Waste recycling can provide economic benefits for the community. However, the price of waste or used goods is very dependent on the conditions and conditions of the world market. If waste segregation done correctly, it will be a significant source for community income and job creation through selling used goods, recycling household waste into organic fertilizer or reuse of used products.

Many literature reviews discussed in (theoretical and empirical review literatures) above are focused mainly on the overall solid waste management practices and their outcomes all over the world. However, as one component of solid waste management, the segregation practices and challenges at household and outdoor level in Addis Ababa are not addressed and studied by different authors even if a single empirical study was conducted on solid waste segregation as if its value chain impact across the solid waste management is minimizing a lot of problems. Moreover, there is a lack of empirical study on solid waste segregation in terms of institutional, social,

economical and contextual aspects in Addis Ababa. Therefore, the researcher focused primarily on this gap including poor segregation practice and identification of its challenges in Addis Ababa City in terms of institutional, social, economical and contextual aspects.

2.3 Conceptual Framework

Otitoju and Seng, (2014), suggested that solid waste segregation is a complex task which shall go beyond purely technical considerations to institutional, social, financial, and economical aspects. Based on literature review, discussion with experts, empirical studies, and personal observation, the conceptual framework for the study is formulated as shown in figure 1.

The conceptual framework shown in figure 1 below illustrates the relationship between factors (institutional, contextual economical and social aspects) affecting solid waste segregation practices at household and outdoor level. Institutional factors that influence solid waste segregation can include institutional capacity, financial, knowledge and skill, resources, expertise, equipment and tools. Social factors can include attitudes of residents and allow sense of responsibility towards solid waste segregation. Contextual factors can include environmental health. And also the economical factors include income generation and job creation .The conceptual framework in figure 1 presents of the major factors determining the study that influence solid waste segregation. Regarding the relationship between institutional, contextual ,economical and social aspects, the research can describe all aspects such that social are related to contextual at the same time contextual aspects are related to institutional and social aspects and vice versa; and finally all aspects in one way or another way related with solid waste segregation practices. Additionally, institutional, contextual economical and social aspects are related with solid waste segregation practices which could influence the effectiveness of the whole waste management system. From this relationship, the research can help understanding of solid waste segregation practice at household and outdoor level which can be considered as dependent variable while institutional, contextual, economical and social aspects are independent variables. The framework also shows that the segregation practice can be done during the waste generation, disposal or recovery stage but this may be difficult as a result of unmanageable volume.

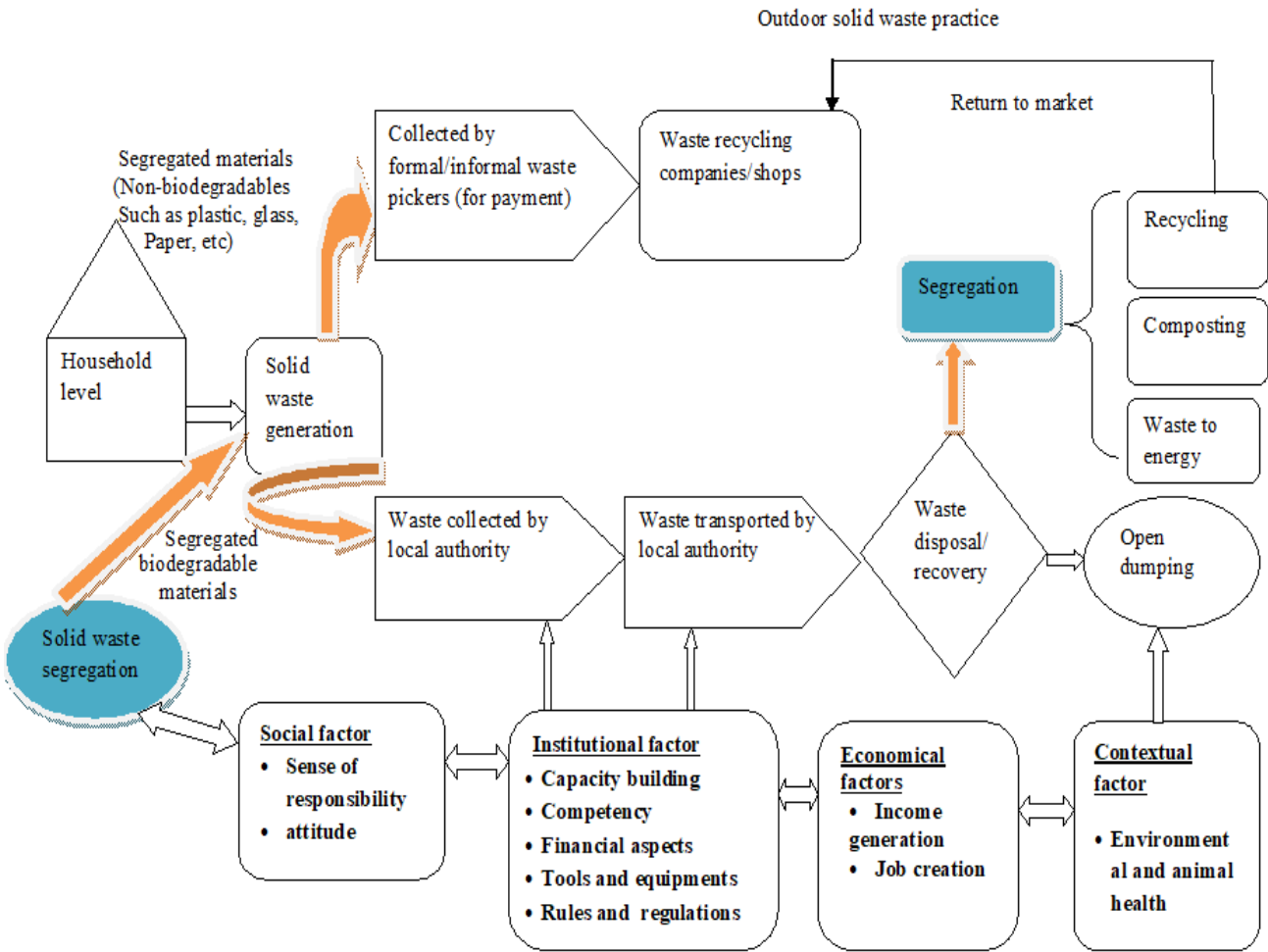


Figure 1: Conceptual framework for solid waste segregation
 Source: Adapted from Lissah et al. (2021) and Saja et al. (2021)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Description of the Study area

Addis Ababa is the political capital of Ethiopia and the country's most important commercial and cultural centre. It is geographically located at the heart of the nation, between 8°50' to 9°40'N latitude and 38°38' to 38°54'E longitude (Figure 2). Its average altitude is 2,400 meters above sea level (m.a.s.l.), with the highest elevations at mount *Entoto* in the north that reach about 3,200 meters a.s.l. This makes Addis Ababa among the high-altitude of the global cities. Addis Ababa occupies a total of 540 square km of land which is, enclosed by hilly landscape in the north and waste. Addis Ababa city is drained by small rivers called Akaki (including small and big Akaki) which originate in two locations and join around the end of the city. Small and big Akaki streams are considered to have played a major role in structuring the land form of the city (Abnet et al., 2017).

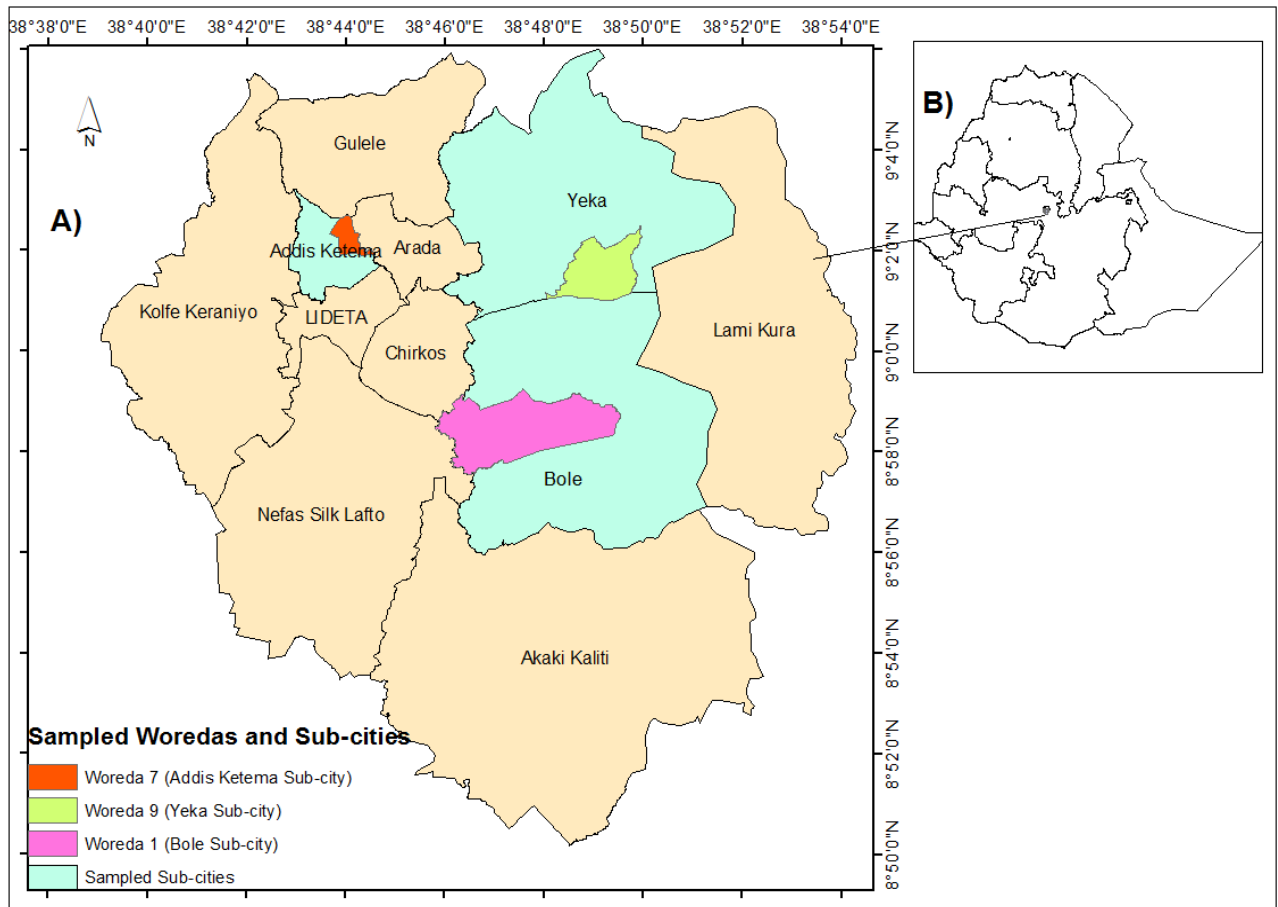


Figure 2: Map of Addis Ababa Sub-cities with selected *woredas*

Source: Developed by researcher using Ethio-GIS database (2007)

Climatic Condition:-According to National Meteorology Agency (NMA, 2017), Addis Ababa has sub-tropical highland climate with a reasonable temperature approximately 23°C average maximum and 11°C average minimum throughout the year. The major rainy season, which is locally referred to as *Kiremt*, extends from June to early October, and the second rain (*Belg*) occur between early March and mid-April. The average annual rainfall is about 1,200 mm, out of this nearly 80% falls during the major rainy season.

Administrative structure: Addis Ababa is one of the two independent chartered cities in Ethiopia with the status of a particular autonomous region within the country's federal government system. Its Council is accountable for both the city voters and the federal government. The city is divided into 11 sub-cities Known as *kifle-ketemas* and the sub-cities are again divided into different *woredas*, which are the lowest administrative units. In total the city has 121 *woredas*.

Demographic Status:-According to the National Central Statistical Agency (CSA, 2015) which revealed that the national census projections put the population of Addis Ababa to be 3,273,000. The population of Addis Ababa accounts for 3.6% of the national population and 18% of the urban population in Ethiopia. It has shown an annual rate of population growth of 2.1%. The city has very high inflow mainly due to rural to urban migration.

Major Economic Activities:-The day-to-day life activities of the city's population is mainly depend on various types of occupation: trade and commerce (22.6% of the population), manufacturing (21.6%), construction industry(15.3%), public service (13.5%), transport and communication (9.6%), social services (including health and other) (8.1%), hotel and other similar services(6.2%), and urban agriculture(3.1%) (Abebe, 2017). Similarly, the city has a considerable capacity of delivering economies of scale in terms of concentrated demand, specialization, diversity, innovation, and technology transfers and thus magnitude of operation (Hoornweg and Bhada-Tata, 2012).

Solid waste Management:-According to Gelan(2021), it is estimated that daily about 0.45kg per capita per solid waste is generated in the existing management practice of the city. Thus, considering the geographical area and population number, the average waste generation is estimated to be about 330kg/m³ and approximately 6019 m³ solid wastes is generated in the city on a daily basis. The estimated physical composition of the wastes include:4.2% vegetables,2.5% paper,2.9% rubber/ plastics, 2.3% woody materials, 1.1% bone, 2.4% textiles, 0.9% metals, 0.5% glass, 15.1% combustibles leaves,2.5% non-combustible stones, and 65% different fine materials (sand, ash, and dust).The produced quantities of municipal solid waste are directed to an uncontrolled landfill site

called *Koshe* (Reppi) which has been blamed for possessing serious health and environmental risk including bad smell and leaching to neighborhoods (surrounding) communities.

3.2 Research Methods

3.2.1 Study design and approach

Descriptive research design was used to study the solid waste segregation practices and challenges of Addis Ababa community. It is a kind of research design that aims to get information to systematically express the context in relation to the situation, phenomenon, or population. As a result, it enables the researchers to collect data from a large number of respondents on the solid waste segregation practice and challenges in Addis Ababa city at household and outdoor level. The research design was included both quantitative and qualitative designs (mixed methods) in such a way that quantitative research is a research method that is used to generate numerical data and hard facts, by employing statistical, logical and mathematical technique while qualitative research is used to get an in-depth understanding of motivations ,experience, attitudes, and intentions of human behavior on the basis of observation and interpretation, to find out the way people think and feel (Ahmad et al., 2019). As a result, both qualitative and quantitative data types were employed to collect primary and secondary source data in this study.

