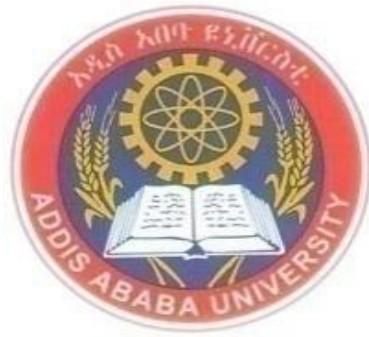


The Effect of Solid Waste Reverse Logistics on the Livelihood Assets of Collectors: The case of Addis Ababa



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This is to certify that the thesis prepared by **Orion Bezabih Ali**, entitled: **the effect of solid waste reverse logistics on the livelihood asset of collectors: the case of Addis Ababa**, submitted in partial fulfillment of the requirements for the degree of Master of Arts in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Statement of Declaration

I, the undersigned, hereby declare that the work contained this paper entitled “**the Effect of Solid Waste Reverse Logistics on the Livelihood Assets of Collectors: The Case of Addis Ababa**” is my own original work and that I have not previously in its entirety or in part submitted at any university for a degree. I have undertaken the work in close supervision from my advisor and all the materials used for this study have been duly acknowledged.

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Certification

This is to certify that this proposal entitled “**the Effect of Solid Waste Reverse Logistics on the Livelihood Assets of Collectors: The Case of Addis Ababa**” is submitted in partial fulfillment of the requirements for the award of the Degree of Master of Arts in Logistics and Supply Chain Management to the College of Business and Economics, School of Commerce, Addis Ababa University, through the Department of Logistics and Supply Chain Management, done by **Orion Bezabih Ali** is an authentic work carried out by him under my guidance.

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Acknowledgement

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Abstract

The government authority to manage Addis Ababa's Solid waste is Addis Ababa Solid Waste Management Agency. This agency uses three solid waste collection systems. These systems are residential, commercial and street waste collections. The residential waste collection system is the responsibility of micro and small enterprises organized under associations in all Woredas of Addis Ababa. These collectors earn their living operating solid waste collection by performing practices which fall in the realm of solid waste reverse logistics i.e. personal reuse, recycling, commercial reuse and organic valorization. There are about 6,400 individual collectors in Addis Ababa under the residential solid waste collection system. These collectors are working in all the sub-cities of Addis Ababa and the research study used a stratified sampling technique to identify a sample size of 376 respondents and study on the effect of solid waste reverse logistics on the livelihood assets of collectors. The research used both primary and secondary data to describe how residential solid waste collection is being practiced in Addis Ababa and infer which solid waste reverse logistics practice highly contribute on the livelihood assets of collectors.

Keywords: *Solid Waste, Reverse Logistics, Personal Reuse, Commercial Reuse, Recycling, Organic Valorization, Livelihood Assets.*

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Acronyms

AASWMA Addis Ababa Solid Waste Management Agency

ISWM Integrated Solid Waste Management

ISWMM Integrated Solid Waste Management Model

MSW Municipal Solid Waste

MSWM Municipal Solid Waste Management

SPSS Statistical Package for Social Sciences

1. Chapter One- Introduction

1.1. Background of the Study

With the increase of urbanization, the volume and frequency of waste disposal also intensifies. Amounts of waste becomes “prodigious with rapid and unplanned urbanization which leaves municipalities largely overwhelmed when it comes to the collection and disposal of the increasing amounts of waste” (Mwanza and Mbohwa, 2017). The rapid economic and population growth experienced by cities has resulted in changes in consumption pattern which in turn have led to an increase in solid waste generation (Buenrostro, Bocco and Bernache, 2001).

The world’s urban population has also been on the increase since 1950. It has been estimated that the figure, which was 3.2 billion in 2005, will rise to 6.4 billion by 2050 (UNDESA, 2007). The increasing urban population growth brought more solid waste than ever as our daily habits are producing an overwhelming solid waste. As a result, the amount of municipal waste will grow by 25% from 2005 to 2020 (Republic, 2008).

The global level of municipal solid waste generation is presently estimated to be around 1.3 billion tons per year and is expected to be double by 2025 (Kingdom, 2015).

Municipal solid waste management continues to remain one of the most neglected areas of urban development and this has called for sustainable means of management. It is characterized by a number of waste types (Mwanza and Mbohwa, 2017).

Increases in municipal waste generation come with challenges for its management. Presently, urban centers in Asia spend about US\$25 billion on solid waste per year, which is expected to double itself by 2025 (Kingdom, 2015). Solid waste management (SWM) often represents a significant proportion of the total recurrent municipal budget in cities of low- and middle income countries (Simpson, Scheinberg and Gupt, 2010). Solid waste management is an expensive service which increases with urbanization and differs from

one part of the world to another, although such data do not exist in Africa (Kingdom, 2015). Currently, solid waste management employs many collectors globally especially in the developing world. Hence, solid waste contributes as an income for the livelihood of millions of waste collectors.

Livelihood is one of the most widely researched topic. A number of development related projects in one way or another has something to do with livelihood. Some defined livelihood as the means through which an individual makes for a living (Chambers, 1995). Livelihood is also defined as a thing which comprises the capabilities (an enabling environment), assets (including both material and social resources) and activities (accessing and using the assets) required for a means of living (Chambers & Conway, 1991). Livelihood becomes sustainable when it is able to resist and recover from stresses and shocks while maintaining or enhancing its capabilities and assets both in the present and in the future, without not undermining the natural resource base (Murray, 2001).

While capabilities enable livelihood to be gained (Chambers and Conway, 1992), Livelihood strategies deals with how people access and use the assets within the aforementioned social, economic, political and environmental contexts (Murray, 2001). Livelihood assets may be tangible like land, livestock and tools or intangible like access to materials, health and employment opportunities. Another way of looking or understanding livelihood assets is to categorize them in to five group i.e. **financial, social, natural, physical** and **human** assets (capitals) (Murray, 2001). These five types of assets are used as an approach “to design development programming at the community level (Hahn, Riederer and Foster, 2009). Solid waste through many reverse logistics activities contributes financially for the livelihood of collectors.

Reverse Logistics plays an important role in Municipal solid waste management (MSWM). It focuses on the recovery of value from a product after its disposal and is, therefore, the starting point of a new supply chain (Brix-Asala, Hahn and Seuring, 2016a).

Reverse logistics is mainly concerned with the role of logistics in product returns, source reduction, recycling, material substitution, reuse of materials, waste disposal and refurbish, repair and manufacturing (Ensermu, 2013).

Addis Ababa is one of the most rapidly growing cities in Africa. It is the seat of the African Union (AU) as well as the United Nations - Economic Commission for Africa (UNECA). It is also a host city for a number of Embassies and other Diplomatic Missions. Addis Ababa is also the seat of many star hotels and restaurants as well as entertainment clubs. All these contribute to the growing solid waste.

The city of Addis Ababa generates more than 3,200 tons of waste per day of which 64.8% constitutes organic waste while paper and cardboard and plastic solid waste stood second and third with 5.4% and 5.2%, respectively. On the other hand, 76% of the solid waste is from residential houses while institutions (commercial and otherwise) registers 9% in second place (AASWMA, 2019). Waste Generation is expected to grow in size with the projected urbanization growth. The Ethiopian population is projected to be a little close to 125 million with 30.2 million urban population with 0.65 Kg/ capita/day and a total daily solid waste generation of 19,690 tones (Review and Management, 2012).

Currently, the Addis Ababa Solid Waste Management Agency (AASWMA) is responsible for the management of the municipal solid waste in Addis Ababa. The Agency uses three waste collection systems. The first one is Residential solid waste collection system which has a primary and secondary collection services. The primary collection service is a door to door solid waste collection system using 74 cleansing share associations while the secondary waste collection service is done by a municipal service which transport residential solid wastes from temporary storage (communal garbage containers) to the final dump site (landfill). The second collection system is an institutional (commercial) center waste collection system which comprises 40 private companies which collects and transport solid waste from institutions both commercial and governmental. The third and final solid waste collection system is done by around 5,000 government employed street sweeper workers.

The 74 cleansing share associations comprises 623 association members who are organized to collect solid waste from residential areas in Addis Ababa (AAWMA, 2019). Each of the 623 cleansing share association members is expected to have utmost 10 members,

making 6,400¹ individual collectors who grouped themselves under the associations to make their living by solid waste collection. The Addis Ababa solid waste agency is currently working with a number of primary stakeholders' solid waste including recycling companies which take some waste compositions from the 623 associations to reuse & recycle for domestic as well as international markets. Hence, the solid waste collection of the city contributes to the livelihood assets of thousands of these solid waste collectors.

1.2. Statement of the Problem

In developing countries, recent urbanization has increased the concentration of people resulting in the accumulation of waste that needs to be properly managed and disposed (Mwanza and Mbohwa, 2017). Addis Ababa of Ethiopia is no exception to the recent urbanization phenomenon happening all over the world.

Ethiopia has proclaimed a solid waste management proclamation (No. 513/2007) with the objective “to enhance at all level capacities to prevent the possible adverse impacts while creating economically and socially beneficial assets out of solid waste”². Furthermore, the proclamation empowers regions and urban administrations of Ethiopia “to set schedule and prepare their own solid waste management plan and report of implementation”.

There are a number of researches which were made on Ethiopian cities regarding municipal solid waste management. All of the researches made that the researcher came across focused on answering research questions like generation of solid waste in the city, existing management practices of household solid waste in the city/ town. For example, (Babiso Yeballework, 2014) made research on generation of solid waste and management practices of household solid waste in Hawassa. In Bahir Dar, a research on sustainability of municipal solid waste management was made which proved not financially sustainable (Lohri, Camenzind and Zurbrügg, 2014). The household solid waste management practice of Dessie town as well as the existing institutional arrangement and capacity of municipal solid waste management were researched by (Jiaoyu, 2011). In a research entitled

¹ Although each association member is expected to have not more than 10 collectors, some has more than the requirement and that is why the number is 6,400 instead of 6,230.

² Article 3 of the Ethiopian Solid Waste Management Proclamation 513/2007.

sustainable solid waste collection in Addis Ababa, (Meine Pieter, 2014) found out that regularity, reliability, service coverage and the frequency of service delivery to the households improved. All the above researches and related others focused generally on the practice of solid waste management.

The organization responsible for the solid waste management for the capital Addis Ababa is AASWMA. Subsequent to proclamation No. 513/2007, the City government of Addis Ababa had issued a regulation (No. 100/2018) to enhance the sanitation of the capital by implementing an integrated solid waste management system. In addition to employing around 5,000 permanent workers, the Agency organized the 74 cleansing associations and 623 association members to collect solid waste from residential areas.

These associations' do activities in the realm of reverse logistics including reuse, reuse with repair, recycling (by collecting, sorting, processing, storing and trading plastic wastes to recycling companies) and organic valorization.

In line with the objective of the proclamation which is “to enhance at all level capacities to prevent the possible adverse impacts while creating economically and socially beneficial assets out of solid waste”, these organized 623 associations members under 74 cleansing share associations, do the above mentioned activities to earn a living. These associations ensure that solid wastes are collected, segregated, processed from other waste composites that are destined for final disposals.

Despite the foregoing and to the best of the researcher's knowledge, no research has been conducted on the effect of Solid waste on the livelihood of collectors in Addis Ababa;

This research therefore, studies the effect of solid waste reverse logistics activities on the livelihood assets of collectors. It also studies how solid waste reverse logistics is being practiced by major stakeholders in Addis Ababa and which solid waste reverse logistics activity contributes the highest in the livelihood assets of collectors.