3.2.2 Data Source

The study was carried out by collecting primary and secondary source data. Both methods are relevant in obtaining data for the study.

The data collected from primary sources were used in both quantitative and qualitative data types. Quantitative data was primarily obtained through household survey, whereas qualitative data was generated through Key Informant Interviews (KIIs), Focus Group Discussions (FGDs) and field observation. Interview with pre-determined questions and checklist was among data collection tools to be used in this study.

Secondary data defined as the research data that has been already gathered and can be accessed by researchers. These types of data could tell us the existing documented information relevant to the study objectives that could be raw, semi processed or processed ones like publications, reports and written documents, Medias, policies and strategies of the government, etc.

3.2.3 Sampling technique and Sampling size determination

According to Singh and Masuku (2014), the sampling technique and sampling size determination have a central role in survey-based research problems in applied statistics. Conversely, sampling techniques are usually used for research investigations to better estimate at low cost and less time with greater precision. Having this consideration on sampling technique, there are many ways to draw a simple random sample such that the most common way to take the sample is the lottery method. Moreover, cluster sampling is a sampling method where the entire population is divided into groups, or clusters and a random sample of these clusters are selected. All observations in the selected clusters are included in the sample. Cluster sampling is a sampling technique used when natural but quite homogeneous groupings are evident in a statistical population and in case of simple random sampling, each unit included in the sample has equal chance of inclusion in the sample. This technique provides an impartial and better estimate of the parameters if the population is homogeneous.

Cochran (1977) the one who provided a simplified formula to determine the sample sizes, as a result the formula was used to calculate the sample sizes with a ninety five percent confidence level and a maximum variability in a population of 0.5. Therefore, the following formula (Eq. 1) was used to estimate sample size.

$$n = \frac{Z^2 pq}{e^2} \dots\dots\dots \text{Equation (1)}$$

Where, n is the sample size, z is the selected critical value of desired confidence level, p is the estimated proportion of an attribute that is present in the population, q = 1-p and e is the desired level of precision.

Selection Requirement:-The annual and biannual report (2020/21) of Addis Ababa Cleaning Management Agency sub-cities have different waste generating capacity, which generally categorized as low, medium and high. Based on this information, cluster sampling method is planned so as to fairly represent the sub cities in which they are also further categorized into Central(Kirkos, Lideta, Arada and Addis Ketema Sub-cities) and peripheral (Nefas silk, Kolfe Keranio, Gulele, Bole, Yeka, Lemi-kura and Akaki Kality sub-cities) based on geography according to Addis Ababa Cleaning Management Agency classification criteria. Therefore, the sample sub-cities were randomly selected based on lottery methods from the 10 sub-cities of Addis Ababa that are assigned to have representative samples from low, medium and high solid waste generating clusters. But the newly established sub-city known as *Lemi-kura* was excluded due to absence of enough data for the study. According to the office 4 (Kirkos, Lideta, Addis Ketema and Arada), 3

(Akaki, Yeka and Gulele) and 3(Bole, Nefas silk Kolfe-keranio) sub-cities are rated as low, medium and high, on their solid waste generating capacity, respectively. After determining the sample sub-cities from each cluster based on the Agency’s classification criteria , *woredas* of sample sub-cities were further again clustered into low, medium and high solid waste generation capacity. Then one sample *woreda* from each category by lottery method which yields 1 sample *woreda* from one sub-city that totaled as 3 sample *woredas* was sampled. Here, it is important to note that one *woreda* representing own category, i.e., one *woreda* with low waste generating capacity sub-city (Addis Ketema), one medium solid waste generating *woreda* from sub-city grouped as medium capacity (Yeka sub-city) and one high solid waste generating *woreda* from high solid waste generating sub-city (Bole) was selected from the 3 clusters of the sub-cities. Then thirdly, using Probability Proportional to Size (PPS) technique the sampled households were allocated to each *woredas* based on their population size. Lastly, households were chosen from each sample *woreda* using a simple random sampling method.

In order to determine the sample size based on the procedure described above, Bole, Yeka and Addis Ketema are nominated by lottery method to represent low, medium and high solid waste generating sub-cities. After this stratification and lottery tossing, *Woreda* 01, 09 and 07 respectively are indentified as potential candidates representing *Bole, Yeka and Addis Ketema* sub-cities respectively, which have a total of 3523, 4573 and 3576 households respectively. From this data, the total population size (N) was 11,672.

And then, by using the Cochran (1977) formula in terms of ninety five percent confidence level and 0.05 precision; Due to the time constraint, the researcher considered and assumed the degree of

variability to be 20% and then, $n(\text{sample size}) = \frac{z^2 pq}{e^2} = \frac{(1.96)^2 * 0.20 * 1 - 0.20}{(0.05)^2}$

$$n = \frac{(1.96)^2 * 0.20 * 0.80}{(0.05)^2} = 245.$$

Therefore, **n = 245.**

The sampled proportion was distributed in each *woreda* by the number of household number proportional as: $nh = \left(\frac{Nh}{N}\right)n$

Where Nh= population on each *woreda*, N= total household population, nh=total sampled population.

Table 3. 1: Total household population (N) and sample size (n) of the study

S.no	Name of sampled woreda and sub-city	Number of household	Sample size from each woreda
1	Woreda 01 in Bole sub-city	3,523	74
2	Woreda 09 in Yeka sub-city	4,573	96
3	Woreda 07 in Addis Ketema sub-city	3,576	75
Total		11,672	245

Data Collection: Quantitative data were generated through structured questionnaires survey. And the qualitative data was generated using key informants interviews (KIIs), focus group discussions (FGDs) and field observation. Regarding the key informant interview, purposive sampling technique was applied from each sample *woredas* and Addis Ababa Solid Waste Cleansing Management Agency through which it includes one KII respondent each from solid waste transportation team, community awareness and social participation team, solid waste reuse and recycling team; totally nine team leaders were selected and interviewed from each *woreda* and three team leaders/higher experts from Agency. Since there are single partnerships / licensed associations in each *woreda*, out of the existing licensed associations or partnerships representative (chairperson or other management members) were purposely selected at a rate of one leader from each *woreda* which were totally three leader respondents were interviewed as key informant interviewee from the three *woreda* partnerships/ licensed associations. In general, a total of 15 key informants were reached. Moreover, the FGDs from the partnerships were conducted with a group of people in each sampled *woreda* to supplement data collected through household surveys. Totally, three FGDs were conducted sampled from solid waste associations or partnership, i.e., one FGD in each sampled *woreda*. Focus groups discussions(FGD) from Bole *woreda* 01, Yeka *woreda* 09 and Addis Ketema *woreda* 07 consisted of 8,10 and 12 participants respectively which were organized from people of diverse characteristics like sex, age and social categories (youth, adult and elderly, female and male). FGD participant's selection was done through consultation with *woreda's* solid waste cleansing management office and relevant experts based on pre-set requirements of the researcher.

Procedure: Then after, enumerators were recruited and properly aware for the household survey from the three sampled *woredas* in collaboration with the three *woreda* solid waste cleansing management office. The awareness delivery program was focused on survey procedures and methods, questionnaire and ethical consideration. In order to keep away from the communication gap among enumerators, respondents and the researcher, the survey questionnaire was translated into Amharic (local language) during the preparation step. Every question of the household interview questionnaire used for the survey was written both in Amharic and English that run together on a continuous line in order to reduce any language induced communication gap. In this regard, a questionnaire pre-test was conducted in non-sampled *woreda* i.e., in *woreda* 06 of Bole sub-city was made on 20 respondents, and then the questioner was improved before administering the actual survey. Then, the primary quantitative and qualitative data were collected through household survey, focus group discussion (FGDs), key informant interviews (KIIs) and field observation. The researcher closely supervised the survey, which was conducted for a period of May 2022.

3.3 Methods of data Analysis

The quantitative data which is collected from questionnaire survey and secondary data sources was analyzed based on the data type using latest version SPSS software and excel tools in order to describe overall key findings and circumstances.

This data analysis focused on observations and measurements that can be made objectively and repeated by other researchers. Before analysis, data coding of responses and analysis was made. To analyze the data, the data was coded to latest Version 26 SPSS software as it collected from questionnaires. This activity involved classifying, identifying, and assigning a numeric or character symbol to data, which was done in only one way pre-coded. Through the data analysis, exploration of data was made with descriptive statistics which may be presented by graphical, percentage and tabular form of analysis to show the severity and depth of problem observed in the study area and major descriptive techniques was used to summarize and compare the data. In this regard, Chi-square test was used to test the relationship between solid waste segregation and each variables used in the study (Ugoni et al., 1995).

This data type is non-numerical in its nature. This type of data is collected through methods of observations, conducting focus groups, one-to-one interviews, and other similar methods. This means that the data collected are in the form of words and sentences. Mostly, such data captures feelings, emotions or subjective perceptions of something else. Qualitative data are exploratory in

nature and mainly concerned with gaining insights and understanding on underlying reasons and motivations. And those data collected from KII and FDG were used for voice recording and writing notes in sampled areas.

Therefore, this study in general provides that the quantitative data were analyzed by means of descriptive statistics and the qualitative data were analyzed by narration. Data were first checked manually for completeness and then coded, entered, and analyzed using Statistical Package for the Social Sciences (SPSS) version 26 software using descriptive statistics such as frequency and percentage. Finally, Chi square was performed to analyze gender, educational level, monthly income, marital status; home type, awareness, guideline, social organizations, etc were tested to identify their correlation with solid waste segregation.

3.4 Ethical Consideration

Since the study involved human participants, the research proposal and assessment tools were submitted and approved by my advisor on behalf of Addis Ababa University for compliance with the rules and regulation of the university code of ethics that are in line with national and international ethical guidelines. At the same time, before starting the survey/interview, enumerators informed each respondent about the purpose of the study, data management strategy and confidentiality statement, asked for the willingness of each interviewee and communicated to them that they can leave the interview at any time whenever they feel uncomfortable. Therefore, the enumerators (7 individuals, i.e, 4 individuals from the two sampled *woredas* and other three individuals from the third sampled *woreda*) interviewed totally 245 respondents who gave their full consent for the interview. Additionally, codes were used during analysis and reporting instead of using respondents' names or other features that could lead to the identification of the individual. As per the agreement with respondents, all records used only for research purpose and the information were strictly kept confidential and will be kept in the same way at all time, as per national and international ethical procedures.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Socio-Demographic characteristics of the respondents

Socio-demographic characteristics of the respondents mainly the gender, age, educational level, marital status, occupational status, monthly income, family size, and home residence are given below.

4.1.1 Gender, family size, marital and educational status

As shown in table 4.1 below, about 42.2 % of the respondents were males and the remaining 57.8 % were females. Regarding the marital status of the respondents, the majority of them (62.7 %) were married and nearly quarter (27 %) of were single respondents. Quite small proportions of the respondents were found to be widowed (6.1 %) and divorced (4.0 %). Looking at the family size of the surveyed households, nearly half of them (47.5 %) had a family size between 4 and 6 followed by 43 % of the respondents with family size of 1 to 3. Only one household (0.4 %) was with a family size above 10 and the remaining households (9 %) were found to have a family size in between 7 and 10. The family size could have direct impact to the volume of waste to be generated and at the same time it could also affect the effectiveness of segregating wastes as the family size increases, it may lead to have sufficient labor to timely segregate the waste at home. Almost half of the surveyed respondents (48 %) were in the age group of 31 to 45 years followed by 24.1 % of respondents with age group between 18 and 30 years. 18.9% and 8.6 % of the respondents were in the age group between 46 and 60 and 61 and 75 years, respectively. Only one respondent (0.4 %) was found with more than 76 years of age. This result showed that the majority of the study populations were within active working age, indicating that the age might not be a limiting factor to be engaged in solid waste segregation at least at household level.

The result as presented in table 4.1 showed that almost one fourth of the sampled respondents (27 %) were first degree holders, which was followed by 19.3, 16 and 11.9 % of respondents with educational status of second cycle (grade 5 to 8), high school (grade 9 to 12), and diploma, respectively. Nearly the same proportions of households (8.1, 7.8 and 6.6 %) were found to have educational status of illiterate, first cycle (1-4) and above first degree, respectively. Smallest proportions of the households (3.3 %) were found to be certificate holders. The education status of the population is very critical in dissemination and adoption of intended knowledge and information (Saseanu, 2019).

4.1.2 Economy of survey households (HHs)

This section presented occupation, income and housing condition of survey respondents as these variables could have implications on solid waste management. With regard to the occupational status, the data presented in table 4.1 showed that around one fourth of the respondents (27.9 %) were civil servants. Nearly the same proportion of the study participants (21.3% and 21.7 %) were self and private sector employed, respectively. In addition, 16 and 6.2 % of the respondents were housewife and retired, respectively. Quite small proportions of the respondents (1.2 %) were found to be students whereas the remaining 5.7 % of the respondents were engaged in other job types. From the above livelihood options of the surveyed households, their monthly earnings have wide variation ranging from less than 1,500 birr/month to over 9,500 birr/month. As shown in the table, relatively larger proportions of households (26.6 %) were earning 6,501 to 9,500 birr/month. Following the larger proportion, 23.8, 18.9, 14.3 and 13.1% of the surveyed households were earning monthly income of 1,501 to 3,000, 4,501 to 6,500, more than 9,500 and less than 1,500 birr/month, respectively. Monthly incomes between 3001 to 4500 birr/month were earned by the least proportion of the households (3.3 %). From this result and considering the current significant inflation of goods and services, it can be assumed that the monthly income generated by the majority of the household may not be enough to afford purchasing of a permanent waste separation material like durable waste bins.

Regarding home residence, almost half of the participants (49.2 %) lived in private rented houses whereas, nearly quarter of the respondents (25.8 and 25 %) lived in their own private houses and in government rented houses, respectively. In this case, it can be assumed that as the majority of the respondents are living in private rented houses, they might not feel strong responsibility for implementing segregation of wastes at their home or outdoor level, of course, this should be further investigated.

Table 4. 1: Socio-demographic characteristics of respondents

Variable	Frequency(n=244)	Percentage (%)
<i>Gender</i>		
Male	103	42.2
Female	141	57.8
<i>Age</i>		
18-30	59	24.1
31-45	117	48
46-60	46	18.9
61-75	21	8.6
> 76	1	0.4
<i>Education Level</i>		
Illiterate	20	8.1
1-4 grade	19	7.8
5-8 grade	47	19.3
9-12 grade	39	16.0
Certificate	8	3.3
Diploma	29	11.9
First Degree	66	27.0
Above First Degree	16	6.6
<i>Marital Status</i>		
Single	66	27.0
Married	153	62.7
Divorced	10	4.0
Widowed	15	6.1
<i>Occupational Status</i>		
Self employed	52	21.3
Private sector	53	21.7
Housewife	39	16.0
Civil Servant	68	27.9
Retiree	15	6.2
Student	3	1.2
Others	14	5.7
<i>Monthly Income</i>		
<1500	32	13.1
1501-3000	58	23.8
3001-4500	8	3.3
4501-6500	46	18.9
6501-9500	65	26.6
>9500	35	14.3
<i>Family size</i>		
1-3	105	43.0
4-6	116	47.5
7-10	22	9.0
>10	1	0.5

Variable	Frequency(n=244)	Percentage (%)
<i>Home Residence</i>		
Governmental house rent	61	25.0
Private house rent	120	49.2
Private Owned	63	25.8

Source: the study survey, 2022

4.2 Solid waste segregation practice

The results for solid waste segregation practice by the participants are depicted in table 4.2 below provides solid waste segregation practices where the majority of surveyed households (63.5%) considered or thought about the importance of segregating solid wastes. This result implies that the community may have better understanding about the advantage of segregating solid wastes and which could be considered as a baseline for the implementation of actual practice of solid waste segregation. In connection to this, a similar result was reported by Otitoju and Seng, (2014) where they indicated that 86.3 % of the respondents have heard about waste segregation mainly from mass media or discussion with the community implemented the practice while the rest have never heard. Though most of the households have heard about solid waste segregation practices, it may not give a guarantee that they will have a strong attitude towards participation and involvement in actual implementation of the practice. Similarly, Abdel-Shafy and Mansour, (2018) also reported that the success of any designed solid waste segregation depends mainly on the public awareness and the active participation of such waste generators in the different communities.

The respondent's willingness on solid waste segregation was also assessed and our result indicated that the majority respondents (84%) expressed their willingness to implement the practice at home or residence area. This finding clearly indicates that if limited awareness creation and capacity building efforts are exerted, there will be a possibility of translating their willingness into actual practice. A similar case study conducted in Suzhou, China revealed that residents' attitudes and willingness for household solid waste separation showed that the respondents have a very positive attitude that helped fast translation of the practice to put on the ground (Zhang and Wen, 2014).

Table 4.2: Solid waste segregation practice

No	Variables/Items	Characteristics	N	%
1	Have you ever thought about segregating solid waste?	Yes	155	63.5
		No	89	36.5
2	Do you have the willingness to segregate solid waste at your home or residence area?	Yes	205	84
		No	39	16
3	In your residence area, is there any place prepared to segregate waste?	Yes	112	45.9
		No	132	54.1
4	Did you prepare different kinds of containers for each type of solid wastes that can be separated at your home or outdoor level?	Yes	111	45.5
		No	133	54.5
5	Do you separate solid wastes generated from your house before your gate/door?	Yes, I always separate solid wastes	52	21.3
		Yes, I sometimes separate solid wastes	111	45.5
		No, I never separate solid wastes	70	28.7
		I am not sure	11	4.5
6	If the answer to question 5 is yes, what kind of solid waste materials are you separating at household level from the junk (multiple answer)?	Plastics	44	27.0
		Metals	13	8.0
		Cardboard	2	1.2
		Organic (decomposable)	13	8.0
		both plastic and metals	16	9.8
		both plastic and organic materials	63	38.7
		both cardboard and organic materials	2	1.2
all types listed above	10	6.1		
7	If the answer for question 4 is no, what is the reason for the non-segregation (separation) at household or outdoor level?	No facilities to separate	34	25.6
		No need to separate, it is wastage of time	4	3.0
		I am not aware, no information	14	10.5
		Separation requires dust bins which can be bought at high cost, thus I can't afford it	14	10.5
		My household produces very small amount of waste, thus separation is worthless	67	50.4
8	Does your household have the experience of separating wastes from your household at temporarily solid waste disposal places?	Yes ,they always separate properly	73	29.9
		Yes, they separate sometimes	51	20.9
		No, they do not separate at all	90	36.9
		I am not sure	30	12.3
9	If free bins are provided at your home or outdoor, do you segregate the solid waste properly?	Yes	219	89.8
		No	25	10.2
10	Is there practice of free disposal of solid waste in your residence area?	Yes, there is a plenty of solid waste disposed at the roadside or everywhere without management	106	43.4
		Yes, there is small amount disposed at the road side or everywhere	115	47.1
		No, there is no solid waste disposed at roadside or everywhere	17	7.0
		I am not sure	6	2.5

Key: N= number of respondents; % stands for percentage
(Source: the study survey, 2022)

Slightly more than half, i.e., 54.1% from residential area respondents reported that the absence of enough space has been challenging for segregation of waste delivered by the community to the waste collectors, particularly in areas where people live in congested conditions. From this it can be deduced that the absence of sufficient place to segregate the collected waste in-situ around the residential areas is one of the barriers for different communities to practice segregation at required level. In this regard, a study conducted by the United States Environmental Protection Agency (2020) has highlighted that a well-designed storage system will not be effective if places or containers are located at inconvenient places for residents or waste collectors.

Regarding the kinds of containers that could be prepared for each type of solid waste at household or outdoor level, 54.5% respondents reported that they do not prepare different containers for solid waste segregation, while (45.9%) of respondents do not have such materials for solid waste segregation or putting different kinds of wastes separately. This implies that awareness of the community on solid waste segregation from the source (household) remains poor. In relation to this, a study conducted by Tassie et al. (2019) revealed that for actual segregation practices a considerable number of people should have good awareness and appropriate facility to properly implement the practice. If the community has adequate awareness and motivation, individual households can prepare temporary storage containers using materials available at home such as baskets, card boxes, and bamboo made containers, cans, plastic bags, barrels and the like. Similarly, Otitoju and Seng, (2014) found that the provision of more facilities (for example, bins and containers) in housing areas (besides awareness rising) can enhance community to participate in waste segregation.

Among the survey respondents 45.5% and 21.3% respectively reported that they segregate sometime and regularly, while 28.7% do not segregate before disposing the waste from their home or compound and the rest 4.5% were not sure whether they practice it or not. This shows that correct solid waste segregation at household level is implemented by almost one-fifth of sampled respondents while the majority (79%) of respondents either rarely practice segregation or not at all. For the respondents who were not practicing segregation at their home and those who were not sure of segregation, there should be similar measures (e.g public awareness, provision of incentives and fines) by concerned regulatory bodies to enhance the practice in the city. In a similar way, Yoada et al. (2014) found that only 17.3% respondents separate their waste while storing at home and delivering wastes to collectors, which is a reflection of what happens broadly in most African Cities. Likewise, a study by Kihila et al. (2021) revealed that the lack of waste segregation

materials at source and on the subsequent stages of waste management has been a main barrier for the implementation of the practice.

The kind of solid waste materials separated at household level from the junk, out of 163 respondents who segregate the solid waste, 38.7% respondents reported that they separate plastic and organic material, 27% respondents reported they separate only plastic materials and 8.0%, 1.2% and 8.0% respondents reported that they separate metallic, cardboard and organic (decomposable) materials respectively. Respondents who separate combinations of items include 9.8% separate plastic and organic materials, 1.2% cardboard and organic materials and the rest 6.1% separate all types of materials. This shows that households who are practicing solid waste segregation focus on biodegradable and non-biodegradable materials. In connection to this, a study conducted by Tassie, (2018) indicated that households practicing solid waste separation focus on sellable materials which are collected by *quralewos*, and *liwach* (in kind exchange) and also to some extent organic wastes which can be used as organic fertilizer by the household itself.

There are various reasons for the non-segregation (separation) at household or outdoor level. As shown in table 4.2 above, out of 133 respondents 50.4% reported that there were a thought they generate very small amount of wastes and thus separation is worthless; 25.6% did not have the facility for waste segregation; 10.5% pointed the need for dust bins but could not afford (because of cost); and the rest 10.5% were not aware of the segregation practice. In the focus group discussions, local dwellers believed that segregation could be implemented if they were generating large volume of solid waste. Some focus group participants expected external support to fulfill facilities like dust bins while others were not bothered and were unaware on the importance of solid waste segregation. This suggests a lack of awareness and limited motivation to undertake solid waste segregation. In relation to this, Kihila et al. (2021) also found that people ignore segregating waste at the door due to lack of awareness, lack of facilities and equipment, or due to low volumes of recyclable materials generated.

In the case of household experience of separating waste at temporary solid waste disposal places, 36.9% respondents do not separate them at all, and 12.3% were not sure of separating the solid waste. On the other hand, 29.9% of the respondents always separate and 20.9% of them separate sometimes. This show in general that the community has low consideration towards the solid waste segregation practice outside the home rather there is a common thinking “I do not care after I used”. This finding is in line with Otitoju and Seng (2014) which also revealed that communities do not have a favorable attitude towards solid waste segregation as long as their waste is collected: “I do

not care about what comes out of the waste, where and how those wastes are disposed as long as they are collected from my surrounding”. Research conducted in Accra, Ghana by Yoada et al. (2014) also highlighted that citizens do not take responsibility for proper waste disposal (including segregation), rather they rely on the government to dispose their waste. This may be partly due to poor attitude and lack of concern about the environment and public health.

The great majority (89.8%) respondents reported that provision of waste bins from government or non-governmental organizations (NGO) might encourage them to properly segregate solid waste either at home or outdoors. This result implies that the community requires free bins to segregate collected solid wastes. This is consistent with a study by Zhang and Wen, (2014) that described the importance of easily accessible bins as incentive for waste segregators. Similarly, Yoada et al. (2014) also indicated that most respondents said they would be happier if more collecting bins were provided to them.

With regard to free solid waste disposal practice, 47.1% respondents from residence area responded that they observed only small amount of waste disposed at road side or anywhere and 43.4% reported plenty of solid waste disposed at the roadside or everywhere without any improved management practice. However, 7.0% indicated as they don't see free solid waste disposed at roadside and 2.5% respondents were not sure to comment concerning such disposal practice about the waste disposal. This result shows that the majority of the community still has the practice of free solid waste disposal at residential area roadside without any isolation having different volume be it is small or not. Consequently, this kind of waste management practice causes blockage of streams and roadside ditches that has been resulting health impacts both on humans and animals. In a similar way, Yoada et al. (2014) indicated that people of Ghana- in Accra city with 39.0% of the households disposed of their waste in the street, gutters, bushes or any open hole without any segregation. A previous study conducted in Addis Ababa city on municipal solid waste management described that the household members regularly apply temporarily illegal solid waste disposal including on main streets. Study of Tassie et al. (2019) also portrayed that the residents have low attention to clean- their surrounding and nearby roads.

As shown in figure 3 below, regarding the three common solid waste management strategies (i.e., Reuse, Recycling and Recovery, the 3Rs), majority (76.2 %) respondents relate 3Rs with segregation, 12.3% do not know about them and the rest (11.5%) were not sure. Overall, majority of the dwellers had good understanding on the 3Rs strategies which they related with solid waste segregation by considering the economic value of the waste (for instance, use of animal dung or

other decomposable wastes for compost and selling plastic bottles to generate income). In relation to this, Kihila et al. (2021) reported that waste segregation is an important component in the waste management chain to realize effective 3Rs and waste segregation at source may ease handling and processing, which enhances resource recovery, fosters reuse and recycling and reduces operational costs. Similarly, Otitoju and Seng, (2014) suggested that discarded products and waste materials have some economic value if reused or returned to the technological cycle. As a result, source segregation is one of the basics for successful and economically feasible recycling activities.

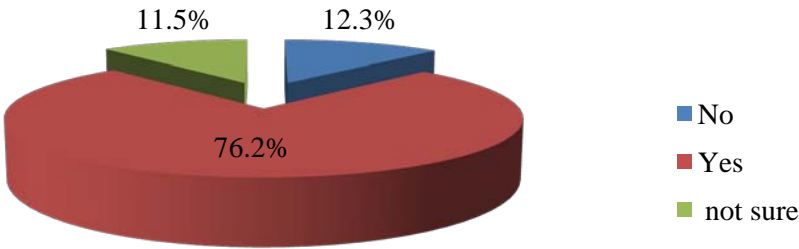


Figure 3: Respondents perception on the relation of solid waste management strategies 3Rs (reduce, reuse and recycling) with segregation

Source: study survey, 2022

As shown in Figure 4, solid waste segregation at the source can be an indicator of achieving waste reduction. In relation to this, respondents were asked whether they think that solid waste segregation at the source is an important way of achieving waste reduction. 73.0% of the respondents thought that segregation practice at the source is effective for waste reduction, while 3.2% of them perceived that it does not has any contribution and the rest were not sure to comment on the relation. Overall, a significant number of the community understood that segregating waste at the source can reduce the volume of solid waste generated at any level. In this regard, a study by Otitoju and Seng, (2014) highlights that the amount of landfill solid waste that could be collected is greatly reduced if segregation is practiced at the source point. Another study by Kihila et al. (2021) also suggests that waste segregation at source may significantly reduce the volumes to manageable amount, which would ultimately improve the collection and disposal efficiency.

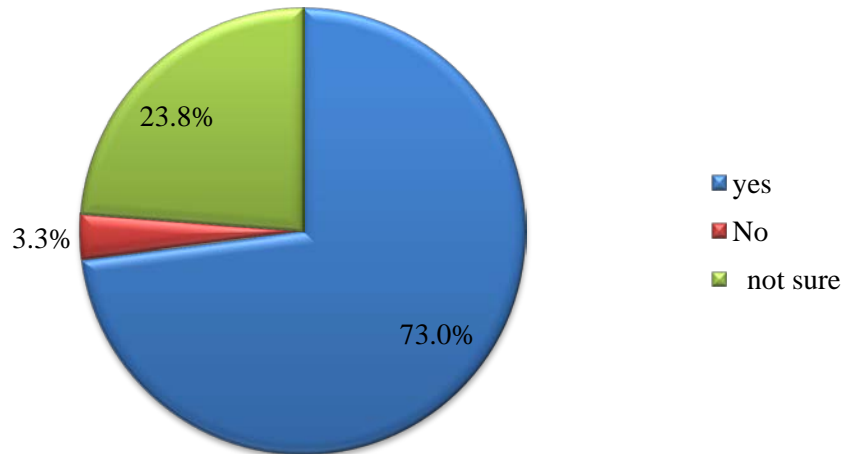


Figure 4: Respondents view of solid waste segregation at the source for waste reduction

Source: Study survey, 2022

Regarding the collecting materials used for waste collection is presented in Figure 5. Among the survey respondents, 65.2% reported that they use sack, 12.3% use plastic bags, 7.7% use plastic and glass containers, 2.5% use metallic materials, while 12.3% do not use any material. Thus, majority of the respondents have been using sacks, which can be reused or recycled for collecting solid waste. However, use of sacks for storing solid waste can also result in escaping of leaching materials which might cause environmental pollution (e.g. through potential water or soil contamination) (Abebe,2017).