1.3. Research Question

- ❖ How is the solid waste reverse logistic being practiced in Addis Ababa?
- ❖ Which solid waste reverse logistics activity highly contributes on the livelihood asset of collectors?
- ❖ How solid waste reverse logistic contribute to the livelihood assets of collectors?

1.4. Research Objectives

1.4.1. General Objective

AASWMA, as part of discharging its responsibilities, organized 74 cleansing share associations which comprises 623 association members in the 10 sub-cities of Addis Ababa all the way to the Woreda level (currently around 120 Woredas). There are also 15 recycling companies working with the Agency which accepts components of the plastic solid waste to recycle and market it to domestic as well as foreign markets.

The objective of the research is to study the effect of solid waste reverse logistics on the livelihood assets of collectors. The research also identified which solid waste reverse logistic activity makes the highest contribution on the livelihood assets of collectors as well as examined how solid waste reverse logistics are being practiced in Addis Ababa.

1.4.2. Specific Objectives

The research study has the following specific objectives:

- ❖ To identify and examine which solid waste reverse logistic activity highly contributes to the livelihood asset of collectors?
- ❖ To examine the solid waste reverse logistic contribution to the livelihood assets of collectors?
- ❖ To investigate how solid waste reverse logistic is being practiced in Addis Ababa?

1.5. Significance of the Study

Addis Ababa is expanding rapidly both vertically and horizontally and attracting residents all over Ethiopia. It is also an international metropolitan city with a considerable expats living and working for livelihood. As a result, one can expect a solid waste volume with an increasing trajectories. Currently, Addis Ababa generates 3,200 tons of solid waste per day. Besides, the physical, chemical and thermal characterization of the waste is dense with 264 kg/m³ density per day (AASWMA, 2019).

According to the director of the reuse and recycling directorate of the Addis Ababa solid waste agency, there is no much research conducted on the issue. The research study fills a significant gap on the area by describing the impact of the solid waste on the livelihood assets of collectors. The study, therefore, contribute to the solid waste industry mainly giving focus on the contribution of solid waste reverse logistics on the livelihood assets of collectors and try to indicate possible researchable gaps that may exist during the course of the research undertaking.

The result of the research study contributes as spring board for future studies on solid waste management of Addis Ababa. Furthermore, the findings of the research helps the municipal solid waste management agency as an input for the sustainable solid waste management program.

1.6. Scope of the Study

A typical household waste stream may contain a variety of solid waste compositions. Addis Ababa generates 3,200 tons of solid waste daily of which organic waste composition registers 64.8% followed by paper and cardboard with 5.3% while plastic is placed on third with 5.2% composition (AASWMA, 2019). Geographically, the research study is limited only in Addis Ababa and its findings in no way be generalizable to the practice and the management of solid waste in Ethiopia. Subsequently, the practice of solid waste reverse logistics is studied focusing only Addis Ababa.

Reverse Logistics is mainly concerned with the role of Logistics in product return. It also incudes, inter alia, source reduction, recycling, reuse of materials and repair (Ensermu,

M., 2013). Hence, the conceptual scope of reverse logistics in this research study only focused on components of four activities i.e. ***Personal Reuse, Reuse with repair for commercial purpose, Recycling, and Organic Valorization*** (Brix-Asala, Hahn and Seuring, 2016b) and (Scheinberg et. al., 2010). Even if the concept of Reverse Logistics mainly deals in the context of Organizational levels, throughout the research study, the scope of reverse logistics is in the realm of solid waste collection and which is also tailored towards the individual collectors. Furthermore, since the associations are organized in a group, some solid waste reverse logistics activities like personal reuse and commercial reuse were also studied as a group.

On the other hand, the scope of livelihood is limited on the asset components i.e. financial, human, natural, physical and social capitals. Methodologically, the scope of the research study is a mixture of inferential and descriptive research designs.

1.7. Limitation of the Study

There are different groups of solid waste collectors in Addis Ababa. These are the 74 cleansing share associations and its 623 association members, the 5,000 street sweepers employed by the Addis Ababa city government, employees of the private institutional waste collectors and finally the informal individual waste collectors. One limitation of the research is its focus on the associations and not on the informal collectors who are not organized. The collectors in the associations and individual informal collectors more or less seems to work on the same setting i.e. they all collect, sort, process the solid waste and target the same recycling companies. But because of the absence of database for the informal collectors, the research was limited only to the individual collectors in the associations. Furthermore, the semi structured interview intended to be made with the recycling companies for triangulation didn't materialize because of their temporary shutdown in operation because of COVID-19.

1.8. Definition of Terms

Solid Waste means anything that is neither liquid nor gas and is discarded as unwanted;³

Solid Waste Management means the collection, transportation, storage, recycling or disposal of solid waste, or the subsequent use of a disposal site that is no longer operational;⁴

Reverse Logistics is the process of moving goods from their typical final destination for the purpose of recapturing value or proper disposal (Kaynak, Koçoğlu and Akgün, 2014).

Recycling: Collecting separately and/or identifying, sorting, processing, storing and trading materials into the global industrial value chain (Brix-Asala, Hahn and Seuring, 2016a).

Livelihood: Livelihood refers to the means of gaining a living, including livelihood capabilities, tangible assets and intangible assets (Chambers, 1995).

Recyclable Material: A material can be considered reclaimable when both a technology for waste treatment and a market for the products are available (Manrich and Santos, 2009).

Formal Waste Sector: The formal waste collection activities are carried through modern, technological, and industrialized means. Furthermore, it exists within public or private organizations whose existence is officially recognized and get benefits from the protection of the authorities. (Alexandru and Bugheanu, 2017).

Informal Waste Sector: Informal waste collection activities lie outside of the official control and protection. (Alexandru and Bugheanu, 2017).

Informal Valorization: which is derived from the waste management stream, includes “the entire process of extracting, storing, collecting or processing materials from the waste stream in order to extract and divert value and direct the material to value added stream” (Brix-Asala, Hahn and Seuring, 2016b).

³ Solid Waste Management Proclamation 513/2007

⁴ IBID

1.9. Organization of the Study

The thesis paper is organized in to five sections: In chapter one, the introduction part which includes the background of the study, problem statement, scope of the study and the like are presented. Then, in chapter two, review of related Literatures which includes empirical and theoretical literatures and related concepts are presented. The review of related literatures provides a context to the paper. In chapter three research methodologies that was followed to undertake the study is described. While chapter four present the result and discussion of the paper including interpretation of the findings, the fifth and final chapter of the paper presents the summary, conclusion and recommendation part of the study.

2. Chapter Two- Review of Related Literature

The literature review highlights and summarizes focusing on solid waste in the umbrella of reverse logistics and how it contributes to the livelihood assets of waste collectors in the context of developing countries. Literatures conducted in line with the Integrated Solid Waste Management (ISWM) Model and its contributions to waste collectors' livelihood assets are summarized which form as a guide for the findings of the research and analysis part. The ISWM Model also forms the outline for the theoretical framework of the research.

In this chapter, the nature and scope of reverse logistics in the context of solid waste i.e. waste reuse, waste recycle and related concepts as well as their contribution to livelihood assets are discussed.

2.1. Theoretical Literature Review

2.1.1. Solid Waste

Waste generally can be viewed as “something which is no longer of use to one individual or for a specific purpose, opening for the idea that it might become useful again, for someone else, or for a different purpose” (Schioldborg and Bjørke, 2014). Waste can also be defined as unwanted leftover or excess material that need to be discarded. It is “any substance or object which the holder discards unwanted leftover or excess material (Holt and Littlewood, 2017).

On the other hand, Solid Waste is defined as, anything that is neither liquid nor gas and is discarded as unwanted⁵. “Some use the term solid waste to separate between solid waste and liquid waste such as waste water and sewage (Schioldborg and Bjørke, 2014). Solid waste is therefore any solid material that comes from domestic, commercial, industrial, agricultural and demolition activities, and is regarded as unwanted by those who own it (Chati, 2012). Throughout the research, the definition of solid waste as defined by the Ethiopian solid waste proclamation no. 513/2007 will be used.

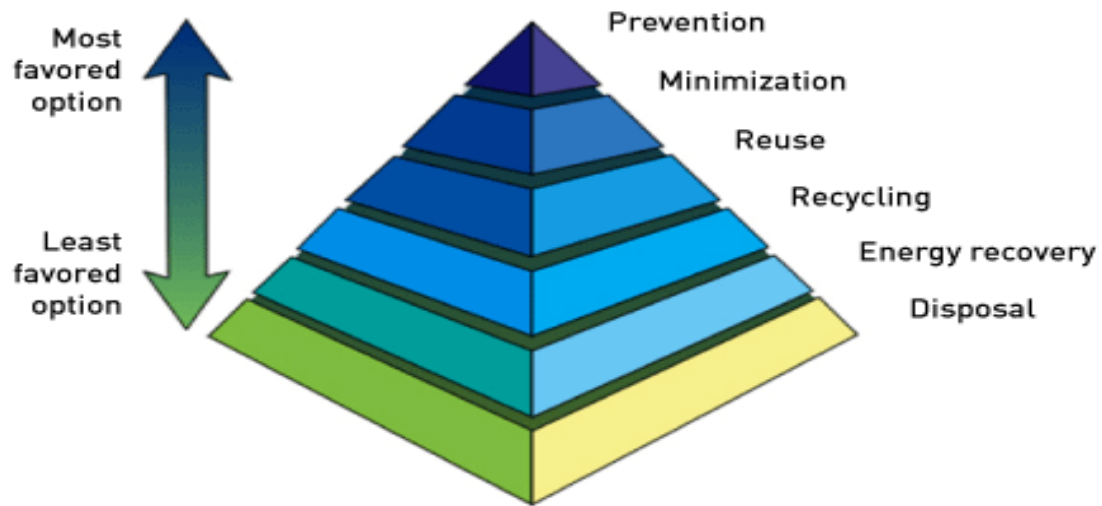
⁵ Ethiopian Solid Waste Management Proclamation No. 513/2007

Solid waste is increasing globally on yearly basis and cost to manage it is expected to be about USD 375.5 billion in 2025. The cost increase will be more severe in low income countries (more than 5 fold increase) and lower middle income countries (more than 4 fold increase) (Review and Management, 2012). Waste generation in “Sub-Saharan Africa is approximately 62 million tons per year and per capita waste generation in the region is generally low, but spans a wide range, from 0.09 to 3.00 kg per person per day with an average of 0.65 kg/capita/day (Review and Management, 2012). The generation of Waste in African is relatively low compared to 63 million tons per year for Middle East and North Africa and 160 million tons for Latin American countries (Review and Management, 2012).

Historically, solid waste disposal by landfilling has been the predominant treatment method for municipal waste, but over time and especially in the 1990s and 2000s, a considerable reductions in landfilling have taken place (Republic, 2008). Waste disposal by landfill is now being seen as a last resort in Modern Waste Management. Increased recovery of waste, and diverting waste away from landfill, therefore, plays a key role in tackling the environmental impacts of increasing waste volumes (Republic, 2008).

The most preferred option in municipal solid waste is prevention of waste from being generated in the first place. However, this option may not seem viable as solid waste generation is an avoidable (Review and Management, 2012). Waste minimization, reuse, recycling, energy recovery and finally disposal are the preferred options of solid waste management in their order.

Figure 2. 1: Preferred Options of Solid Waste Management



Source: (Review and Management, 2012) and ⁶

As waste is generally an unwanted disposal, technological advancements greatly helped to shape waste as a resource. Some composition of solid waste like plastics, nonetheless, have a number of demerits to the environment and from waste management perspectives. In the context of solid waste management hierarchy, recycling is considered as one of the best option to reduce the impacts presented by end of life (EoL) and end of use (EoU) post-consumer packaging plastic wastes (Mwanza and Mbohwa, 2017).