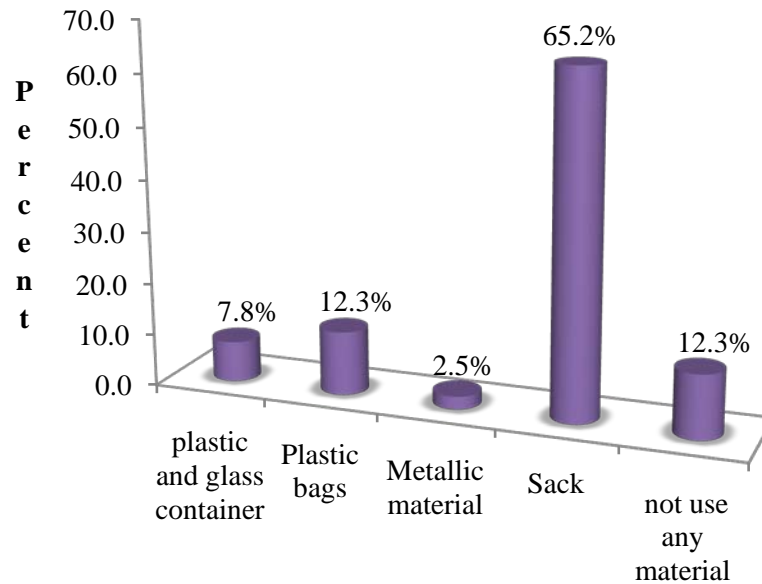


Figure 5: Collecting materials for solid waste

Source: Study survey, 2022

All the key informant interviewee (KIIs) involved in qualitative data generations both from Addis Ababa Cleaning Management Office at *woreda* level and Addis Ababa City Cleaning Management Agency indicated that currently awareness on solid waste segregation is slightly improved due to door-to-door awareness creation program. However, the solid waste segregation practice in the city is still not fully implemented. Concerning this, the KIIs with Associations' Management Members (Chairs) also reported that even if there is awareness creation on solid waste segregation, its implementation was not effective. Similarly, all focus groups involved from the three *woredas* reported that even if the community has some awareness on solid waste segregation, the implementation was still not properly actualized. Apart from this, the KII conducted with sampled *woredas* and Cleansing Management Agency in Addis Ababa City, the practice of preparing containers for segregating solid waste was still poor. The KII participants attributed the poor solid waste segregation to lack of space, finance and low attitude of sometimes community members.

In general, key informant interviews, focus group discussions and survey analysis on solid waste segregation practice confirmed that the level of household understanding and awareness on solid waste segregation is low in Addis Ababa although there has been some improvement lately. As a result, in most residential areas of the city, implementation of proper practices of solid waste segregation have been lagging behind at all levels.

4.3 Solid waste segregation challenges

Table 4.3 provides the challenges of solid waste segregation. The respondents were asked whether they receive any awareness creations or training on solid waste segregation systems or any solid waste management at household or outdoor level from *woreda*. Accordingly, 38.5% respondents indicated that their household members participated sometimes in such awareness creations or trainings while 23.8%, 20.1% and 17.6% respondents reported that their households always participated, did not participate and were not sure, respectively. This implies that a considerable number of the households have no willingness to participate in awareness creation/training program when provided. In relation to this, the study conducted in Kuching South City, Sarawak, Malaysia revealed that public awareness and attitudes to waste can affect the population's willingness to cooperate and participate in waste segregation practices (Otitoju and Seng, 2014).

Table 4.3: Solid waste segregation challenges

No	Variables/Items	Characteristics	N	%
1	Do you get any awareness/training on solid waste segregation from your <i>woreda</i> administration by delegating relevant experts?	Yes ,where my household was properly participated	58	23.8
		Yes, sometimes my household was participated	94	38.5
		No, my household was not invited at all	49	20.1
		I am not sure	43	17.6
2	How do you evaluate implementation of the learning (training/awareness creation)?	Implemented most (>50%) of the learning's	49	20.0
		Implemented some (25-50%) of the learning's	111	45.5
		Implemented very few (<25%) of the learning's	68	27.9
		Almost don't implemented any of the learning	16	6.6
3	Are there any <i>woreda</i> experts coming to your houses to tell you about waste segregation?	Yes	217	88.9
		No	27	11.1
4	If the answer is yes to question 3 above is yes, how do you evaluate the knowledge and skill of experts who are delegated in your <i>woreda</i> administration solid waste management while they are delivering technical support to you?	Excellent	44	20.3
		V. good	64	29.5
		Good	92	42.4
		Satisfactory	17	7.8
5	Is there any supply of collecting materials of which segregated solid waste stored from the government?	Yes, there is sufficient supply of collecting materials	47	19.2
		Yes, but small amount	38	15.6
		No, there is no sufficient supply of collecting materials	139	57.0
		I am not sure	20	8.2
6	Is there a suitable and sufficient place for collecting segregated solid waste prepared by <i>woreda</i> administration?	Yes, there is sufficient and suitable place	60	24.6
		Yes, but not sufficient and suitable place	47	19.3
		No, there is no sufficient and suitable place	137	56.1

No	Variables/Items	Characteristics	N	%
7	Is there a directive (guideline) prepared by <i>woreda</i> administration to implement rules and regulation of solid waste management?	Yes	39	16.0
		No	106	43.4
		I am not sure	99	40.6

Source: the study survey, 2022

Implementation of awareness creation/training learning was assessed, where nearly about half (45.5%) respondents reported that some (25-50% of the acquired knowledge), while the remaining 27.9%, 20.0% and 6.6% respondents indicated that they implemented very few (<25% of the acquired knowledge), most (>50% of acquired knowledge) and don't implement the awareness creation/training learning's, respectively. From the provided awareness/trainings facilitated by the *woreda* cleansing management office, almost half households did not realize how to implement the program. As a result, solid waste segregation remained unpractical at the city level even though a slight improvement observed in limited areas. In general, lack of proper awareness/training affected households solid waste segregation practiced. In a similar case, a study conducted in Philippines indicate lack of awareness/training on proper solid waste management retarded implementation of solid waste segregation practice (Limon et al., 2020). The study conducted in Tabriz, Iran also revealed that the lack of training(education) have caused less engagement of the citizens and less institutionalization of waste separation at source/home affected behavior of the residents, which may have consequently increased the problems of implementation of waste separation at source (Babazadeh et al., 2018). Regassa et al. (2011) also identified that the lack of public awareness and illegal dumping are among the most challenging factors for integrated solid waste management practice in Addis Ababa.

The great majority (88.9%) of respondent's survey affirmed that *woreda* experts were coming to their home to tell them about solid waste segregation. From experience, the frequent contact and discussion of experts with the community on solid waste management has high likelihood of getting experiences and learning from experts. A study conducted by Debrah et al. (2019) indicated that solid waste management can be sustained in the community with the support of education and awareness. However, it is difficult to conclude that the *woreda* experts having contact with the household/community have provided full technical support.

The survey households were asked about the capacity/skill of *woreda* experts concerning their technical support on solid waste management. Thus, they rated the *woreda* knowledge and skill excellent to satisfactory. Accordingly, 42.4% of the respondents reported that the experts have good

performance, followed by 29.5% reported rated the experts have very good performance; and the rest 20.3% and 7.8% respondents rated the experts have excellent and satisfactory performance respectively. From this data, it can be deduced that knowledge and skill of experts is in moderate status but this does not mean that experts have good competency, so it is vital to capacitate the *woreda* experts to properly discharge their duties and responsibilities. A similar study conducted in the East Coast of Malaysia revealed that sufficient knowledge and skill can increase the probability of waste separation behavior at the expert or community level (Fadhullah et al., 2022). As a result of this, experts' knowledge and skill gap could be considered as one of the challenges for solid waste segregation practice.

The possible contribution of having appropriate waste collecting materials (like dustbins, sacks, etc) was assessed. Hence, 57.0 % respondents reported no supply of sufficient waste collecting materials given to the community, while 19.2% and 15.6% survey households reported that sufficient and small amount of waste collecting material supply, respectively but the rest 8.2% were not sure about such material supply. The respondents who reported on getting sufficient supply of material in small amounts seem better practicing solid waste segregation. In line with this, the study conducted in Dares Salaam City, Tanzania revealed that several physical facilities like bags and dust bins improve waste segregation and free provision of bins may promote waste segregation at household level (Kihila et al., 2021). However, based on the analysis of this data, there was no sufficient supply of waste collecting material for the community which might attribute to the poor solid waste segregation. The finding of Boadi, (2013) indicated that lack of separations and classification of organic and inorganic wastes occur due to poor financing. According to Tassie et al. (2019), the storage bins used in the city of Addis Ababa are not standardized even if the materials are rarely provided rather the dust bins are located only on main roads with the assumption that those roads are the popular ones.

The suitability and adequacy of waste collection and segregation place for solid waste management prepared at their respective villages in their *woreda* was assessed. In connection to this, somehow little above half (56.1%) survey respondents underlined that no suitable and sufficient place at all for collecting solid waste material to be segregated, whilst 24.6% respondents reported that there was sufficient and suitable place and also 19.3% reported that there was a place but spaces are not sufficient and suitable to properly perform the activity. This implies that the dwellers in general have no sufficient temporarily prepared place for collecting the segregated solid waste which contributes to ineffective/poor waste segregation practice in the city. This challenge is in line with

the study conducted by Gelan (2021) in Addis Ababa who indicated lack of space to perform different activities related to solid waste as main challenge for solid waste segregation.

On the presence of cascaded directive from rules and regulation of the solid waste management in the city, 43.4% respondents reported that directive, rules and regulations are not cascaded down to the community level, but only 16.0% reported that they know the directives and rules and considerably large (40.6%) respondents were not sure whether there are directive or not. This shows that the rule/regulation and directive (guideline) were not properly cascaded to community level. As a result, the implementation of solid waste management including segregation at *woreda* level or sub-city has been a critical challenge. A similar study conducted by Hirpe and Yeom (2021) revealed that specific technical guideline frameworks like separation at the source were not available to bring sustainable Municipal Solid Waste Management at all levels of government. This also realizes that lack of enforcement caused an obstacle to effective waste management (Kihila et al., 2021). Similarly, the finding of Abebe (2017) revealed that there is policy about segregation of solid waste at the source and also no specified rules and regulations in the country at lower level of the governmental structure that focused on segregation of solid waste at household level.

Practice of plastic bags (*festal*) segregation from solid waste is shown in figure 6 below, where majority (61.1%) of respondents reported that as they are not segregating plastic bags from other wastes. In relation to this, FGD participants indicated that there is no market demands for these products for recycling purpose at the city or country level and it is a major global environmental problem (Abdel-Shafy and Mansour, 2018). Another similar study also revealed that plastic bag waste disposal is one of the most critical problems that threaten the sustainability of natural resources (Aurah, 2013). Absence of segregating plastic bag from biodegradable can result significant health impacts on animals. In relation to this, Adane and Muleta (2011) reported that during feed shortage domestic animals eat plastic bags (especially those wastes containing food leftovers) that can cause complications to the digestive systems and health of the animals.

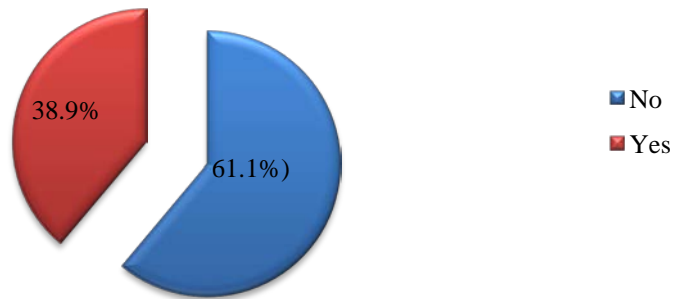


Figure 6: HHs plastic bags segregation practices from solid waste

Source: Study survey, 2022

In order to understand the practice of not separating plastic bags from other solid wastes, survey HHs (households) was asked possible time elapsed to do so. As shown in figure 7, 71.3% of the respondents confirmed that the practice is not time tacking while 15.2%, and 7.8% respondents indicated that the practices consume slight and moderate time respectively and 5.7% survey HHs don't noticed the time required. As great majority (86.5%) reported the plastic bag separation practice performed within a short period of time, this implies that there might be understanding problem on solid waste segregation at the household level. Consequently, offering a frequent awareness on the issue can create a good opportunity to enhance solid waste segregation practice.

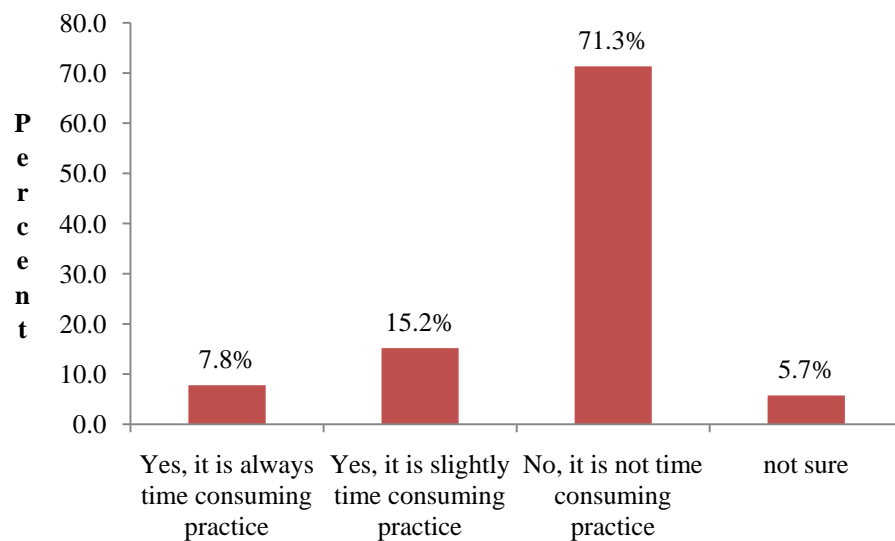


Figure 7: HHs view of segregating solid waste

Source: Study survey, 2022

The survey captured the role of social institutions (like *Idir, Ikub*) on creating awareness about clean the environment and solid waste segregation. As shown in figure 8, majority of the respondents which account 63.9% reported that they do not discuss on solid waste segregation and creating clean environment on their social institutions meetings. In relation to this, FGD participants pointed out mostly little attention has given to social institutions to discuss such issues as a result, solid waste management (segregation) remained persistent problem among the community. Similarly, McAllister, (2015) indicated that the participation of the community in the production and use of scientific knowledge is considered the best approach for environmental and waste management.

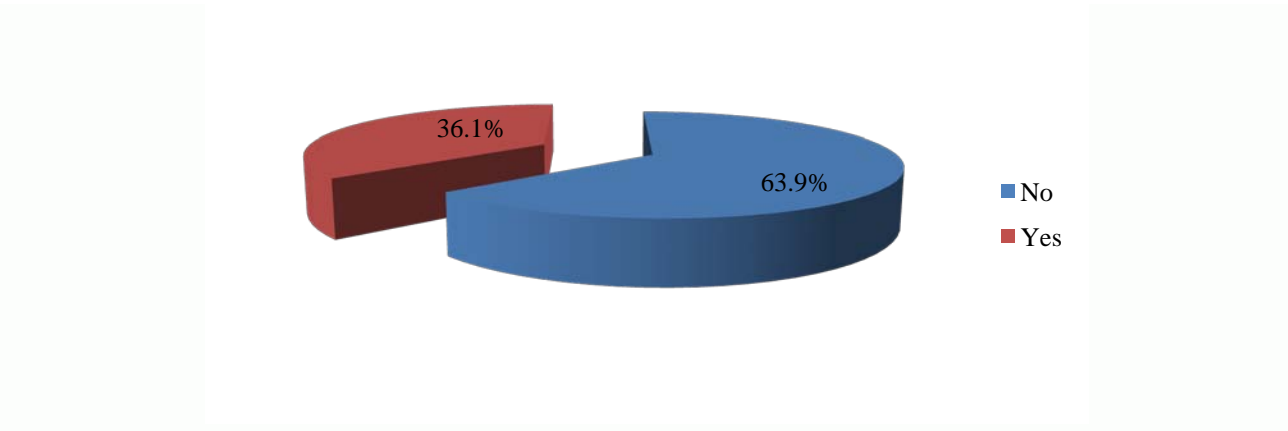


Figure 8: Survey HHs perception ensuring use of social institutions’ (like *Idir and Ikub*) to discuss about cleaning environment and solid waste segregation

Source: Study survey, 2022

In this regard, KII respondents underlined that even though a door to door awareness creation program on solid waste management planned to be conducted repeatedly with residents, the awareness creations were not implemented due to the lack of budget. In addition, the Addis Ababa City Administration Cleansing Management Agency KII’s confirmed that TOT (Training of Trainers) were given for sub-city and *woreda* team leaders including other stakeholders so as to address segregation issues for the community in different budget years. From this perspective in general, key informants from cleansing management office at *woreda* level and Addis Ababa city administration Cleansing Management Agency reported that training and other material support for the community and solid waste collectors (partnerships) or associations were not delivered as required due to lack of budget and other factors. Probably some kinds of material supports like sacks have been given for some villages (“*ketenas*”) that are taken to be models for others by collecting those materials from local business men. Similarly, information obtained from waste

collectors (partnerships) and focus group discussions confirmed that there was no technical training or other material support from the government.

Regarding the absence of the implementation guideline at the *woreda* level, it has created an obstacle for undertaking solid waste segregation practice. As confirmed by both key informants from sampled *woredas* and Addis Ababa City Administration Cleansing Management Agency, the implementation guideline was not developed or distributed to the concerned bodies. The key informants also indicated that the mandate of regulating illegal solid waste management is transferred to a third party called Addis Ababa City Law Enforcement Authority. This practice made the performance of the cleansing management sector to be ineffective and inefficient.

Moreover, the key informants from the government offices and all the focus groups discussants from the three *woredas*' reported that due to inadequate solid waste segregation practice at the city level, environmental pollution and health problems observed frequently. Due to the poor practice of segregation, waste collectors have been experiencing severe challenges like they are affected by broken glasses, pined by contaminated injection needles and blades which are discarded together with other biodegradable materials. FDG and KII participants reported that during sorting of the collected waste, the waste collectors cut their hands or pierced by sharpened materials or inhale bad waste smell, thus they could get different health problems..

In general, from KII, FDG, field observation and survey findings (table 4.3) discussed above, the challenges related to solid waste segregation can be summarized to social, institutional and contextual aspect which are directly related to the overall solid waste management practices and also interrelation of one another. Therefore, from the perspective of the social aspect in implementing solid waste segregation practice at the household or outdoor level, the community has shown negligence and low attitude. Similarly, at the institutional level it was observed that there was a gap on knowledge and skill of experts who are assigned to provide door-to-door awareness, lack of budget to provide material support and to offer awareness/training and lack of allocating adequate places to the community or associations to carry out the segregation activities and collect the segregated materials. In the case of contextual aspect, the gap related to the solid waste segregation at household or outdoor level would be ineffective due to the absence of guideline expected to be cascaded from the regulatory body at *woreda* level as a result the *woreda* cleansing management office performs its sector implementation through the third party known as Addis Ababa City Law Enforcement Authority for the case where fines are needed. This shows that

enforcement of solid waste segregation practice at the city level is too weak/poor due to third party intervention which is considered as a main challenge for its implementation.

4.4 The linkage between partnerships /legal associations and recycling industries

Table 4.4 presents solid waste collectors linkage with recycling industries. In this regard, 57% and 42.2% of survey respondents reported that recyclable materials (like metal, plastic) daily and sometimes collected by waste collectors respectively but very few (0.8%) respondents said no collection of the materials. This data indicated that high rate of recyclable materials separation by the waste collectors. FGDs and KIIs participants’ indicated high market demand for selected recyclable materials (e.g., plastic bottles and containers, metallic scraps) as there are recyclers or whole sellers who use the material to fabricate new goods or raw materials. Such business promotes solid waste separation as it creates job opportunities for citizens. In relation to this, Kihila et al. (2021) reported that recycling practitioners who can buy recyclable materials from waste pickers encourage segregation practice.

Table 4. 4: Solid waste collector or partnerships and their linkage with recycling industries

No	Variables/Items	Characteristics	N	%
1	Do you think that the recyclable materials (like metal, plastic) that would be disposed of at your resident area are collected?	Yes, the recyclable materials are daily collected by waste collectors /association	139	57.0
		Yes, the recyclable materials are sometimes collected by waste collectors /association	103	42.2
		No, the recyclable materials are always not collected by waste collectors /association	2	0.8
2	How do you handle the recyclable materials (like metal, plastic) at your home?	Sell to waste collectors	50	20.5
		Own reuse	37	15.2
		Give free to waste pickers/collectors	157	64.3
3	Are you asked by associations to collect recyclable materials separately while you deliver the solid waste for them?	Yes	158	64.8
		No	86	35.2
4	If your answer is yes to question 1, are these collectors supplied for recycling industries?	Yes	152	62.8
		No	52	21.5
		I am not sure	38	15.7
5	Do the waste collectors impose on you to separate the recyclable materials from the decomposable ones while you give the solid waste?	Yes, the waste collectors always impose me to separate and deliver them	59	24.2
		Yes, the waste collectors sometimes impose me to separate	95	38.9
		No, the waste collectors don’t impose me at all to separate and deliver them	70	28.7
		I am not sure at all	20	8.2

No	Variables/Items	Characteristics	N	%
6	At your residence with a place where you give the solid waste, do the waste collectors have the tendency to put the non -biodegradable alone?	Yes, I frequently observe that they are separately collecting recyclable materials	88	36.1
		Yes, I sometimes observe that they are separately collecting recyclable materials	51	20.9
		No, I don't observe such practices	60	24.6
		I am not sure	45	18.4

Source: Study survey, 2022

The transfer mechanism of the recyclable materials (such as metal, plastic) from residents to waste collectors was assessed and it was found that 64.3% of survey households reported that they offer the recyclable materials for free to waste pickers/collectors, while 20.5% HHs reported that they sell the materials to waste collectors and the rest 15.2% themselves reuses the materials. This shows that other type of solid waste segregation is not widely practiced due to lack of awareness of the individual community concerning economic value of these materials and limited market linkage for other recyclable materials among collectors and recyclers. This result can be supported by Kihila et al. (2021) findings who revealed that the community members do not consider selling recyclables as an important source of income. However, the selling practice of recyclable materials by most community members is low. During the field visit, it was observed that the waste collectors sometimes make partnerships with some individuals to separate these materials after they received from the individual community at the area of solid waste disposal. In this regard, the partnerships/associations segregation practice of the recyclables at the area of solid waste disposal, the solid waste may encourage their market linkage with the available recyclers.

As shown in table 4, the majority of survey HHs (64.8%) reported that they were asked by waste collectors to properly separate the recyclable materials. Out of respondents who reported that they were asked to separate the solid wastes by the collectors almost all (96.2%) indicated that the waste collectors supply the recyclables to recycling industries/individual buyers. In this case, FGDs revealed that the experience of the community to separate the solid waste was not as it was expected. The participants attributed this to different factors, like negligence, lack of knowledge and limited investment (recycling industries) who receive and reprocess recyclable both at city or country level. Thus, waste collectors/partnerships are not satisfied in waste separation practices due to the lack of incentive to involve in segregation work as income source and livelihood means. A similar finding Kihila et al. (2021) show that recyclables are picked by groups or individual waste pickers and sold to the recyclers.

The question related to waste collectors experience to impose the community to separate the recyclables from the decomposable during collection 24.2% and 38.9%, respondents respectively reported that the waste collectors always and sometimes impose them, separate the materials before delivering, while 28.7% respondents indicated that the waste collectors don not impose them to separate the materials and 8.2% were not sure to tell about such imposition. This may indicate that the effort of some collectors to enforce solid waste separation at household level might enhance proper waste segregation and management practice minimizes the energy and time of collectors at the waste disposal point.

The survey also assessed the practice of waste collectors to put non-biodegradable materials at separate container or place while collecting from house (Table 4.4). Accordingly, 36.1% and 20.9% of respondents respectively indicated that the waste collectors frequently and sometimes separately collecting recyclable materials. In converse, 24.6% HHs indicated as they do not observe such practices and 18.4% respondents are not sure to comment on such practice. This implies that a considerable number of waste collectors might segregate and put the non-biodegradable wastes like plastic bottles, cardboard and metal scraps for the purpose of income generation. Addis Ababa city has been collecting above two million cubic meters solid waste annually, which can have the opportunity for income generating from solid waste collectors through segregating the recyclables as well as creating extra jobs for citizens (Gelan, 2021).

Similarly, FDG with waste collectors/ partnerships and KII with government offices reported that recycling industries and emerging associations (licensed for specific collectors on cardboard or plastic bottle, etc) have better linkage; and conversely the partnerships in Amharic“*Shirkina mahberat*” do not have strong linkage, as a result they were not effective. This is due to their better financial capacity through which they did their market linkage by themselves other than the emerging ones. Apart from this, the KII from partnerships and focus groups reported that the partnerships were not effective towards recycling industries linkage. Similarly, the key informants from the governmental sector and the focus groups and KII from partnerships reported that the linkage between recycling industry and partnership was very weak. According to key informant interviews report from partnerships, even though there is a weak linkage between them, the amount of income generated from the selling of existing recyclable materials can have a little support to buy fuel and sustain the salary of their driver. However, nowadays almost all partnerships by themselves report that they are creating their private means to enhance their income generation through linking with recycling industries or other private buyers. As a result currently they are not much more

effective in the linkage. Likewise, all key informants interviewed and the three focus groups reported that the recycling industries have interest to buy the recyclable materials for which they are segregated unless there is low access to generate the recyclable material from the residents.

Generally, the findings of table 4.4 revealed that there was a market demand for recyclables. However, the linkage between waste collectors (partnerships) and recycling industries was low. This is firstly due to the absence of financial subsidy from the government (for example plastic bottles and cardboard) and secondly in most cases due to lack of temporary dump sites for which the waste collector's collect and safely store recyclable material. On the other hand, emerging associations who are established for selling specific recyclable materials (such as cardboard, plastic metal scraps, etc) have relatively high supply capacity for industries due to financial subsidy from the government and also the presence of storage warehouses for recyclables.

4.5 Determinants of solid waste segregation

In this study, statistical analysis of Chi-square test was used to correlate the relationship between different variables and solid waste segregation. In this regard, p-value is presented to measure the probability of obtaining the observed results and when p-value <0.05, it indicates the greater level of the statistical significance. Thus, the variables of gender, age, educational level, monthly income, and residences home type, willingness, collecting materials supply, awareness/training, directives/guideline, and discussion of the social organizations and imposing of solid waste collectors are assessed for their possible correlation with solid waste segregation.

4.5.1 Gender and solid waste segregation practice

According to the result presented in table 4.5, the calculated value of Chi-square is equal to 8.314 and the p-value=0.04. The analysis revealed statistically significant ($P < 0.05$) association between gender of respondents and solid waste segregation practice at the gate. From this statistical analysis it can be associated with the contribution of female members' activity at home whereby they would be available for waste segregation. In this regard, Gani et al (2012) in Bauchi Nigeria revealed that relating to household solid waste handling, women have sole responsibilities and 89.5% are willing to segregate their solid waste at source. Similarly, a study conducted by Banga, (2011) also found that females are more likely to separate solid waste than male because within the household it is the female members who know and decide what is useful and what constitutes waste even though males are cooperative

4.5.2 Age of the respondents and solid waste segregation

The result presented in table 4.5 reveals that the p-value obtained from testing the association between age and solid waste segregation practice at the gate is 0.207 which exceeds the 5% level of significance. From this statistical analysis it can be deduced that the difference of age between households does not significantly affect the solid waste segregation practice. Similarly there is a finding which supports this analysis that illustrates age of households is not a determinant factor of segregation (Abebe, 2017).