2.1.2. Classification of Waste

“A number of criteria are usually employed to classify wastes into types including their sources, physical state, material composition and the level of risk associated with waste substances (Nottingham and User, 2009).

⁶ <http://www.researchtrends.com/issue19-september-2010/research-and-practice-inwaste-management/>

Table 2. 1: Classification of Waste

Criteria for Classification	Examples of Waste
Sources or premises of generation	Residential, commercial, industrial, municipal services, building and construction, agricultural
Physical state of waste materials	Liquid, solid, gaseous, radioactive
Material composition of waste	Organic food waste, paper and card, plastic, inert, metal, glass, Textile
Level of risk	Hazardous, non-hazardous

Source: (Nottingham and User, 2009)

2.1.3. Challenges of Solid Waste Management

Solid Waste Management is generally challenging to deal with for any country as it endangers human health and the environment (Aaniamenga Bowan and Mumuni, 2013). The challenge is even more difficult for developing countries. The challenge for developing countries is exacerbated by rapid and unplanned urbanization leaving municipalities largely overwhelmed by solid waste management where collection and disposal is increasing to the level like never before. Rapid Urbanization is happening in developing countries which is increasing the concentration of people resulting in accumulation of waste that need to be properly managed (Mwanza and Mbohwa, 2017). Hence, the challenge of rapid and unplanned urbanization coupled with one of the most neglected areas of urban development, Municipal Solid Waste management continues to remain challenging for developing countries (Mwanza and Mbohwa, 2017).

Furthermore, the challenge of solid waste management is exacerbated not only by rapid and uncontrolled urbanization, it is also by social upheaval and the continuing variation of waste composition as a result of radical changes in residents' lifestyle change and the resulting consumption pattern (Noel, 2010). The improper and at times unlawful solid waste pre-disposal practices of urban dwellers is also another challenge for solid waste management.

“The African continent is typically rural, but has experienced an extensive urbanization during the last decades, accelerated by increased regionalization and globalization. For many countries in Africa this has stimulated the already unprecedented urban growth phenomenon and increased the challenges that come with it, one of them being management of municipal solid waste” (Schioldborg and Bjørke, 2014). Despite a growing concern about solid waste from government and individuals in Africa, there is still a widespread and serious challenges of solid waste management (Douti, Abanyie and Ampofo, 2017). As a result, municipal authorities are struggling to manage the waste generated due to factors related with low financial budget, inability to enforce the law related with solid waste management (Ampofo, Soyelle and Abanyie, 2016).

The past 20th century and developments in the early 21st century points that waste (solid, liquid, or toxic,) has majorly become a consequence of economic development and modernization (Chati, 2012). The global Solid waste is increasing at unprecedented level and the issue of managing it has to be given the utmost importance irrespective of the state of any country’s developmental level.

2.1.4. Solid Waste for Livelihood Assets

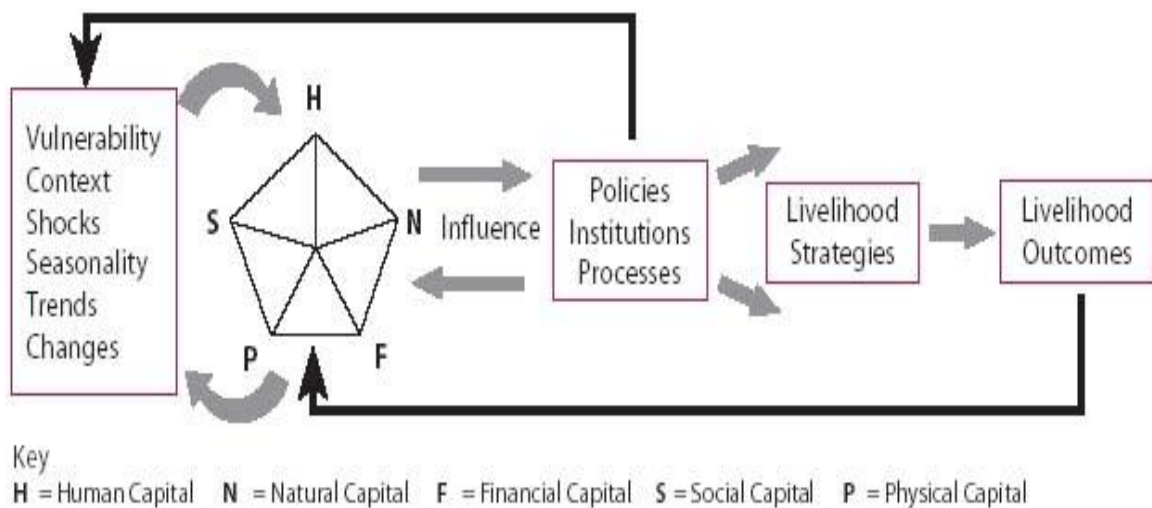
Livelihood is one of the most widely researched topic. A number of development related projects in one way or another has something to do with livelihood. Some defined livelihood as the means through which an individual makes for a living (Chambers, 1995). While others defined it as a thing which comprises the capabilities (accessing & using assets), assets (including both material and social resources) and activities required for a means of living (Chambers & Conway, 1991). On the other hand, livelihood becomes sustainable when it is able to resist and recover at the same time from stresses while maintaining its capabilities and assets now and in the future. (Murray, 2001).

While capabilities enable livelihood to be gained (Chambers and Conway, 1992), Livelihood strategies deals with how people access and use the assets within the aforementioned social, economic, political and environmental contexts (Murray, 2001). Livelihood assets may be tangible like land, livestock and tools or intangible like access to materials, health and employment opportunities. Another way of looking or understanding

livelihood assets is to categorize them in to five group i.e. **financial**, **social**, **natural**, **physical** and **human** assets (capitals) (Murray, 2001). These five types of assets are used as an approach “to design development programming at the community level (Hahn, Riederer and Foster, 2009).

The livelihood assets are the resource base of communities and different categories of households. The five livelihood assets are drawn from the sustainable livelihood approaches diagrammatically depicted as per the below framework.

Figure 2. 2: Framework of Sustainable Livelihood Approach



Source: Adopted from (Anani, 1999)

These five livelihood assets, drawn from the sustainable livelihood approaches are presented as follows:

The **Human Capital** includes the skills, knowledge, ability to labor and good health and physical capability important for the successful pursuit of different livelihood strategies (Anani, 1999).

The **Natural Capital** includes the natural resource stocks (soil, water, air, etc.) and environmental services (hydrological cycle, pollution sinks etc.) from which resource flows and services useful for livelihoods are derived (Anani, 1999).

The **Financial Capital** – the capital base (cash, credit/debt, savings, and other economic assets, including basic infrastructure and production equipment and technologies) which are essential for the pursuit of any livelihood strategy (Anani, 1999).

The **Social Capital** – the social resources (networks, social claims, social relations, affiliations, associations) upon which people draw when pursuing different livelihood strategies requiring coordinated actions (Anani, 1999).

The **Physical Capital** includes basic infrastructure, such as roads, water & sanitation, schools Hosni, Mohammad, 2006).

Livelihood has different approaches including needs approach and empowerment approach (Schioldborg and Bjørke, 2014). Throughout the thesis, livelihood on a basic needs approach will be utilized.

Employees in one way or another, either in formal or informal sectors, are engaged in different professions depending on many factors including level of education, experience, skill and related backgrounds. Solid waste collection is one sector through which millions all over the world especially in developing countries are engaged in as a means through which millions of poor people make a living. The labor intensive nature of waste collection and recycling, reuse and recovery in developing countries may provide employment for the poor and unskilled (Schioldborg and Bjørke, 2014). A very common feature of most less developed countries is an urban informal sector which provides livelihoods for millions (Deporah, 2007). Waste picking (collection), is a “significant income stream for many across the developing world. Hence, in resource constrained environments, free or discounted resources like waste are used to create livelihood income” (Talyan, Dahiya and Sreekrishnan, 2008). For example, in Delhi alone, there are up to 100,000 waste pickers and 17,857 waste collectors involved to earn a living (Talyan, Dahiya and Sreekrishnan, 2008). Generally, the millions of solid waste collectors in cities of most developing countries all around the world do earn a living by finding value in the waste that other people throw away (Scheinberg et. al., 2010).

Finally, even if, solid waste is largely “neglected in urban development planning policies”, it plays a key role on the basket of poor urban waste collectors as job creation activity (Simatele and Etambakonga, 2015). Many waste management basic activities in low

income countries including in Africa are being carried out within the context of profound urban poverty (Noel, 2010). Some study “estimates that more than 2% of the population in the underdeveloped and developing states is involved in informal waste collection activities” (Alexandru and Bugheanu, 2017). As a result, “solid waste has come to play an important role in contributing to the urban food basket of poor waste collectors in developing countries including in urban Africa” (Simatele and Etambakonga, 2015).

2.1.5. Reverse Logistics

Supply chain is undergoing a huge transformation as a result of a massive competition happening in the world (Raci and Shankar, 2005). It is common to hear a product recall by some major producers in the global supply chain. Currently, we observe globally that companies are receiving an increase in the flow of returns of the product due to warranty returns, product recalls, service returns, end-of-use returns, end-of-life returns, and so on (Raci and Shankar, 2005). All these activities are within the realm of reverse logistics.

Some scholars define reverse logistics in their own way with the similar and overlapping themes and activities. For example (Rohan, Varun & Hulgur, 2006), defines Reverse Logistic as a discipline which ...

... Stands for all operations related to the reuse of products and materials. More precisely, reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal. Remanufacturing and refurbishing activities also may be included in the definition of reverse logistics (Rohan, Varun & Hulgur, 2006).

Reverse logistics is also defined as “the process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or for proper disposal” (Daugherty *et al.*, 2005). Reverse Logistics also stands for all the activities and operations in relation to the reuse of products and materials. It includes all the processes of moving goods from their specific final destination for the purpose of regaining and capturing value, or for appropriate disposal (Lee, Jeong & Kim, 2006).

Much of the solid waste activities including recycling, reuse, and organic valorization are in the realm of reverse logistics. Subsequently, “informal valorization stemming from waste management emphasis the role of informal waste pickers who extract value from the end-of-life product (Brix-Asala et al., 2016a). Subsequently, the solid waste collection forms an essential part of industrial value chain in much of the developing countries by integrating collectors in the operation (Brix-Asala, et al., 2016a). Furthermore, (Scheinberg et. al., 2010) also identified reuse, recycle and related recovery activities in solid waste collection.

(Gunsilius *et al.*, 2011) identified following four main forms of valorization in the solid waste collection which contribute the livelihood of individual collectors:

- ❖ **Personal or Commercial Reuse:** This activity uses materials for household maintenance, which includes as food for persons or animals, or as household, agricultural, or business inputs. Second-hand shops and flea markets are examples of this.
- ❖ **Reuse with Repair:** Repairing items and materials and marketing them.
- ❖ **Recycling:** collecting materials separately and/or identifying, sorting and processing, as well as storing and trading materials into the global industrial value chain.
- ❖ **Organics Valorization:** collecting separately or sorting and processing kitchen, garden, commercial, agricultural and animal wastes and paper, and marketing it as animal feed or compost.

The above four solid waste reverse logistics activities contribute to the livelihood of millions of collectors throughout the world in the developing countries.

2.1.6. Integrated Solid Waste Management Model

In the last two decades, efforts are being made by the formal sector to Integrate Solid Waste Management (ISWM) which is a “shift from the victimization of scavengers to an inclusive discourse focused on achieving effective management of solid waste” (Simatele and Etambakonga, 2015). ISWM Model among other things include recognizing, strengthening

and integrating solid waste collectors into solid waste management (Simatele and Etambakonga, 2015).