4.5.3 Educational level of the respondents and solid waste segregation

As shown in table 4.5, the p-value obtained from testing the association between educational level and solid waste segregation practice at the gate is 0.267 which exceeds the 5% level of significance. Accordingly, the educational level of the respondents is not associated with solid waste segregation practice at the gate. This is in line with the observations made by Otitoju and Seng (2014) who also reported that there is no significant relationship between educational levels of the households and participation in solid waste segregation at source.

4.5.4 Monthly income of the respondents and solid waste segregation

According to the result presented in table 4.5, the calculated value of Chi-square is equal to 27.172 and the p-value=0.027. The analysis showed there is statistically significant ($P < 0.05$) association between monthly income of respondents and solid waste segregation practice at the gate. From this analysis, it is clear that those residents with low income might not afford buying required segregating containers and materials and may not be able to undertake waste segregation practice at home.

4.5.5 Marital status of the respondents and solid waste segregation

The result presented in table 4.5, the calculated value of Chi-square is equal to 21.412 and the p-value=0.011. The data revealed that there is statistically significant ($P < 0.05$) association between marital status of respondents and solid waste segregation practice at the gate. In this analysis, it can be deduced that those who are married have expected to be at a higher level of social responsibility, as a result they would be accountable for implementation of solid waste segregation. Similarly, (Shabani, 2015) indicated that married people are likely to be more responsible to keep the environment clean for improved waste segregation.

4.5.6 Residences home type of the respondents and solid waste segregation

The result presented in table 4.5 showed that the calculated value of Chi-square is equal to 13.541 at $P = 0.035$. The test showed that there is statistically significant ($P < 0.05$) association between home residence of respondents and solid waste segregation practice at the gate. From this analysis it can be deduced that the majority of households living in private rented houses might not be responsible to carryout appropriate segregation practice. Similarly Fadhullah et al. (2022) finding indicated that house type was significantly correlated with waste segregation practice. Therefore, residence type of households significantly affects the segregation practice.

4.5.7 Willingness of the respondents to segregate solid waste at home and solid waste segregation

According to the result presented in table 4.5, the calculated value of Chi-square is equal to 60.432 at $p\text{-value} = 0.000$. The analysis showed that statistically significantly ($P < 0.05$) high association between willingness of respondents to segregate solid waste at home gate and solid waste segregation practice. This finding mirrors with Abebe (2017)'s observation that there is a high association between willingness of segregation and actual practice of undertaking segregation at the household level.

4.5.8 Supply of collecting/segregating material to use or reuse by the respondents and solid waste segregation

According to the result presented in table 4.5, the calculated value of Chi-square is equal to 29.977 and the $p\text{-value} = 0.003$. The test revealed that there is a statistically significant ($P < 0.05$) association between collecting material to use or reuse by respondents and solid waste segregation practice at the gate. From this statistical analysis, it can be deduced that the more supply of segregating material the more will be the implementation of segregation. As a result, the possibility of supplying material for the community might enhance the tendency of implementing solid waste segregation.

4.5.9 Association of respondents awareness/training on solid waste segregation and practice of solid waste segregation

In the relationship between respondents awareness/training on solid waste segregation accesses and practice of solid waste segregation reveled calculated value of Chi-square equal to 23.818 at $p\text{-value} = 0.005$ (Table 4.5). Since the $p\text{-value}$ less than that of the level of significance (0.05), there is a statistically significant association between awareness/training on solid waste segregation of respondents and solid waste segregation practice at the gate. Increasing public awareness and

offering relevant training can thus enhance the possibility of solid waste segregation practice at home or outdoor level.

4.5.10 Lack of directive (guideline) for implementation of solid waste management and solid waste segregation

Based on the result presented in table 4.5, the calculated value of Chi-square is equal to 12.934 and the p-value=0.044. Because the p-value is less than that of the level of significance (0.05), there is a statistically significant association between lack of directive (guideline) for implementation of solid waste management and solid waste segregation practice at the gate. From this statistical analysis, it might be concluded that the absence of guidelines at the city level negatively affects the performance of the sector all over solid waste management including waste segregation.

4.5.11 Discussion of the social organizations (like *Idir*, *Ikub*) about cleaning the environment and solid waste segregation practice of the respondents and solid waste segregation

As shown in Table 4.5, the Chi-square value of 18.939 at the P-value=0.000 shows that there is statistically significant ($P < 0.05$) high association between use of social organizations (such as *Idir*, *Ikub*) and solid waste segregation practice at the gate. The use of social organizations like *Idir* or *Ikub* could help reach to the community and positively impact solid waste segregation practices at home or door.

4.5.12 Imposing of solid waste collectors/associations to separate recyclable materials from decomposable ones and solid waste segregation

Based on the result presented in table 4.5, the calculated value of Chi-square is equal to 28.066 and the p-value=0.001. Since the p-value less than that of the level of significance (0.05), there is a statistically high significant ($P < 0.05$) association between imposing of solid waste collectors/partnerships to separate recyclable materials from decomposable ones and solid waste segregation practice at the gate. Regarding the analysis of enforcement of partnerships, in one way or another there would be an opportunity of implementation of segregation practice at the community level. Apart from this, the market access of partnerships to supply for recyclers might be increased. So, solid waste segregation is negatively affected by partnerships enforcement.

Table 4. 5: Relationship between variables and solid waste segregation

No	Variables	Solid waste segregation practice at the gate/door		
		Degree of freedom (Df)	P-value	Chi-square value
1.	Gender	3	0.040	8.314
2.	Age	12	0.207	15.659
3.	Education level	21	0.267	24.555
4.	Monthly Income	15	0.027	27.172
5.	Marital status	9	0.011	21.412
6.	Home residence type	6	0.035	13.541
7.	Willingness to segregate solid waste	3	0.000	60.432
8.	Collecting/segregating materials	12	0.003	29.977
9.	Awareness	9	0.005	23.818
10.	Lack of directive (guideline)	6	0.044	12.934
11.	Discussion of the social organizations (like <i>Idir, Ikub</i>)	3	0.000	18.939
12.	Imposing of solid waste collectors	9	0.001	28.066

Source: Study survey, 2022

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Segregating solid waste enhances the business sector to recycle more items besides preventing waste items from ending up in landfills and this can reduce the overall impact on the environment. However, solid waste segregation in most developing countries is not properly implemented instead waste disposed in mixed way which shows that the practice is at low level. In this regard, the study analysis showed that solid waste segregation at household level (at gate/door) before disposal has promising start even if considerable difference exists among the survey households. This result shows that correct solid waste segregation at household level was implemented by almost one-fifth of sampled respondents while the majority (79%) of respondents either rarely practice the segregation or not at all. Analysis of both qualitative and quantitative data of this study revealed that the awareness of the community on solid waste segregation in Addis Ababa City was poor even if there was some improvement compared to some time ago. Therefore, in most residential areas of the city, the practice of implementing solid waste segregation was very weak.

Our analysis also identified that the major challenges of solid waste segregation practice in the City are problems related to social (such as negligence, low attitude and low understanding of the community), institutional (lack of training, knowledge and skill gap of experts, lack of budget and lack of space) and contextual aspect (absence of guideline that cascaded from rules and regulations and weak enforcement) and also the gap on the interrelation between them.

In the aspect of recyclers and association or partnership linkage, the finding indicated that their linkage was low due to the absence of financial support; lack of temporary dump site for waste collectors to safely collect and store recyclable material. On the other hand, emerging associations which are established for selling specific recyclable materials (like cardboard, plastic metal scraps, etc) have relatively high supply capacity for industries since they have some financial support/subsidy and storage facility/warehouse for recyclables from the government.

The statistical test mainly the Chi-square showed that respondent's age and educational level were not associated with solid waste segregation. In converse sex, monthly income, marital status and home residence of survey respondents were associated with solid waste segregation. Similarly, variables of willingness, collecting/segregating materials, awareness, lack of guideline, social organization and imposing solid waste segregation were all associated with the solid waste

segregation such that they have high statistical significance relationship ($P < 0.05$) between the two variables.

5.2 Recommendations

Based on the findings of this study, the following recommendations are forwarded for the improvement of the solid waste segregation practice and solve the challenges in Addis Ababa City.

- To make improvement on solid waste segregation in Addis Ababa City, the associations /partnerships should be encouraged by incorporating in the training programs, providing material support and allocating sufficient budget in the annual plan at least by engaging relevant stakeholders.
- To familiarize solid waste segregation at all levels of the community, the Municipal of Addis Ababa City should establish awareness program through different Mass Media and other resident, women and youth forums.
- The Municipal of Addis Ababa City should provide capacity building for relevant institutions to be well organized in terms of technology, knowledgeable and skilled man power and good governance so as to make segregation practice effective in the community.
- To implement the solid waste segregation at the City level, the Municipal should provide responsibility through guidelines/directives for solid waste cleansing offices rather than other third party.
- The Municipal of Addis Ababa City should provide enough temporarily dump sites (places) for waste collectors which would be used to segregate solid wastes without affecting the environment.
- Since the Addis Ababa City population number is increasing nowadays, the volume of solid waste generation is increasing. So the practice of separating the solid waste should be enhanced by creating job opportunities through linking waste collectors and recyclers. Moreover, Addis Ababa City Administration should promote the opportunity for waste recycling investment by providing incentives like free tax to minimize the waste generation in the City.
- The solid waste cleansing management offices of Addis Ababa City should implement and develop training programs for solid waste collectors/associations or partnerships based on the Ethiopian Standard ES ISO 45001 to improve the management system of the sector in terms of maintaining occupational health and safety.

5.2.1 Recommendation for further research

- Since plastic bags are used widely by the community in the city for the purpose of collecting different materials at household or outdoor level, the tendency of disposing these bags to the environment is highly practiced. As a result, further research is needed on how to substitute by decomposable materials for ease use for the community, environment, health and safety for instance through subsidizing/promoting the manufacturers of decomposable materials that could be used as bag.

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Annex A
Survey Questionnaire
SCHOOL OF GRADUATE STUDIES
COLLEGE OF DEVELOPMENTAL STUDIES
CENTER FOR ENVIRONMENT AND DEVELOPMENT STUDIES

Dear respondents,

I am Worku Adefris, student in Addis Ababa University. I designed this questionnaire to collect data for Master thesis research purposes which is titled as “Practice and Challenge on solid waste segregation in Addis Ababa City”.

This research is intended for academic purpose authorized by Addis Ababa University. Thus, your ideas and comments are highly honored and kept confidential. Your honest responses to the question have higher value for the success of the research. Therefore, I kindly ask you to respond to the questions, but if you have an issue you can ask clarification or withdraw at any time.

Thank for your cooperation

Address:-

Email: workuadefris595@gmail.com

I. Socio-Demographic Characteristics and Respondent’s Background

1.1.Gender of respondent 1) Male 2) Female

1.2.Age of respondent -----

1.3.Education level of the respondent

1) Illiterate 2) 1-4 grade 3) 5-8 grade 4) 9-12 grade 5) certificate
6) Diploma 7) Degree 8) Above first degree

1.4.Merital Status of respondent

1) Single 2) Married 3) Divorsed 4)Widowed

1.5.Monthly Income -----

1.6.Occupation of the household heads (bread winners)

1) Self employed 4) Civil servant 7) others
2) Private sector 5) Retiree
3) Housewife 6) Student

1.7.Family size-----

1.8.Home residence type

- 1) Governmental house rent 2) Private house rent 3) Private owned

II. Solid waste segregation practice

2.1 Have you ever been thought about segregating solid waste?

- 1) Yes 0) No

2.2 Do you have willingness to segregate solid waste at your home or residence area?

- 1) Yes 0) No

2.3 In your residence area, is there any a place prepared to segregated waste?

- 1) Yes 0) No

2.4 Did you prepare different kinds of containers for each types of solid wastes that can be separated at your home or outdoor level?

- 1) Yes 0) No

2.5 Do you separate solid wastes generated from your house?

- 1) Yes, I always separate solid wastes
2) Yes, I sometimes separate solid wastes
3) No, I never separate solid wastes
4) Not sure

2.6 If the answer to question 2.5 is yes, what kind of solid waste materials are you separating at household level?

- 1) Plastics
2) Metal
3) Cardboard
4) Organic (decomposable)
5) Both plastic and metals
6) Both plastic and organic materials
7) Both cardboard and organic materials
8) All kinds listed above

2.7 What do you think the reason for those practices of non-segregation at household or outdoor level?

- 1) No facilities to separate
2) No need to separate, it is wastage of time
3) I am not aware, no information

- 4) Separation requires dust bins which can be bought at high cost, thus I can't afford it
- 5) My household produce very small amount wastes, thus separation is worthless
- 2.8 Does your household have the experience of separating wastes from your household at a place where solid waste temporarily disposing places?
- 1) Yes ,I separate properly
 - 2) Yes, I separate sometimes
 - 3) No, I do not separate at all
 - 4) I am not sure
- 2.9 If free bins are provided at your home or out door, are you able to segregate the solid waste properly?
- 1) Yes 0) No
- 2.10 Is there any solid waste in your residence area which simply disposed?
- 1) Yes, there is a plenty of solid waste disposed at the roadside or everywhere without management
 - 2) Yes, there is small amount disposed at the road side or everywhere
 - 3) No, there is no solid waste disposed at roadside or everywhere
 - 4) I am not sure
- 2.11 Do you believe that solid waste management strategies 3R(reduce, reuse and recycling) are related to segregation?
- 1) Yes 0) No
- 2.12 Do you think that solid waste segregation at the source is important way of achieving waste reduction?
- 1) Yes 0) No
- 2.13 Which collecting/segregating materials do you use to reuse or recycle for solid wastes at your home or outdoor level while you use these practices ?
- 1) Plastic and glass containers
 - 2) Plastic bags
 - 3) Metallic material
 - 4) Sack
 - 5) I do not use any material

III. Solid waste segregation challenges

- 3.1 Do you get any awareness/training on solid waste segregation from your *woreda* administration by delegating relevant experts?
- 1) Yes ,where my household was properly participated
 - 2) Yes, sometimes my household was participated
 - 3) No, my household was not invited at all
 - 4) Not sure
- 3.2 How do you evaluate implementation of the learning (training/awareness creation)?
- 1) Implemented most (>50%) of the learning's
 - 2) Implemented some (25-50%) of the learning's
 - 3) Implemented very few (<25%) of the learning's
 - 4) Almost don't implemented any of the learning
- 3.3 Are there any *woreda* experts coming to your houses to tell you about waste segregation?
- 1) Yes
 - 0) No
- 3.4 If the answer is yes to question 3.2 above, how do you evaluate the knowledge and skill of experts who are delegated in your *woreda* administration solid waste management while they are delivering technical support to you?
- 1) Excellent
 - 2) v. good
 - 3) good
 - 4) satisfactory
- 3.5 Is there any supply of collecting/segregating materials of which segregated solid waste stored from the government?
- 1) Yes, there is sufficient supply of collecting /segregating materials
 - 2) Yes, but small amount
 - 3) No, there is no sufficient supply of collecting/segregating materials
 - 4) I am not sure
- 3.6 Is there a suitable and sufficient place for collecting segregated solid waste prepared by *woreda* administration?
- 1) Yes, there is sufficient and suitable place
 - 2) Yes, but not sufficient and suitable place
 - 3) No, there is no sufficient and suitable place

3.7 Is there a directive (guideline) prepared by *woreda* administration to implement rules and regulation of solid waste management

1) Yes 0) No

3.8 Do you segregate plastic bags from solid waste like that of other recyclable materials for example cardboard?

1) Yes 0) No

3.9 In the management of solid waste, do you think that segregating solid waste is time consuming practice at any level?

1) Yes, it is always time consuming practice

2) Yes, it is slightly time consuming practice

3) No, it is not time consuming practice

4) I am not sure

3.10 Have you ever been discussed on the social organization (like *Idir, Ikub*) about cleaning your environment based on solid waste segregation?