ISWMM is a model that allows intricate studies of the multidimensional elements of waste management.(Schioldborg and Bjørke, 2014). “The model has been constantly developed since the mid-1980s by organizations and scholars concerned with urban environment and development and partners working in developing countries and further developed by combined working groups in solid waste management” (Guerrero, Maas and Hogland, 2013). The model acknowledges three dimensions in solid waste management system. (Guerrero, Maas and Hogland, 2013) elaborates these dimensions as follows:

- ❖ **Stakeholders** are all organs that have an interest in solid waste management;
- ❖ The **Elements** or stages of the movement or flow of solid waste materials from the point generation all the way to treatment and final disposal, and;
- ❖ The **Aspects** is a lens by which the system is thoroughly analyzed.

The three scopes altogether aim at assisting sustainable waste management (Schioldborg and Bjørke, 2014). The three scopes alone do not sustain solid waste management unless an empowering and enabling environment which facilitates the performance of the system exists. These enabling environments among other things, includes technical, financial, institutional and legal aspects, based on which the whole system exists and functions (Guerrero, Maas and Hogland, 2013).

The ISWMM is, therefore, a comprehensive model in solid waste management and the research study is within the context of the model. The collectors, the agency and the recycling companies are the primary stakeholders in solid waste management. The elements or flow of solid waste from generation point to final disposal and the waste valorization process is addressed in the research. Finally, the effect of solid waste reverse logistics on the livelihood assets of collectors and which reverse logistic activity highly contribute to collectors is also analyzed.

2.2. Empirical Literature Review

There are a number of empirical researches made on the impact of solid waste on the livelihood of collectors in every corner of the world. The effect of solid waste for livelihood is especially prevalent in the developing countries where millions engage in it to earn a living. Empirical studies on solid waste management and livelihood are done in all continents. “The economic, environmental, and social benefits resulted from waste valorization potentials are clearly higher in the formal waste sector compared with formal waste activities”(Alexandru and Bugheanu, 2017) cited (Adama, 2011).

According to studies made on six cities i.e. Cairo (Egypt), Cluj-Napoca (Romania), Lima (Peru), Lusaka (Zambia), Pune (India) and Quezon City (the Philippines) from 2006-2007, the informal waste sector approximately employs 73,000 workers who valorize more than 3 million tons per year (Scheinberg et. al., 2010). The informal waste and recycling sector in cities is comprised of two distinct sub-sectors i.e. an informal service sector and an informal valorization sector (Scheinberg et. al., 2010).

In Haiti, the Greater Port-au-Prince solid waste management system is “very inclusive with respect to age, while highly segregated with regard to gender. Even children are involved in working either as scavengers or self-employed as informal waste collectors. Most of the young workers were hired by the private companies or involved in the informal waste sector as scavengers or refuse collectors. The level of education of the workers was very low. Male workers dominated the managerial positions, whereas female workers were hired by the State agencies to sweep and gather solid waste or self-employed as scavengers on the dump sites” (Noel, 2010).

Solid waste collection in Ghana has an implication for the livelihood of the poor (Nottingham and User, 2009). Waste collectors collect recyclable materials to support their livelihood (Douti, Abanyie and Ampofo, 2017).

In Democratic Republic of Congo, scavenging or solid waste collection plays a vital role in supporting to the urban food basket of poor households in Kinshasa. While the solid waste collection sector is largely ignored in urban development and planning policies, it

still aids as a job creating industry. Furthermore, solid waste collection and valorizing waste in Kinshasa is a widespread activity and it is primarily carried out by men and in some cases children and women (Simatele and Etambakonga, 2015).

In Nigeria solid waste pickers accumulate, recover, sort and recycle solid waste materials not only to generate a means of livelihood but also guaranteeing the sustainability of solid waste management (Kingdom, 2015). In Kaduna Metropolis in North West Nigeria, “women are only playing a very fringe but yet complementary roles in the waste collection, sorting and recycling processes, which are fast becoming catalyst for livelihood for the underprivileged urban dwellers”. The study further presented women and children playing principal role in collection and trade of recyclable materials (Muhammad and Manu, 2013).

Municipal solid waste dumpsites in Kenya reveals strong scavenging for recyclables in disposed waste (Henry, Yongsheng and Jun, 2006). Originally motivated by poverty and aspiration to earn a living, scavenging or valorizing solid waste is growing together with the appearance of recycling companies.

In Delhi (India), the informal waste recycling sector employs thousands of waste collectors who earns a living mainly by sale of valorizing materials from the waste (Talyan, Dahiya and Sreekrishnan, 2008).

In Pakistan, waste collectors play roles in recycling of waste in southern Lahore. Furthermore, as there is no formal sorting of waste in cities of Pakistan, the sorting activity of the waste is primarily left to the informal sector i.e. scavengers (Asim, Batool and Chaudhry, 2012). These solid waste collectors perform waste valorizing activity for their livelihood.

In Bangladesh, informal waste collectors play a major role in municipal solid waste collection (Matter, Dietschi and Zurbrügg, 2013). The solid waste collectors perform waste valorization to contribute for their livelihood.

Generally, informal service sector consists of “individuals and micro enterprise informal service providers earning fees for removal of waste, litter, more broadly known as dirt”. An informal valorization sector also consists of “co-operatives, individuals and family &

micro enterprises which functions as an extractive resource industry”(Scheinberg et. al., 2010). The main activity of the valorization sector is identifying and removing valuable materials from the waste stream and places where waste accumulates and valorizing it (Brix-Asala, Hahn and Seuring, 2016b).

Both the informal service and the informal valorization sectors are part of the private sector. In most cities of the developing countries, there is some degree of private sector partaking in solid waste sector either in collection or disposal. Furthermore, some cities have contractual contract engagements between the city authorities and the formal solid waste collection. There is, however, variation in the institutional and financial arrangements that finance public-private partnerships in the handling, transport, recovery and disposal of solid waste (Scheinberg et. al., 2010).

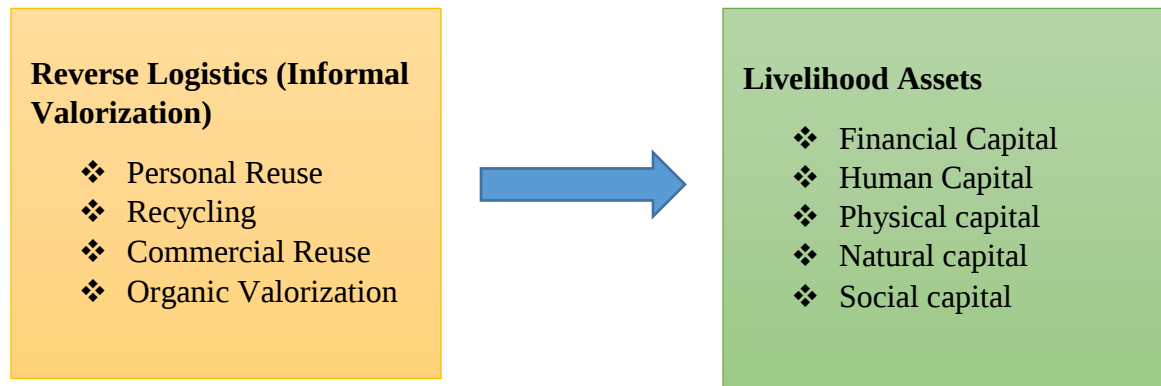
A material can be reclaimable when both the technology for waste management (treatment) and a market for the products are available. (Brix-Asala, Hahn and Seuring, 2016b) and (Scheinberg et. al., 2010) have identified four main forms of valorization in the private waste management sector as follows:

- ❖ **Personal or commercial reuse:** Using materials for household maintenance, including as food for persons or animals, or as household, agricultural, or business inputs. Second-hand shops and flea markets are examples of this.
- ❖ **Reuse with repair:** Repairing items and materials and marketing them.
- ❖ **Recycling:** collecting separately and/or identifying, sorting, processing, storing and trading materials into the global industrial value chain.
- ❖ **Organics Valorization:** collecting separately or sorting and processing kitchen, garden, commercial, agricultural and animal wastes and paper, and marketing it as animal feed or compost.

Generally, valorization is primarily done for economic purpose which contributes to the livelihood assets of millions of waste collectors around the world. For example, the “economic impact of the valorization sector in six cities around the world along the entire value chain generates a total net profit of 130 million Euro” (Gunsilius *et al.*, 2011). It also keep the street hygienic and add to a better ecological performance in the context of solid waste reverse logistics (Brix-Asala, Hahn and Seuring, 2016b).

2.3. Conceptual Framework

Figure 2. 3: Conceptual framework



Conceptual Framework Model

3. Chapter Three- Research Methodology

3.1. Description of the Study Area

The study area of the research is in Addis Ababa. The capital Addis Ababa, which is subdivided into ten sub-cities having a total of around 120 Woredas (the lowest administrative unit in Addis Ababa). Addis Ababa is also the most populous city of Ethiopia with rapid urbanization which shows no sign of slowing down. Currently, the city government of Addis Ababa is constructing thousands of condominium houses which is expected to increase solid waste of the city in the coming decade.

The study area is selected to be Addis Ababa as it generates solid waste on an industrial scale. There are private and government primary solid waste collectors in Addis Ababa. The solid waste recycling companies are mostly located in and around Addis Ababa.

Hence, due to the above mentioned and related reasons, Addis Ababa is selected to be the study area for the research.

3.2. Research Approach

The research study is designed to have a Quantitative methodological framework as a dominant research approach. The researcher also utilized qualitative approaches to one research question and complement the dominant quantitative methods. Qualitative instruments like semi-structured interviews and observations were used. Observation and semi-structured interviews gave the researcher a contextual meaning which helped the researcher to have a better insight in the analysis and interpretation of the data. Semi-structured interview was administered with the official of the Agency and experts of solid waste management from sub-cities to understand how solid waste valorization is performed as well as whether there are policy augmentations to sustain the solid waste collection industry. On the other hand, survey questionnaires were used as the main instrument to collect data for the quantitative research technique, while the qualitative instruments complemented the questionnaires to collect the empirical data.

The research study, therefore, utilized both qualitative and quantitative approaches and hence, the study was a mixed one.

3.3. Research Design

The research study portrayed the effect of solid waste and its contribution on the livelihood asset of collectors. The research also identified which solid waste reverse logistics contribute on the livelihood assets of collectors. Hence, descriptive and inferential research designs were utilized.

Descriptive survey enables to obtain the current and existing information about the practice of solid waste management in Addis Ababa. Furthermore, descriptive research design helped to portray the practice of solid waste collection in Addis Ababa and how solid waste reverse logistics contribute on the livelihood asset of collectors. The inferential research design identified which solid waste reverse logistics highly contributed to the livelihood asset of collectors.

Hence, the research study employed and utilized both inferential and descriptive research designs.

3.4. Population and Sampling

The unit of analysis for this study was individual collectors. The population framework of the study is the 74 cleansing associations and the respective 623 association members. The Addis Ababa solid waste management agency is the primary stakeholder to describe the practice of solid waste collection in Addis Ababa. There are also 15 recycling companies working with the associations in the supply chain, and the researcher planned to use information from these sources for triangulation purposes.

Each solid waste collection association member is organized to have ten members making the total number of collectors to be around 6,230 (Addis Ababa Waste Management Agency, 2019).

The population do not exhibit a major differences in characteristics i.e. the collectors are organized uniformly, they all work the same activities on the same setting. The character of the area may, however, create some unique features on the operation of solid waste collection. The researcher, therefore, decided a stratified sampling technique, which base location as a reason of stratification to be the optimal way to represent respondents. Hence, used the location of the associations' to create a mutually exclusive groups, i.e. sub-cities of Addis Ababa. Accordingly, the lowest number of cleansing share associations are found in Arada, Kirkose and Lideta Sub-cities while Kolfe and Bole have more than 10 share associations. On the other hand, Kolfe leads with 87 while Bole and Nifas Silk have each 86 association members.

Once the researcher identified sub-cities as the ten strata, he used a proportional quota sampling to represent every solid waste collectors in each association. To this end, the researcher used a proportional quota sampling to select the sample size from the 74 cleansing share and the 623 association members, which are organized at the sub-city and Woreda levels. The researcher believed the appropriateness of employing proportional quota sampling technique to represent solid waste collectors. Once each sub-city is represented using the proportional quota sampling, the researcher then used convenient sampling to the individual unit of analysis i.e. collectors.

The researcher used Yamane (1967) formula to calculate the sample size. Hence, at 95% degree of confidence and with $\pm 5\%$ variance, the sample size became **376** as per the below calculation.

n=	N
	1+N(e ²)

n=	6230
	1+6230(0.0025)

Table 3. 1: Sample Design

No.	Sub City	Number of Cleansing Share Association	Number of association Members	No. of Collectors	Quota %age	Sample Size
1	Bole	13	86	860	13.8	52
2	Arada	3	39	390	6.26	24
3	Gullele	5	50	500	8.04	30
4	Kirkose	3	50	500	8.04	30
5	Nifas Silk	10	86	860	13.8	52
6	Addis Ketema	6	64	640	10.27	39
7	Yeka	10	82	820	13.16	49
8	Akaki Kality	6	43	430	6.9	26
9	Kolfe	15	87	870	13.96	52
10	Lideta	3	36	360	5.77	22
Total		74	623	6,230	100%	376

Source: Addis Ababa Solid Waste Management Agency

Data using key informant interview was collected from the Agency and experts from some sub-cities, which the researcher used to triangulate and also describe the practice of solid waste collection in Addis Ababa.

3.5. Data Source and types

The research used both primary and secondary data. Primary data was collected with survey questionnaires. Observation and semi structured interviews was also used as primary data sources. The secondary data were collected from the Agency and related literatures in solid waste management.

3.6. Data Collection Procedure

A pre-tested, structured survey questionnaire in Amharic was developed as the main data collection instrument. The survey questions were adopted from research undertakings with similar or related context. Back translation of these survey questions was made in Amharic. These survey questions were collected at the work place i.e. collection sites, temporary transfer points, and at the Agency's headquarter. The researcher observed how the collectors perform their operation. The semi structured interviews was also conducted at the premises of the agency with a face to face interviews with municipal experts in the concerned recycling directorate.

After the collection of data was completed, data cleaning process had been undertaken to check if the duly completed questionnaires were identified, which later were sorted and encoded to the SPSS software for those questionnaires which were fit for analysis.

Some workers in the solid waste collection business may have a literacy issue, hence the researcher personally administered the questionnaires by asking survey questions out loud and got the response from the collectors.

3.7. Data Analysis

Descriptive data were generated by the selected instruments from primary and secondary data sources. The descriptive data generated are presented, interpreted and analyzed. In the analysis part, the researcher used his field observations as well as the semi structured interview made with the agency officials and experts in sub-cities solid waste administration units. Based on the findings, the researcher also inferred which solid waste reverse logistics practice contribute highly to the livelihood assets of collectors. Both quantitative and qualitative techniques were used to analyze the findings. The quantitative methods that was employed to analyze and present the findings include percentages, frequency distribution, pictures as well as tabular analysis. The Data validity and reliability were checked. Correlation tests were generated and presented, followed by a regression test. The regression analysis was made after all the regression assumption tests were conducted and found to be in conformity with the standards. The researcher utilized SPSS, excel computer programs and analytical tools to analyze and present the data collected.

3.8. Ethical Considerations

Ethical clearance was obtained from Research Ethical Review Board of Addis Ababa University, School of Commerce, and Department of Logistics and supply chain management to conduct this research study. During the course of undertaking this research study, all participants including Addis Ababa Solid Waste Management Agency, the solid waste collectors, and relevant primary stakeholders of the research were all informed. Data from potential respondents was collected after their consent were obtained. Furthermore, the data gathered was used only to undertake the research study. Generally, the research was undertaken after informed consent was obtained from all the study participants.

The survey questionnaire instrument reduced any possible bias the researcher might had. It also avoided sensitive and leading questions while at the same time circumvented issues that might offend the research participants.

4. Chapter Four- Results and Discussions

4.1. Introduction

In the result and discussion part of the paper, response rate and demographic data, the result of the study as well as interpretation and discussion parts are presented.

In order to answer the research questions, the researcher collected both primary and secondary data. The researcher collected primary data by personally administering a survey questionnaire from the solid waste collectors. Personal Administration of the questionnaires by the researcher helps to clarify items that would have been missed. The researcher made a pilot data collection from 25 respondents and found some industry jargons and made minor adjustments for some words that convey clear message to the collectors. These adjustments were made in consultation with the advisor and were needed as a result of back translation of the survey questionnaire in to Amharic as majority (if not all) of the respondents are not with English language.

This chapter provides results and discussions of the collected data (both primary and secondary). It describes the sample study using descriptive statistics. The chapter further presents variable descriptive analysis by using cross-tabulation with biological and general data of respondents with some components of livelihood assets. Internal consistency and goodness of test as well as correlation and regression analysis are also presented to answer the research questions.

4.2. Response Rate and Demographic Data

In order to meet the research objective, 376 questionnaires were administered as outlined in the thesis proposal. Hence, all the sample projected in the proposal were filled and duly incorporated in this chapter which are presented hereafter.

The researcher planned to collect 376 questionnaires from respondents of solid waste collectors working in the ten sub-cities of Addis Ababa. All the target questionnaires were duly administered with 100% response rate.

The questionnaires were collected from the work places of the respondents. Key informant discussions in the form of semi-structured interviews were conducted with supervisors and experts of AASWMA. Such discussions were also made with managers and officers (both

senior and otherwise) of some sub-cities in Addis Ababa. The researcher also extended the discussion with foremen and secretary of solid waste associations who are in the frontline of the operation. The researcher's plan of key informant discussion with some managers of the recycling companies didn't materialize as a result of the COVID-19 pandemic which disrupted majority of the global supply chain including the fifteen recycling companies. These companies temporarily cease to accept recycling plastic inputs from solid waste collectors or are working with a very limited capacity with essential staff only.

Furthermore, the administrations of the questionnaires in the work place of the respondents helped to see the operation firsthand and gave the researcher an important insight for analysis and triangulation.

This part of the paper presents the characteristics of the sample including the age of the respondents, the proportion of male and female respondents, educational level, family size, average income and related biological and general information of the respondents.

Respondents' Gender

The gender mix shows the type of respondents from involved in the study and the information of the respondents looks as depicted in the below table:

Table 4. 1: Respondents' Gender

		Frequency	Valid Percent	Cumulative Percent
	MALE	157	41.8	41.8
	FEMALE	219	58.2	100.0
	Total	376	100.0	

Source: Field Survey, 2020.

As seen from table 4.1, female respondents are the majority with 58.2 % or 219 head counts compared to 41.8% or 157 for male respondents. This figure is corroborated by key informants from AASWMA and the respective managers of Solid waste administration of sub-cities. Furthermore, supervisors of the solid waste share associations also re-confirmed that women collectors counts more than male collectors.

Education Level of the Respondents

The diversity of the educational level of solid waste collectors is shown in the below table:

Table 4. 2: Education in Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diploma	4	1.1	1.1	1.1
	First Cy	96	25.5	25.5	26.6
	Highscho	53	14.1	14.1	40.7
	No Forma	60	16.0	16.0	56.6
	Second C	148	39.4	39.4	96.0
	Vocation	15	4.0	4.0	100.0
Total		376	100.0	100.0	

Source: Field Survey, 2020

60 or 16% of the respondents have not attended any form of formal education while only 19 or 5.1% of the respondents attended formal education above 10th grade and from these respondents, 4 or 1.1% of the respondents have diploma. Nearly 65% of the respondents have attended first and second cycle education. Generally, however, 94.9% of the respondents have attended below 10th grade. The educational level of collectors is also more or less in other developing countries (Noel, 2010).

Respondents' Age and Work Experience

Respondents were asked about their work experience and age as shown in the table below:

Table 4. 3: Respondents' Age and Work Experience

	N	Minimum	Maximum	Mean	Std. Deviation
Age of Respondents	376	20	76	35.19	8.677
Work Experience of respondents	376	1	15	6.16	2.695
Valid N (list wise)	376				

Source: Field Survey, 2020

The maximum age was 76 years old in observed in Woreda 5 of Yeka Sub-city while the minimum is 20 years. The average mean age of the respondents is 35.2 years. As per the discussion made with supervisors of the association in Addis Ketema and Yeka sub cities, the researcher learned that those collectors with age 60 and above were expected to retire by taking their saving. However, because of the dire economic fallout they would face, the association chose to let them stay work nominal tasks like keeping and watching the waste container.

The average work experience of the respondents is 6.16 years. On the other hand, maximum work experience of the respondents' are 15 years while the minimum is 1 year (work experience of less than one is also observed).

Monthly Average Income and Family size of the Respondents

Table 4. 4: Monthly Average Income & Family Size of Respondents

Monthly Average income of Respondents	Family Size of Respondents								Total
	1	2	3	4	5	6	7	9	
500-1500	1	3	1	0	0	0	0	0	5
1501-2500	2	0	0	3	0	0	0	0	5
2501-4000	51	9	25	29	15	9	2	1	141
4001-8000	79	35	48	35	21	6	1	0	225
Total	133	47	74	67	36	15	3	1	376

Source: own field survey, 2020

Majority of the respondents i.e. 225 (59.8%) of the respondents earn a monthly average income in the category of ETB 4,001 - 8,000, while 141 (37.5%) of them earn from ETB 2,501 - 4,000. A small fraction of them i.e. >2.7% of them claimed to earn an average monthly income of less than ETB 1,500. As per the discussion the researcher had with collectors and concerned primary stakeholders including managers in the Agency, the income of the respondents highly fluctuates depending on the collected solid waste size and season of collection. For example, in summer, the average income of collectors rises due to the moisture content of the solid waste. The collected solid waste is destined at Reppie Water to Energy Plant, which receives the solid waste and provides receipt

containing size and weight based on which payment to collectors is effected. Hence, the higher the weight the higher payment. The monthly mean payment of collectors seems to be better as compared with Ethiopian paid employees of urban population, which is shown in the below table:

Table 4. 5: Statistical Report on the 2018 Urban Employment Unemployment Survey

Sr. No	Total Payment	Mean Amount of Monthly Payment	Total Paid Employees
1	500-1500	3,249.00	853,293
2	1501-2500		999,243
3	2501-4000		707,039
4	4001-7000		823,162
5	> 7000		289,142

Source: CSA Statistical Report on the 2018 Urban Employment Unemployment Survey

On the other hand, the maximum family size of the respondents is observed to be 9 for one respondent while 133 respondents are a family of one. Overall, nearly 95% of the respondents have a family of five or less.