1)) Yes 0) No

IV. Survey questionnaire for legal associations/partnerships and their linkage with recycling industries

4.1 Do you think that the recyclable materials (like metal, plastic) that would be disposed at your resident area are collected?

1) Yes, the recyclable materials are daily collected by waste collectors /association

2) Yes, the recyclable materials are sometimes collected by waste collectors /association

3) No, the recyclable materials are always not collected by waste collectors /association

4) Not sure

4.2 How do you handle the recyclable materials (like metal, plastic) at your home?

1) Sell to waste collectors

2) Own reuse

3) Give free to waste pickers/collectors

4.3 Are you asked by associations to collect recyclable materials separately while you deliver the solid waste for them?

1) Yes 0) No

4.4 If your answer is yes for question 4.1, are these collectors supply for recycling industries?

- 1) Yes 0) No

4.5 Do the waste collectors impose you to separate the recyclable materials while you give the solid waste?

- 1) Yes, the waste collectors always impose me to separate and deliver them
- 2) Yes, the waste collectors sometime impose me to separate and deliver them
- 3) No, the waste collectors don't impose me at all to separate and deliver them
- 4) I am not sure at all

4.6 At your residence with a place where you give the solid waste, do the waste collectors have the tendency to put the non biodegradables alone?

- 1) Yes, I frequently observe that they are separately collecting recyclable materials
- 2) Yes, I sometimes observe that they are separately collecting recyclable materials
- 3) No, I don't observe such practices
- 4) I am not sure

V. Key Informant Interview Question for FDG and Experts

Interview for Focus Group Discussion

Sub-city/Woreda Name -----

- 1) How do you manage solid waste at your home or outdoor level?
- 2) How is your awareness about solid waste segregation?
- 3) In your resident area, how is the practice of solid waste segregation? Explain.
- 4) What is your experience on places where solid waste is collected temporarily?
- 5) How do you think that segregating solid waste at home or outdoor level?
- 6) What is your challenge to segregate solid waste?
- 7) How is the support of *woreda* administration to segregate wastes at home or outdoor level?
- 8) Does the government create the linkage with recycling industries so as to generate income through the supply of recyclable materials?
- 9) Currently, are you beneficial through your performance of supplying recyclable materials for industries?

VI. Key Informant Interview Questions for Experts (At *Woreda* level and Solid waste Mgt Cleaning Agency)

Organization Name-----

Name of Expert-----

Job Title-----

1. What mechanisms are used to supervise and control solid waste management segregation in your office?
2. How do you consider the awareness of resident on solid waste segregation?
3. Do you have any training program and its output regarding segregating solid waste for the community? Explain it.
4. How do you consider the current solid waste segregation practice of the community?
5. What kinds of solid waste materials are segregated by the community?
6. Is there a material support for the community to segregate solid wastes?
7. Do you know any environmental/health impacts on the residents due to absence of solid waste segregation around disposal sites?
8. How do you consider the implementation of rules and regulation with respect to solid waste segregation?
9. How do you consider the linkage of waste pickers/ associations (SMEs) with recycling industries?
10. Are all waste pickers/ associations are effective in supplying recyclable solid waste materials for recycling industries?
11. Do you think that waste pickers/ associations are beneficiary through segregation of solid waste?
12. Do you have extra comment for practices and challenges of solid waste segregation in Addis/Your *woreda*?

Annex B
(Amharic Version survey questionnaire)

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መካነ-ጥናት ኮሌጅ
የአካባቢና ዘላቂ ልማት ፕሮግራም

የተከበራችሁ ተሳታፊዎች፡-

ወርቁ አደፍርስ እባላለሁ። በአዲስ አበባ ዩኒቨርሲቲ መካነ-ጥናት ኮሌጅ የአካባቢና ዘላቂ ልማት ፕሮግራም የድህረምረቃ ተማሪ ነኝ። ይህ መጠይቅ የተዘጋጀው “በአዲስ አበባ ከተማ የደረቅ ቆሻሻ አተገባበር እና ልዩታ” በሚል ርዕስ ለምርምር ዓላማ በመሆኑ መጠይቁን በመሙላት እንድትተባበሩኝ በአክብሮት እየጠየቅሁ የሚሰጡኝን መረጃዎች ለትምህርት ዓላማ ብቻ እንደሚውል እና ምላሽዎም ምስጢራዊ እንደሚሆን አረጋግጣለሁ።

ለሚኖርዎት ጥያቄዎች ፡-

ኢሜይል፡-workkuadefris595@gmail.com

ትዕዛዝ አንድ ፡-የሚከተሉትን መጠይቆች ካነበቡ በኋላ ከተሰጡት አማራጮች መልሰዎን በማክበብ ይምረጡ።

- I. የተሳታፊው ግለ ታሪክ(respondent's background)
 - 1.1. የተሳታፊው ያታ 1) ወንድ 2) ሴት
 - 1.2. እድሜ -----(እድሜ በሚለው ባዶ ቦታ ላይ በአሃዝ ያስቀምጡት)
 - 1.3. የትምህርት ደረጃ
 - 1) መሰረተ ትም/ት ወይም ጎልማሶች ት/ት
 - 2) ከ1-4 ኛ ክፍል
 - 3) ከ5-8ኛ ክፍል
 - 4) ከ9- 12ኛ ክፍል
 - 5) ስርተፊኬት
 - 6) ዲፕሎማ
 - 7) የመጀመሪያ ዲግሪ
 - 8) 2ኛ ዲግሪና ከዚያ በላይ
 - 1.4. የትዳር ሁኔታ
 - 1) ያላገባ/ች 2) ያገባ/ች 3) የተፋታ/ች 4) በሞት የተለዩ
 - 1.5. ወረሃዊ የገቢ መጠን-----ብር (ወርሃዊ የገቢ መጠን በሚለው ባዶ ቦታ ላይ በአሃዝ ያስቀምጡት)
 - 1.6. የአባወራው/የእማወራዋ ስራ ሁኔታ
 - 1) በራስ አገዝ የሚተዳደር/የምትተዳደር
 - 2) የግል ድርጅት ተቀጣሪ
 - 3) የቤት እመቤት
 - 4) የመንግስት ሰራተኛ
 - 5) ጡረተኛ
 - 6) ተማሪ
 - 7) ሌላ
 - 1.7. የቤተሰብ ብዛት----- (የቤተሰብ ብዛት በሚለው ባዶ ቦታ ላይ በአሃዝ ያስቀምጡት)

- 1.8. የመኖሪያ ቤት ሁኔታ
 - 1) የመንግስት ቤት ተከራይ
 - 2) የግለሰብ ቤት ተከራይ
 - 3) የግል/የራስ ቤት

II. የደረቅ ቆሻሻ ልዩታ ተግባራት (Solid waste segregation practices)

- 2.1 በአለት ከአለት ስለደረቅ ቆሻሻ ልዩታ አስበው ያውቃሉ?
 - 1) አዎ 0) አስቤ አላውቅም
- 2.2 በቤትዎ ወይም በመኖሪያ ቤትዎ አካባቢ ደረቅ ቆሻሻ በፈርጅ በፈርጁ(በአይነቱ) የመለየት ፍላጎት አለዎት?
 - 1) አዎ 0) ፍላጎት የለኝም
- 2.3 በመኖሪያ ቤትዎ አካባቢ ደረቅ ቆሻሻ በፈርጅ በፈርጁ(በአይነቱ) ለይቶ ለማስቀመጥ የተዘጋጀ ቦታ አለወይ?
 - 1) አዎ 0) የተዘጋጀ ቦታ የለም
- 2.4 በቤትዎ ወይም በመኖሪያ ቤትዎ አካባቢ ለተለየ ደረቅ ቆሻሻ የሚሆን እና ቆሻሻው በየአይነቱ የሚከማችበት እቃ አዘጋጅተው ያውቃሉ?
 - 1) አዎ 0) አዘጋጅቼ አላውቅም
- 2.5 ደረቅ ቆሻሻ ከቤትዎ ውጭ ከመጣልዎ በፊት በቤት ውስጥ በፈርጅ በፈርጁ(በአይነቱ) ይለያሉ?
 - 1) አዎ፣ የቤቴን ደረቅ ቆሻሻ ሁልጊዜ ለይቼ አስቀምጣለሁ
 - 2) አዎ፣ የቤቴን ደረቅ ቆሻሻ አልፎ አልፎ ለይቼ አስቀምጣለሁ
 - 3) የቤቴን ደረቅ ቆሻሻ ለይቼ አላውቅም
 - 4) ደረቅ ቆሻሻ ስለመለየቴ እርግጠኛ አይደለሁም
- 2.6 በ2.5 ጥያቄ መሰረት መልስዎ አዎን ከሆነ፣ በቤትዎ ውስጥ ምንምን አይነት የቆሻሻ አይነቶች ይለያሉ (ከአንድ በላይ መልስ ሊኖር ይችላል)?
 - 1) ፕላስቲክ ነክ ነገሮችን
 - 2) ብረታ-ብረት ነክ ነገሮችን
 - 3) ወረቀቶችን
 - 4) በስባሽ ነገሮችን(organic materials)
 - 5) ፕላስቲክና ብረታ-ብረት
 - 6) ፕላስቲክና በስባሽ ነገሮች
 - 7) ወረቀትና በስባሽ ነገሮች
 - 8) ከላይ ሁሉንም የተዘረዘሩትን የደረቅ ቆሻሻ አይነቶችን እለያለሁ
- 2.7 በ2.4 ጥያቄ መሰረት መልስዎ አይደለም ከሆነ፣ በቤትዎ ደረቅ ቆሻሻ ያለመለየት ምክንያት ምንድነው?
 - 1) ለመለየት የሚያስችል የቁሳቁስ አቅርቦት ስለሌለ
 - 2) ልዩታ ስለማያስፈልግ፣ ጊዜ ማባከን ስለሆነ
 - 3) ግንዛቤው/መረጃው የለኝም
 - 4) ለልዩታው የተለያዩ ማጠራቀሚያዎች (dust bins) ቢያስፈልጉም ዋጋቸው ውድ ስለሚሆን ግዥ መፈጸም አልችልም
 - 5) ከቤቴ የሚወጣው ደረቅ ቆሻሻ መጠኑ በጣም ትንሽ ስለሆነ በፈርጅ በፈርጁ መለየት አላስፈላጊ ስላልሆነ

- 2.8 ቤተሰብዎ በጊዜያዊ የደረቅ ቆሻሻ ማከማቻ ስፍራዎች በመሄድ ከቤትዎ የሚወጣውን ቆሻሻ የመለየት ልምዱ አላችሁ?
 - 1) አዎ፣ በሚገባ ሁልጊዜ እንለያለን
 - 2) አዎ፣ አልፎ አልፎ እንለያለን
 - 3) ሙሉ በሙሉ አንለይም
 - 4) እርግጠኛ አይደለሁም
- 2.9 በቤትዎ ወይም ከቤትዎ ውጭ ደረቅ ቆሻሻን ለይቶ ለማከማቻት የሚያገለግል እቃ ወይም ቁሳቁስ በነፃ ቢሰጥዎ ደረቅ ቆሻሻን ለይቶ በየፈርጁ ማስቀመጥ ይችላሉ ወይ?
 - 1) አዎ ለይቶ ማስቀመጥ እችላለሁ
 - 0) ለይቶ ማስቀመጥ አልችልም
- 2.10 በመኖሪያ ቤትዎ አካባቢ ደረቅ ቆሻሻን በዘፈቀደ የመጣል ሁኔታ አለ?
 - 1) አዎ፣ በሰፈራችን በየመንገዱ ጭምር ደረቅ ቆሻሻ ያለምንም ከልካይ ይጣላል
 - 2) አዎ፣ በሰፈራችን በየመንገዱም ጭምር ደረቅ ቆሻሻ በመጠኑም ቢሆን ይጣላል
 - 3) በሰፈራችን ወይም በአካባቢያችን በየመንገዱም ቢሆን ምንም ቆሻሻ አይጣልም
 - 4) እርግጠኛ አይደለሁም
- 2.11 የደረቅ ቆሻሻ አያያዝ ስልቶች (ማለትም ደረቅ ቆሻሻን መቀነስ፣ መልሶ መተቀም እና ደግሞ መጠቀም) ከልየታ ጋር ተዛምዶ አላቸው ብለው ያምናሉ?
 - 1) አዎ አምናለሁ
 - 0) አላምንም
 - 2) እርግጠኛ አይደለሁም
- 2.12 ደረቅ ቆሻሻን በየፈርጁ ለይቶ ማስቀመጥ አጠቃላይ ከቤት የሚወጣውን የቆሻሻ ብዛት ለመቀነስ ይረዳል ብለው ያስባሉ?
 - 1) አዎ፣ ውጤታማ ይሆናል ብዬ አስባለሁ
 - 0) ውጤታማ ይሆናል ብዬ አላስብም
 - 2) እርግጠኛ አይደለሁም
- 2.13 በቤትዎ ወይም ከቤትዎ ውጭ 3R(ማለትም ደረቅ ቆሻሻን መቀነስ፣ መልሶ መተቀም እና ደግሞ መጠቀም) ሲተገብሩ የትኛውን ማጠራቀሚያ እቃ ይጠቀማሉ?
 - 1) ከፕላስቲክና ከብርጭቆ የተሰራ እጠቀማለሁ
 - 2) ስስ ፌስታል፣ ኩርቱ ፌስታል የመሳሰሉትን እጠቀማለሁ
 - 3) ብረት ነክ የሆኑ ቁሶችን እጠቀማለሁ
 - 4) ጆንያ ወይም ማዳበሪያ እጠቀማለሁ
 - 5) ምንም አይነት ቁሶችን አልጠቀምም