Number of Family Bread Winners Vis-à-vis a Family size

Respondents were asked if they are the sole source of income for their family. In order to compute this characteristics, 133 of respondents who are one Family size are excluded leaving the remaining 243 respondents for the computation, which is shown in the below table:

Table 4. 6: No. of Family Bread Winners vs. Family Size

		Family Size of Respondents								Total
		1	2	3	4	5	6	7	9	
Are you the only source of the Family?	YES	123	29	37	25	8	3	1	0	226
	NO	10	18	37	42	28	12	2	1	150
Total		133	47	74	67	36	15	3	1	376

Source: Field Survey, 2020

From the 243 respondents who are a family of one or more, 103 of them responded that they are the only source of income for the family while the remaining 140 responded that there are other member of the family who generate income. Solid waste collectors being the only bread winners in their household is also not new in other parts of the world (Noel, 2010).

Table 4. 7: Availability of Credit Facility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	207	55.1	55.1	55.1
	No	169	44.9	44.9	100.0
	Total	376	100.0	100.0	

Source: Field Survey, 2020

Regarding access to credit facility for the solid waste collectors, 55.1% or 207 of the respondents responded to have access to credit facility while the remaining 44.9% of them claimed not to have access to the credit facility. As per the researcher's discussion administrators of solid waste in some sub-cities, Woredas as well as chairperson of the association, all collectors of solid waste are entitled to have access to credit provided conditions are fulfilled. Some respondents whom the researcher interviewed, however, said that having credit access is not easy.

4.3. Data Coding

Once data were collected from the field, the coding stage followed. The first and second part of the questionnaire i.e. biological and general data were coded. Male and female were coded as 1 and 2 respectively. While age, although, presented to respondents categorically, the researcher managed to collect the exact age of respondents. Average monthly income of the respondents was collected with 5 categories of income. General data like income source, access to credit, insurance coverage, were coded as a category. On the other hand, biological data such as work experience, educational level and age of the respondents were collected described as is (without category). Age, educational level and family size were

designed to be collected in category by the questionnaire. The personal administration of the researcher, however, helped to gather the data without category.

Part three of the questionnaire were designed to measure the independent and dependent variables which used a five point agree-disagree scale. Responses were coded from 1 to 5; “strongly disagree” as 1, “disagree” as 2, “Neutral” as 3, “Agree” as 4 and “strongly agree” as 5 in ascending order.

4.4. Results

4.4.1. Measurement of Goodness

One of the most important phases of research is the measurement of goodness test, which reduces measurement error to ensure the integrity of the measure. Two vital test in this regard are the test of validity and reliability.

4.4.1.1. Validity Analysis

Validity analysis is another important step in professional research undertaking. It is an important term in research which refers to the conceptual and scientific soundness of a research study (Graziano & Raulin, 2004). Its primary purpose is to increase the accuracy and usefulness of research findings by eliminating as many confounding variables as possible (Marczyk & DeMatteo, 2005). There are two ways of establishing construct validity i.e. convergent or divergent analysis and factor analysis. An item can show convergent validity if it has high correlation with another item under similar construct. The other method i.e. factor analysis which can be applied to analyze the construct validity of items.

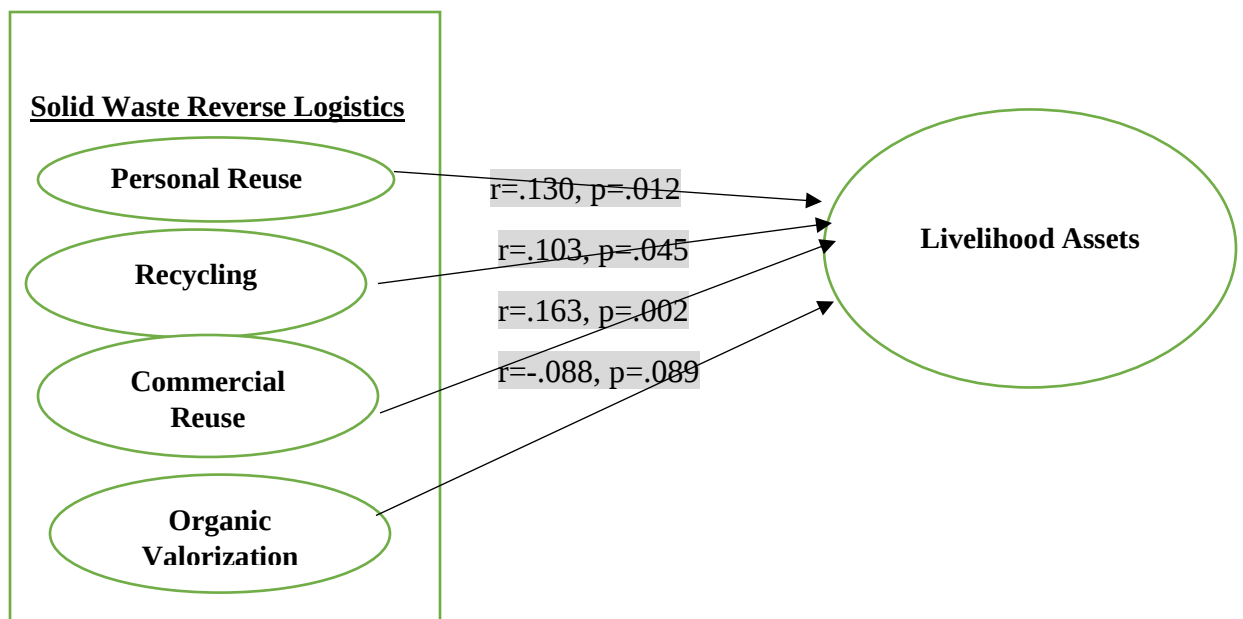
This research study applies the correlation to investigate the level of relationship strength between the latent variables of solid waste reverse logistics and the livelihood asset variables. A correlation test were calculated to measure the relationship between the independent and dependent variable. The test gave the direction of the relationship, either positive (when one variable increase so does the other) or negative (when one variable decrease the other one increases) (Pallant, 2010).

The correlation test shows the strength of the relationship between variables by a value which ranges from 1.00 (shows perfect positive correlation) to -1.00 (which shows negative correlation), while 0 shows no relationship (Pallant, 2010). Accordingly, the remaining values were used as per below guideline:

For values from 0.1 - 0.29, the correlation is small; for values from 0.3 - 0.49, the correlation is medium, while it is a strong correlation for values from 0.50 to 1.0 (Pallant, 2010). The correlation test is valid if the correlation value (Pearson correlation $> r$), on the other hand invalid if the correlation value (Pearson correlation $< r$).

Accordingly, as the sample size of the study is 376, the degree of freedom (DF) becomes 374 i.e. $DF = 376 - 2 = 374$. The corresponding critical correlation value (r_c) for a significant level of alpha is .05 for a two-tailed test is 0.101.

Figure 4. 1: Solid Waste Reverse Logistics vs. Livelihood Assets Correlation



As depicted in the figure above, the dimensions of solid waste reverse logistics have correlations (either positive or negative) with the dependent variable i.e. Livelihood Assets.

Personal Reuse = 0.130 (small correlation) > 0.101 = Valid

Recycling = 0.103 (small correlation) > 0.101 = Valid

Commercial Reuse = 0.163 (small correlation) > 0.101 = Valid

Organic Valorization = -0.088 (Negative Correlation) < 0.101

4.4.1.2. Reliability Analysis

Another essential phase of research is ensuring its reliability. Reliability is an assessment of the degree of consistency between multiple measurements of a variable (Hair Jr. et al., 2006). A variable is reliable if respondents answer to items is consistent or stable over time. There are indicators that measure the reliability of the measurement including the test-retest method, which is an assessment by administering the same measurement scale to the same respondent on two various occasions, and computing the correlation between the two scores (results) obtained (Zikmund et al., 2010). The other indicator is the internal consistency method, which assesses the degree to which the items are measuring the same attribute. Accordingly, to measure the internal consistency, the most commonly used indicator is coefficient of alpha (Zikmund et al., 2010).

Accordingly, the coefficient alpha have different ranges. 0 shows no internal consistency while 1 shows an absolute (complete) consistency. Accordingly, as per (Zikmund et al., 2010), results or scales between 0.8 and 0.95 are very good in quality. Similarly, scales between 0.7 and 0.8 have good reliability. Coefficient alpha between 0.6 and 0.7 are fairly reliable. For this research study, the researcher uses the following categorization of alpha coefficient based on (Hair Jr. et al., 2007). Hence, (>0.9 = Excellent), (0.8 to < 0.9 = Very Good), (0.7 to < 0.8 = Good), (0.6 to < 0.7 = Moderate) and (< 0.6 = Poor).

Table 4. 8: Reliability Analysis

Variable	Cronbach's Alpha	No of Items	Strength of Association
Personal Reuse	.702	4	Good
Recycling	.832	3	Very Good
Commercial Reuse	.775	3	Good
Organic Valorization	.786	3	Good
Financial Capital	.823	4	Very Good
Human Capital	.734	3	Good
Physical Capital	.706	3	Good
Natural Capital	.805	3	Very Good
Social Capital	.704	3	Good

Source: own field survey, 2020

4.5. Practice of Residential Solid Waste Reverse logistics in Addis Ababa

One of the research questions that this study planned to answer was to examine the solid waste reverse logistic practice. To this end, the practice of solid waste reverse logistics is presented based on interview data, personal observation as well as respondents view.

The municipal solid waste management of Addis Ababa is governed in line with the Federal solid waste management proclamation No. 513/2007. The preamble part of the proclamation states “to essentially promote community participation in order to prevent the adverse effects and enhance the benefits resulting from solid waste”. Furthermore, it empowers “solid waste management action plans to be designed and implemented by the lowest administrative units of urban administration” i.e. Sub-Cities and Woredas.

There are six sources of the daily solid waste generation in Addis Ababa. The residential source constitutes the lion share with 76% of the total solid waste while Commercial (9%), Street sweeping (6%), Industries (5%), Hotels (3%) and hospitals (1%) contribute to the daily total solid waste generation (AASWMA, 2019). The Residential source constituted 71% share in 2014 against its 76% share in 2019 showing an increase of 5%, while the other sources show no significant variation (Meine Pieter, 2014).

4.5.1. Addis Ababa Solid Waste Management Agency

Addis Ababa took the solid waste management initiatives to overcome the problem posed by waste generally and solid waste particularly (Meine Pieter, 2014). Since 2004, “institutional arrangements have been undergoing significant shifts in Addis Ababa solid waste collection system” and changes have focused on decentralization of solid waste collection service to local government by introducing private sector service delivery (Meine Pieter, 2014). AASWMA through each sub-cities solid waste administration unit, uses the micro and small associations (which have 6,230 collectors) to collect the residential solid waste.

4.5.2. Transportation of Residential Solid Waste from the Source to its Final Place

Transporting the solid waste from residential houses to its final destination i.e. Reppie waste to energy plant involves human labor, push carts, three wheel vehicles, medium truckers as well as container carrying vehicles.

The residential solid waste collection system has primary and secondary collection systems. The primary collection service is handled by the 74 cleaning service share associations. The collection of residential solid waste is door to door service which uses human labor, push carts, three wheel vehicles to transport the solid waste.

Once the solid waste is generated from each household, members the family using human labor take the solid waste to the designated collection sites. These collection sites are used by a cluster of residential neighborhood as a common place to temporarily accumulate the waste. The residential solid waste collectors collect the solid waste from this collection sites three times a week (on Monday, Wednesday and Saturday).

The collectors use labor, push carts, three wheel vehicles and medium size truckers to transport the solid waste from residential collection sites to the temporary storage sites or communal garbage containers. As per AASWMA, currently there are 130 medium trucks owned and operated by the 74 share associations.

Figure 4. 2: Transporting Residential Solid Waste using Push Carts



Figure 4. 3: Transporting Residential Solid Waste using Three Wheel Vehicles



Figure 4. 4: Transporting Residential Solid Waste using Medium Trucks



Transporting the solid waste from the residential households to the temporary storage sites uses the forgoing levels and methods of transportation and it is collectively named as primary collection service by AASWMA (the Agency).

After transporting the solid waste to the temporary storage sites, compactor vehicles and container carrying vehicles will transport it to its final destination i.e. Reppie waste to energy plant or to the final dumping site (landfill). Currently, the Agency uses 46 compactor vehicles and 129 container carrying vehicles. The transportation of solid waste from the communal garbage container to its final destination using its vehicles is known as secondary collection system.

The transport service for secondary collection system in all sub-cities are currently handled by the Agency. According to Ato Kassahun (head of the recycling directorate of the AASWMA), however, a decision is passed recently by the agency to outsource the secondary transportation service to private transport companies. One pilot outsourcing of the secondary transportation service is recently implemented in Bole sub-city where private companies transport the solid waste to its final destination. The future direction of transporting the solid waste will be using private transport companies.

Figure 4. 5: Transporting Residential Solid Waste using Container Carrying Vehicle



Figure 4. 6: Transporting Residential Solid Waste using Compactor Vehicle



4.5.3. Storage Facility of the Solid Waste

The designated collection sites around residential houses serve as the first storage facility of the residential solid waste. The solid waste stays from 24 up to 48 hours in this site until it is collected and transported to the temporary storage sites (communal garbage containers).

The next solid waste storage facility is the communal garbage containers (aka, transfer points) where the solid waste stays until it is transported to its final destination by the Agency vehicles. Currently, there are hundreds such temporary storage sites in Addis Abeba. These temporary storage sites are located in open air which is visible for any bystander. The sorting, processing activities of the solid waste by collectors is visible with stench in the nearby. Furthermore, these practice is unappealing to the eye with visible damage to the environment. In order to avoid this, the Agency planned to construct a state of the art temporary storage sites in sub-cities. One such construction is being undertaken in Bole Sub-city at Bole Arabsa site. The construction of such temporary storage sites will reduce much of the side effects of the existing storage sites. Furthermore, each share association are given a 500 sq. m of land to construct their own storage facilities. Even if this still do not materialize.

Figure 4. 7: Temporary Storage Site - Arada Sub-city



Figure 4. 8: Temporary Storage Site Arada Sub-city



Figure 4. 9: Temporary Storage Site Nifas Silk Lafto Sub-city



The temporary storage sites the agency plans to construct reduces much of the side effects of the existing storage sites. Designs of the temporary storage sites which will be constructed to each cleansing share associations looks like the below:

Figure 4. 10: Designs of the Temporary storage sites



Source: AASAMA, 2019.

“A study made by the Addis Ababa City Administration shows that, the collection coverage has been constantly increasing from 38 % in 2000 to 40 % in 2001, 53% in 2002, 53.9% in 2004 and 78% in 2005” (Meine Pieter, 2014). Over all, about 20%-30% of the waste generated in Addis Ababa remains uncollected (Meine Pieter, 2014).

4.5.4. Final Disposal Site

Addis Ababa uses an open dumping landfill which was established before 50 years and located 13 kilometers from the center of the city. Its surface area is more than 13 hectares and the recently constructed modern Reppie waste to energy plant is built near it.

4.5.5. Response of Collectors on Solid Waste practices and Livelihood Assets

In five point Likert scale, respondents were asked their agreement level about the practice of solid waste reverse logistics and their livelihood assets. Accordingly, their responses are presented using the mean score to categorize their agreement level.

Table 4. 9: Dimension Mean Result

	N	Minimum	Maximum	Mean	Std. Deviation
Personal Reuse	376	1	4	2.46	.368
Recycling	376	1	4	2.74	.443
Commercial Reuse	376	3	5	3.86	.512
Organic Valorization	376	1	4	2.25	.494
Financial Capital	376	2	5	3.97	.469
Human Capital	376	2	5	3.81	.418
Physical Capital	376	1	4	2.39	.522
Natural Capital	376	1	4	2.24	.652
Social Capital	376	2	5	3.34	.527
Valid N (listwise)	376				

Source: Own Survey Result 2020

Table 4.9 shows the statistical description of solid waste reverse logistics activities of the 376 respondents who are the solid waste collectors. From the independent variables, Commercial Reuse practice is the dominant solid waste reverse logistics with the highest mean score, (M=3.86 and SD=.512). The Recycling dimension follows commercial reuse with mean score, (M=2.74 and SD=.443). While Personal Reuse with a score mean of (M=2.46 and SD=.368) stood as the third dimension, Organic Valorization scored the

lowest mean score, ($M=2.25$ and $SD=.494$) and is the least dimension of solid waste reverse logistics.

As per the observation and discussion of the researcher with experts of the solid waste reverse logistics practices of some sub-cities, Woredas as well as the collectors, Organic valorization or compost is barely practiced in the city. The researcher learned about two sites (one in Addis Ketema Sub-city, Woreda 5 and the other in Kirkos sub-city) that can be mentioned as a sample for Organic Valorization practice. Furthermore, following the recent announcement by the City government of Addis Ababa regarding urban farming, some solid waste association members hoped to see a growing contribution of compost to their livelihood.

The five point scale questionnaire distributed to measure the agreement – disagreement level on the items of each dimension of solid waste reverse logistics and livelihood assets in Addis Ababa is presented based on the below standards:

For five point scale, scholars use different types of categorization to analyze the mean score of respondents. (Murry, 2013) for example use mean score benchmarks ($1 - 1.8 =$ strongly disagree), ($1.81 - 2.6 =$ disagree), ($2.61 - 3.4 =$ neutral), ($3.41 - 4.2 =$ agree), and ($4.21 - 5 =$ disagree). Other scholars, on the other hand, reduced the mean score of the five point scale in to three categorization as: ($1 - 2.8 =$ disagree), ($2.8 - 3.2 =$ neutral), and ($3.21 - 5 =$ agree) (Jones & Loe, 2013). This study use (Jones & Loe, 2013) benchmark to interpret the findings of the respondents.

Personal Reuse

Valorizing solid waste for the purpose of personal reuse forms an essential part of the industrial value chain in developing countries by integrating poor people into the business of solid waste reverse logistics (Brix-Asala, et al., 2016a). Personal reuse from solid waste, therefore, is one form of valorization for collectors.

Table 4. 10: Personal Reuse Statistics

	N	Mini mum	Maxi mum	Mean	Std. Deviation
We find household maintenance items from the solid waste we collect	376	1	4	2.48	.579
We find food for our domestic animals from the solid waste we collect	376	1	4	2.37	.545
We find materials as household inputs from the solid waste we collect	376	1	4	2.37	.545
We find other materials useful for personal use from the solid waste we collect	376	1	4	2.51	.665
Valid N (listwise)	376				

Source: Field Survey, 2020

As depicted from table 4.10, all the four items used to measure the personal reuse dimension of solid waste reverse logistics recorded a mean score of less than 2.8. This shows that all the respondents on average disagree that valorizing the solid waste for personal reuse is not common (to say the least). Possible reasons for this could be the unavailability of materials from the solid waste for personal reuse. On the other hand, as the solid waste collectors in Addis Ababa have a scheduled collection days i.e. three days a week (Monday, Wednesday and Saturday), other private collectors (informal collectors, aka scavengers or refuse collectors) may valorize the solid waste between the scheduled collection days. The researcher observed such practices on multiple residential waste dumping sites.

Recycling

The livelihood of many collectors either semi-formal or informal ones depend on collecting recyclable materials. For the case of this study, the recycling focus goes to the plastic solid waste whose value depended on collecting separately, sorting and processing it to the level acceptable to the fifteen recycling companies.

The assessment to measure the recycling solid waste dimension has produced the below table:

Table 4. 11: Recycling Statistics

	N	Mini mum	Maxi mum	Mean	Std. Deviation
I don't find a recyclable solid waste separated at the source	376	1	5	4.16	.677
I don't find sorted recyclable solid waste at the source	376	1	5	4.05	.803
I process recyclable solid waste	376	1	5	4.19	.660
Valid N (listwise)	376				

Source: Field Survey, 2020

As seen from table 4.11, the highest mean score is 4.19 with a standard deviation of .660 and all the three items recorded a mean score of more than 4.00 which indicates that the solid waste collectors separate, sort and process the plastic refuse.

The researcher noticed huge disappointment from the respondents regarding the unsegregated waste disposal by residential households. This is despite the solid waste proclamation 513/2007 article 11 (1) which says, “The head of each household shall ensure that recyclable solid waste are segregated are segregated from those that are destined for final disposal and are taken to the collection site designated for such waste”. The collectors also said, despite campaigns by the AASWMA, little progress has been made in this regard. The foregoing and the role of scavengers (informal individual collectors) seems to undermine the revenue of the associations, which would otherwise be more.

Commercial Reuse

Valorizing items from the solid waste for commercial reuse (aka, ኮልኮሌ as the collectors call it in Amharic) is another important stream of business for solid waste collectors in Addis Ababa. As per the researcher’s discussion with the association managers and foreman, this stream of line especially helps to cover the working capital. Most of them use it as salary for their truck drivers and crew, as well as an operating expense to administer the office of the association.

Table 4. 12: Commercial Reuse Statistics

	N	Mini mum	Maxi mum	Mean	Std. Deviation
We find materials to be reused with repair for commercial firms	376	3	5	4.15	.626
There are commercial purchasers of materials which repair materials to be reused	376	1	5	4.03	.692
We find Commercial firms which accept materials	376	1	5	3.97	.742
Valid N (listwise)	376				

Source: Field Survey, 2020

As seen from table 4.12, the highest mean score for commercial reuse of respondents 4.15 with a standard deviation of .626. The next higher mean score is 4.03 with standard deviation of .692, while the lowest mean score is 3.97 with a standard deviation of .742. The mean score of the three items is greater than 3.21, one can therefore, comfortably say that the respondents agree to all the items of the commercial reuse dimension. Hence, from the data analyzed, it is safe to say that the commercial reuse practice of the solid waste contribution to the livelihood of the collectors is agreed by the respondents.

Organic Valorization

Organic valorization or compost stream of the solid waste dimension deals with collecting separately or sorting and processing kitchen, garden, commercial, agricultural and animal waste and paper, and marketing it as animal feed or compost (Gunsilius *et al.*, 2011).

The output of the finding on the practice of organic valorization in Addis Ababa is presented in the below table:

Table 4. 13: Organic Valorization Statistics

		Count	Sub-table Total N %	Mean	Standard Deviation
We find organic garden fertilizer from the solid waste we collect	STRONGLY DISAGREE	109	29.0%	1.98	.800
	DISAGREE	176	46.8%		
	NUETRAL	81	21.5%		
	AGREE	8	2.1%		
	STRONGLY AGREE	2	0.5%		
	Subtotal	376			
We find organic waste to market it as animal feed from the solid waste we collect	STRONGLY DISAGREE	102	27.1%	2.07	.815
	DISAGREE	157	41.8%		
	NUETRAL	108	28.7%		
	AGREE	8	2.1%		
	STRONGLY AGREE	1	0.3%		
	Subtotal	376			
We find organic waste to market it as compost from the solid waste we collect	STRONGLY DISAGREE	125	33.2%	1.93	.816
	DISAGREE	167	44.4%		
	NUETRAL	73	19.4%		
	AGREE	9	2.4%		
	STRONGLY AGREE	2	0.5%		
	Subtotal	376			

Source: Field Survey, 2020

As seen from table 4.13, the highest mean score is 2.07 with standard deviation of .815 and overall response for organic valorization practice is a disagreement. According to the AASWMA, out of Addis Ababa's 3200 tons of daily solid waste generation, 64.8% or 2073.6 ton is organic solid waste. Even if the potential of practicing organic valorization is immense, its current performance is below expectation. The response of the collectors is also corroborated by two agency experts, as well as four managers in the sub-city solid waste administration directorate. The city administration has recently announced its plan to commence and scale-up urban farming. If it materializes, this stream of solid waste may probably boom.