III. የደረቅ ቆሻሻ ልየታ እንቅፋቶች ወይም ተግዳሮቶች (Solid waste segregation challenges)

- 3.1 ካሉበት ወረዳ አስተዳደር በሚመደቡ የዘርፉ ባለሙያዎች በደረቅ ቆሻሻ ልየታ ላይ በቂ ስልጠና/የግንዛቤ ማስጨበጫ አግኝተው ያውቃሉ?
 - 1) አዎ፣ ስልጠናው በሚሰጥበት ወቅት ሁልጊዜ ቤተሰቦቼ በአግባቡ ተሳትፎ ያደርጋሉ
 - 2) አዎ፣ ስልጠናው ሲሰጥ ቤተሰቦቼ አልፎ አልፎ ተሳትፎ ያደርጋሉ
 - 3) ቤተሰቦቼ ስልጠና/የግንዛቤ ማስጨበጫ እንዲያገኙ ተጋብዘው አያውቁም
 - 4) እርግጠኛ አይደለሁም
- 3.2 በአጠቃላይ በወረዳ አስተዳደር በኩል በደረቅ ቆሻሻ ልየታ ላይ የሚሰጠውን ስልጠና /የግንዛቤ ማስጨበጫ እንዴት ይገመግማሉ?
 - 1) አብዛኛው (ከ50 በመቶ በላይ) ነዋሪዎች የደረቅ ቆሻሻ ልየታ ሂደቱን ተግባራዊነት አሉ
 - 2) የተወሰኑ (ከ25-50 በመቶ) ነዋሪዎች የደረቅ ቆሻሻ ልየታ ሂደቱን ተግባራዊነት አሉ
 - 3) በጣም ጥቂት (ከ25 በመቶ በታች) ነዋሪዎች የደረቅ ቆሻሻ ልየታ ሂደቱን ተግባራዊነት አሉ
 - 4) ሙሉ በሙሉ በሚባል ሁኔታ ነዋሪዎቹ የደረቅ ቆሻሻ ልየታ ሂደቱን አልተገቡትም
- 3.3 ስለደረቅ ቆሻሻ ልየታ አተገባበር ለማስተዋወቅ ሲባል የወረዳ ባለሙያዎች ቤትዎ ድረስ መጥተው ያውቃሉ?
 - 1) አዎ መጥተው ያውቃሉ
 - 0) መጥተው አያውቁም

- 3.4 በጥያቄ 3.3 መሰረት መልስዎ አዎን ከሆነ ፣ከወረዳው የሚመደቡት በለሙያዎች ያላቸው እውቀትና ክህሎት እንዴት ገመገሙት ?
- 1) እጅግ በጣም ጥሩ ነው
 - 2) በጣም ጥሩ ነው
 - 3) ጥሩ ነው
 - 4) አጥጋቢ ነው
- 3.5 ደረቅ ቆሻሻን ለይቶ ለማስቀመጥ የሚያስችል ማከማቻ ገንዳ(ቅርጫትና ተዛማጅ ቁሳቁሶች) የወረዳ አስተዳደሩ ለነዋሪዎች አመቻችቷልወይ ?
- 1) አዎ፣ ወረዳው ደረቅ ቆሻሻን ለይቶ ለማስቀመጥ የሚያስችል ማከማቻ ገንዳ በበቂ ሁኔታ ያቀርባል
 - 2) አዎ፣ ወረዳው ደረቅ ቆሻሻን ለይቶ ለማስቀመጥ የሚያስችል ማከማቻ ገንዳ በጥቂቱ ያቀርባል
 - 3) ወረዳው ደረቅ ቆሻሻን ለይቶ ለማስቀመጥ የሚያስችል ማከማቻ ገንዳ በበቂ ሁኔታ አቅርቦ አያውቅም
 - 4) እርግጠኛ አይደለሁም
- 3.6 በመኖሪያ ቤት አካባቢ የወረዳ አስተዳደሩ ደረቅ ቆሻሻን ለይቶ ለማስቀመጥ የሚያስችል በቂና የሚመች ቦታ አዘጋጅቷልወይ?
- 1) አዎ፣ወረዳው በቂና ምቹ ቦታ አዘጋጅቷል
 - 2) አዎ፣ ግን በወረዳው የተዘጋጀው ቦታ በቂና ምቹ አይደለም
 - 3) ወረዳው በቂና ምቹ ቦታ አላዘጋጀም
- 3.7 የደረቅ ቆሻሻ አያያዝና አወጋገድ በአግባቡ እንዲተገበር ወረዳው መመሪያ አዘጋጅቷልወይ ?
- 1) አዎ
 - 0) አልተዘጋጀም
 - 2) እርግጠኛ አይደለሁም
- 3.8 ወረቀቶች፣የተለያዩ ብረታብረቶች ከደረቅ ቆሻሻ መካከል እንደሚለዩ ሁሉ ስስ ፌስታሎችን ይለያሉወይ?
- 1) አዎ
 - 0) አልለይም
- 3.9 በቆሻሻ አወጋገድ ና አያያዝ ሂደት ላይ ፣ደረቅ ቆሻሻን የመለየት ተግባር ጊዜን የሚሻማ ተግባር ነው ብለው ያምናሉ?
- 1) አዎ፣ ደረቅ ቆሻሻን የመለየት ተግባር ሁልጊዜ ጊዜን ይሻማል
 - 2) አዎ፣ ደረቅ ቆሻሻን የመለየት ተግባር በመጠኑም ቢሆን ጊዜን ይሻማል
 - 3) ደረቅ ቆሻሻን የመለየት ተግባር ጊዜን የሚሻማ አይደለም
 - 4) እርግጠኛ አይደለሁም
- 3.10 የአካባቢን ንፅህና ከመጠበቅ አንፃር ከማኅበራዊ ተቋማት ለምሳሌ በእድር ፣በእቁብ ስትገናኙ ስለደረቅ ቆሻሻ ልየታ ተወያይታችሁ ታውቃላችሁወይ?
- 1)አዎ ተወያይተን እናውቃለን
 - 0) ተወያይተን አናውቅም

IV. በመንግስት እውቅና ያላቸው ማኅበራት(ደረቅ ቆሻሻ ሰብሳቢዎች) ተረፈ ምርትን ወደ ምርት ከሚቀይሩ ኢንዱስትሪዎች ጋር ያላቸው ትስስር (legal associations/solid waste collectors and their linkage with recycling industries)

- 4.1 መልሶ ጥቅም ላይ የሚውሉ ቁሶች ለምሳሌ ፕላቲክ ጠርመራ፣ጀሪካን፣የብረት ቁርጥራጮች የመሳሰሉት በመኖሪያ ቤት ውስጥ አካባቢ ማኅበራት(ደረቅ ቆሻሻ ሰብሳቢዎች) ያጠራቅማሉ ወይም ያከማቻሉ ወይ?
 - 1)አዎ፣ መልሶ ጥቅም ላይ የሚውሉ ቁሶች በየቀኑ በማኅበራቱ(ደረቅ ቆሻሻ ሰብሳቢዎች) ይጠራቀማሉ
 - 2) አዎ፣ መልሶ ጥቅም ላይ የሚውሉ ቁሶች አልፎ አልፎ በማኅበራቱ(ደረቅ ቆሻሻ ሰብሳቢዎች) ያጠራቀማሉ
 - 3) መልሶ ጥቅም ላይ የሚውሉ ቁሶች በማኅበራቱ(ደረቅ ቆሻሻ ሰብሳቢዎች) በኩል ሙሉ በሙሉ አይጠራቀምም
 - 4)እርግጠኛ አይደለም
- 4.2 መልሶ ጥቅም ላይ የሚውሉ ቁሶች ለምሳሌ ፕላቲክ ጠርመራ፣ጀሪካን፣የብረት ቁርጥራጮች አያያዝነት ምን ይመስላል?
 - 1) ለደረቅ ቆሻሻ ሰብሳቢዎች እሰጣለሁ
 - 2) በራሴ እጠቀምበታለሁ
 - 3) በነፃ ለደረቅ ቆሻሻ ሰብሳቢዎች እሰጣለሁ
- 4.3 በደረቅ ቆሻሻ ሰብሳቢ ማኅበራት በኩል እርስዎ ከቤትዎ ቆሻሻውን ከማውጣትዎ በፊት መልሶ ጥቅም ላይ የሚውሉ ቁሶችን በየፈርጁ ለይተው እንዲያቀርቡላቸው ይጠየቃሉ?
 - 1) አዎ፣ ይጠይቁኛል 0) ጠይቀውኝ አያውቁም
- 4.4 በጥያቄ ቁጥር 4.1 መሰረት መልስዎ አዎን ከሆነ በመኖሪያ ቤት ውስጥ አካባቢ መልሶ ጥቅም ላይ የሚውሉ ቁሶች ማኅበራቱ ተረፈ ምርትን ወደምርት ለሚቀይሩ ኢንዱስትሪዎች(recycling industries) እንዲያቀርቡ ያውቃሉ?
 - 1) አዎ አውቃለሁ 0) አላውቅም 2) እርግጠኛ አይደለም
- 4.5 በእርስዎ መኖሪያ ቤት አካባቢ ያሉ የደረቅ ቆሻሻ ሰብሳቢ ማኅበራት መልሶ ጥቅም ላይ የሚውሉ ቁሶችን ከሚበሰብሱ ደረቅ ቆሻሻዎች ጋር ቀላቅለው ሲሰጧቸው የማይበሰብሱትን እንዲለዩ ያስገድድዎታል?
 - 1) አዎ፣ ሁልጊዜ ለይቼ እንድሰጣቸው ያስገድዳኛል
 - 2) አዎ፣ አልፎ አልፎ ለይቼ እንድሰጣቸው ያስገድዳኛል
 - 3) ለይቼ እንድሰጣቸው አስገድደውኝ አያውቁም
 - 4) እርግጠኛ አይደለም
- 4.6 በእርስዎ መኖሪያ ቤት አካባቢ ደረቅ ቆሻሻ በሚሰጡበት ቦታ ፣ ቆሻሻ ሰብሳቢዎቹ በራሳቸው ተነሳሽነት መሸጥ የሚችሉትን ብቻ ለይቶ የማስቀመጥ ዝንባሌ አላቸው ብለው ያስባሉ?
 - 1)አዎ፣ መሸጥ የሚችሉትን ቁሶች ለይተው ሲያስቀምጡ በተደጋጋሚ ተመልክቻለሁ
 - 2)አዎ፣ መሸጥ የሚችሉትን ቁሶች ለይተው ሲያስቀምጡ አልፎ አልፎ አይቻለሁ
 - 3)እንደዚህ አይነት ተግባር ሲሰሩ አላየሁም
 - 4)እርግጠኛ አይደለም

ለደረቅ ቆሻሻ ማኅበራት ሰብሳቢዎች/አመራር አባላት የቀረበ ቃለመጠይቅ

1. በማኅበራችሁ ስር የታቀፉት አባላት ስለ ደረቅ ቆሻሻ ልየታ ግንዛቤ አላቸወደ?
2. ከነዋሪዎች የሚሰበሰቡ ደረቅ ቆሻሻዎችን ማኅበራችሁ የመለየት ተግባር ያከናውናልወይ?
3. በወረዳችሁ የሚገኘው ማኅበረሰብ ደረቅ ቆሻሻን የመለየት ልምድ አለወይ?
4. በማኅበራችሁ ስር የታቀፉት አባላት ከወረዳው አስተዳደር ወይም መንግስታዊ ካልሆኑ ድርጅቶች ስለደረቅ ቆሻሻ ልየታ በቂ ስልጠና አግኝተው የውቃላቸወይ?
5. ማኅበራችሁ ከወረዳው አስተዳደር ወይም መንግስታዊ ካልሆኑ ድርጅቶች ለደረቅ ቆሻሻ ልየታ የሚሆን ግብዓት/የቁሳቁስ አቅርቦት ያገኛልወይ?
6. ማኅበራችሁ ተረፈ ምርትን ወደ ምርት ከሚቀይሩ ኢንዱስትሪዎች ጋር ትስስር አላቸወደ? ካለ ማነው ያገናኛችሁ(የወረዳ ው አስተዳደር ወይስ መንግስታዊ ያልሆኑ ድርጅቶች)?ትስስራችሁንስ እንዴት ገመገማችሁት?
7. ወደ ሌላ ምርት የሚቀየሩ ተረፈ ምርቶች(recyclable materials) ለማኅበራችሁ የገቢ ምንጭ ይሆናሉ ብላችሁ ታስባላችሁወይ? ከሆነ ያብራሩ።
8. ኢንዱስትሪዎች ወይም አምራቾች ወደሌላ ምርት ሊቀየሩ የሚችሉ ተረፈ ምርቶችን (recyclable materials) የመግዛት ፍላጎት አላቸወደ? ካለ በምሳሌ ያስረዱ።

Annex C FDG Photograph



Figure 9: Focus Group Discussion from Addis Ketema Sub-city *Woreda* 07

(Source: own survey, 2022)



Figure 10: Focus Group Discussion from Yeka Sub-city *woreda* 09

(Source: own survey, 2022)



Figure 11: Focus Group Discussion from Bole Sub-city *Woreda* 01

(Source: own survey, 2022)