Livelihood Assets

The sustainable Livelihood approach was first introduced by the Brundtland Commission on Environment and Development to eradicate poverty. The approach states that livelihoods should be considered in terms of peoples' access to capital assets (financial, Human, Physical, Natural and Social) and the ways people combine these assets to create and support their livelihood. Once these capitals are created, people work to enlarge their asset base by interacting with other actors and institutions (Quandt, 2018). These asset capitals, therefore, are bases that can be stored, accumulated or allocated to activities to generate income, which is a means of livelihood. These five asset capitals of livelihood were included in the questionnaire and the solid waste collectors' response is presented as follows.

Financial Capital

The Financial Capital is one element of livelihood asset which include capital base elements like cash, credit/debt, savings, and other economic assets. It also includes basic infrastructure and production equipment and technologies which are essential for the pursuit of any livelihood strategy (Anani, 1999). The analysis of the field survey for this element of livelihood is presented in the below table:

Table 4. 14: Financial Capital Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
I save monthly from income in solid waste collection	376	2	5	4.18	.778
I earn my income from solid waste collection alone	376	1	5	4.31	.728
I get credit facility from the solid waste collection	376	2	5	4.18	.778
I have access to bank account due to solid waste collection	376	1	5	4.18	.792
Valid N (listwise)	376				

Source: own field survey, 2020

As shown from table 4.14, the highest mean score with ($M= 4.31$ and $SD= .728$) is accounted for the respondents earning their income from solid waste collection alone. Even

if, the respondents collect solid waste three days a week, it seems that they are only working as solid waste collectors and diversifying their income is long way ahead. As per the researcher's discussion with some collectors, they tried to diversify their income by organizing themselves in safety net programs, the Woreda administration, however, do not allow them saying an individual can only be organized under one line of activity. Overall, for all the items under financial capital dimension, the mean score is 4.18 or more with a standard deviation of .792 or less. From the respondents' response, it is safe to conclude that all are on the same page in agreeing the financial capital dimension of livelihood.

Human Capital

The Human Capital includes the skills, knowledge, ability to labor and good health and physical capability important for the successful pursuit of different livelihood strategies (Anani, 1999). The result and analysis of the field survey for this element of livelihood is presented in the below table:

Table 4. 15: Human Capital Statistics

		Count	Sub-table Total N %	Mean	Standard Deviation
I have the required knowledge and skill for solid waste	STRONGLY DISAGREE	0	0.0%	4.47	.602
	DISAGREE	1	0.3%		
	NUETRAL	18	4.8%		
	AGREE	160	42.6%		
	STRONGLY AGREE	197	52.4%		
	Subtotal	376			
I face health problems due to solid waste collection	STRONGLY DISAGREE	0	0.0%	4.45	.626
	DISAGREE	1	0.3%		
	NUETRAL	24	6.4%		
	AGREE	155	41.2%		
	STRONGLY AGREE	196	52.1%		
	Subtotal	376			
My work affects my family members' health	STRONGLY DISAGREE	0	0.0%	4.22	.741
	DISAGREE	0	0.0%		
	NUETRAL	71	18.9%		
	AGREE	152	40.4%		
	STRONGLY AGREE	153	40.7%		
	Subtotal	376			

Source: own field survey, 2020

As can be seen from table 4.15, the highest mean score accounted is (M= 4.47 and SD= .602) for the item which questions respondents whether they have the required knowledge and skills solid waste undertaking. Regarding the item for the health of the collectors, the mean score is (M= 4.45 and SD= .626) implying that they are vulnerable for their health as a result of the profession. Furthermore, their response to the effect of their profession for the family members health also accounted a mean score of (M= 4.22 and SD= .741) confirming that their profession affects their families' health as well.

Physical Capital

The Physical Capital includes basic infrastructure, such as roads, water & sanitation, schools (Hosni, Mohammad, 2006).

Table 4. 16: Physical Capital Statistics

		Count	Sub-table Valid N %	Mean	Standard Deviation
I have enough equipment to undertake the solid waste	STRONGLY DISAGREE	56	14.9%	2.35	.821
	DISAGREE	160	42.6%		
	NUETRAL	136	36.2%		
	AGREE	22	5.9%		
	STRONGLY AGREE	2	0.5%		
	Subtotal	376			
he vehicles to transport the solid waste are sufficient	STRONGLY DISAGREE	28	7.4%	2.57	.766
	DISAGREE	141	37.5%		
	NUETRAL	171	45.5%		
	AGREE	36	9.6%		
	STRONGLY AGREE	0	0.0%		
	Subtotal	376			
I have modest household physical capital (fixed assets)	STRONGLY DISAGREE	57	15.2%	2.35	.828
	DISAGREE	159	42.3%		
	NUETRAL	135	35.9%		
	AGREE	23	6.1%		
	STRONGLY AGREE	2	0.5%		
	Subtotal	376			

Source: own field survey, 2020

As shown from table 4.16, the lowest mean score ($M=2.35$ and $SD=.821$, $SD=.828$) was accounted for items related to having enough equipment to undertake the collection and modest household physical assets. For the item regarding the Agency's vehicle to transport the solid waste to its final place (Reppie plant) has also accounted a low mean score of 2.57 and standard deviation of .766 indicating their disagreement on the service. On the issue of enough equipment including proper safety gear protective materials when performing their task, the researcher observed that considerable solid waste collectors working on bare hand. The situation is not uncommon in developing countries, in Haiti Metropolitan area of Port-au-Prince, for example, despite environmental and occupational health and safety manual, workers do not apply it (Noel, 2010).

Natural Capital

The Natural Capital includes the natural resource stocks (soil, water, air, etc.) and environmental services (hydrological cycle, pollution sinks etc.) from which resource flows and services useful for livelihoods are derived (Anani, 1999). The items included in the questionnaire are related to what actually exist in the context of the residential solid waste collection in Addis Ababa. The result of the analysis is shown in the below table:

Table 4. 17: Natural Capital Statistics

		Count	Sub-table Valid N %	Mean	Standard Deviation
I access land to undertake the solid waste collection	STRONGLY DISAGREE	24	6.4%	2.60	.870
	DISAGREE	170	45.2%		
	NUETRAL	119	31.6%		
	AGREE	58	15.4%		
	STRONGLY AGREE	5	1.3%		
	Subtotal	376			
The temporary storage land to undertake the solid waste collection work is sufficient	STRONGLY DISAGREE	46	12.2%	2.55	.911
	DISAGREE	135	35.9%		
	NUETRAL	146	38.8%		
	AGREE	42	11.2%		
	STRONGLY AGREE	7	1.9%		
	Subtotal	376			

		Count	Sub-table Valid N %	Mean	Standard Deviation
I get sufficient water access to keep my hygiene	STRONGLY DISAGREE	46	12.2%	2.44	.868
	DISAGREE	159	42.3%		
	NUETRAL	136	36.2%		
	AGREE	28	7.4%		
	STRONGLY AGREE	7	1.9%		
	Subtotal	376			

Source: own field survey, 2020

As shown from table 4.17, the respondents disagree for the item land access to undertake the solid waste operation with a mean score of (M= 2.6 and SD= .870). They also disagree for the temporary storage land to undertake the solid waste collection work of being sufficient with a mean score of 2.55 and standard deviation of .911. Furthermore, access to water to keep their hygiene in the work place is also disagreed by an overwhelming number of respondents accounting the lowest mean score (M= 2.44 and SD= .868).

Social Capital

The Social Capital – the social resources (networks, social claims, social relations, affiliations, associations) upon which people draw when pursuing different livelihood strategies requiring coordinated actions (Anani, 1999).

Table 4. 18: Social Capital Statistics

	N	Mini mum	Maxi mum	Mean	Std. Deviation
I can be a member of different social networks	376	1	5	3.90	.746
Is it easy for me to be a member of social networks	376	1	5	3.91	.743
I am a member of an association which has a voice and influence	376	1	5	2.67	.694
Valid N (listwise)	376				

Source: own field survey, 2020

As shown from table 4.18, the highest mean score is accounted (M= 3.90 and SD= .746) implying, solid waste collectors do not face marginalization from their surrounding because of their profession. On the item of becoming easy to join different social networks the mean score (M= 3.91, and SD= .743) showing their agreement, which re-confirms that marginalization is hardly felt by the respondents. On whether or not they are a member of an association that has a voice and influence, however, their mean score is (M= 2.67 and SD=.694), which shows their neutral stand on the issue, The issue of marginalization is also prevalent in solid waste collectors in other developing countries as well (Noel, 2010).

4.6. How Solid Waste Reverse Logistics Contribute to Livelihood Asset?

Solid waste reverse logistics practices supports the livelihood of millions of collectors worldwide especially in the developing countries (Brix-Asala, Hahn and Seuring, 2016b) (Scheinberg et. al., 2010). In order to examine the contribution of solid waste reverse logistics practices i.e. personal reuse, recycling, commercial reuse and organic valorization, on the livelihood of collectors, the study applied correlation analysis. The result of how these practices contributes to the collectors' livelihood assets are shown as follows:

Table 4. 19: Correlations

		Personal Reuse	Recycling	Commercial Reuse	Organic Valorization	Livelihood Asset
Personal Reuse	Pearson Correlation	1	.021	.050	.027	.130*
	Sig. (2-tailed)		.681	.337	.608	.012
	N	376	376	376	376	376
Recycling	Pearson Correlation	.021	1	.117*	-.086	.103*
	Sig. (2-tailed)	.681		.023	.095	.045
	N	376	376	376	376	376
Commercial Reuse	Pearson Correlation	.050	.117*	1	-.105*	.163**
	Sig. (2-tailed)	.337	.023		.043	.002
	N	376	376	376	376	376
Organic Valorization	Pearson Correlation	.027	-.086	-.105*	1	-.088
	Sig. (2-tailed)	.608	.095	.043		.089
	N	376	376	376	376	376
Livelihood Asset	Pearson Correlation	.130*	.103*	.163**	-.088	1
	Sig. (2-tailed)	.012	.045	.002	.089	
	N	376	376	376	376	376

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.19 above presents the correlation coefficient and the respective significance level of the correlation. Accordingly, commercial reuse has a positive and small correlation at ($r = .163$) with livelihood assets at significant level ($\text{Sig.} = 0.002$), which indicates an increase in commercial reuse results in a small increase of contribution on the livelihood of collectors. Personal reuse has a positive and small correlation ($r = 0.130$) with livelihood assets at a significant level of ($\text{Sig.} = 0.012$), which indicates that an increase in personal reuse from the solid waste has a small contribution to the livelihood assets of collectors. Similarly, recycling has also a positive and small correlation ($r = .103$) with livelihood assets at a significant level of ($\text{Sig.} = .045$), which also suggests that an increase in recycling has a small contribution on livelihood assets of collectors.

Organic valorization, on the other hand, has a negative correlation at ($r = -.088$) with livelihood assets which is not significant at ($\text{Sig.} = .089$). This implies that organic valorization do not contribute to the livelihood assets of collectors. From 3200 tons of solid waste Addis Ababa generates on daily basis, 64.8% of it is organic solid waste which has huge potential for organic valorization. The finding also supports that the practice of organic valorization is almost non-existent.

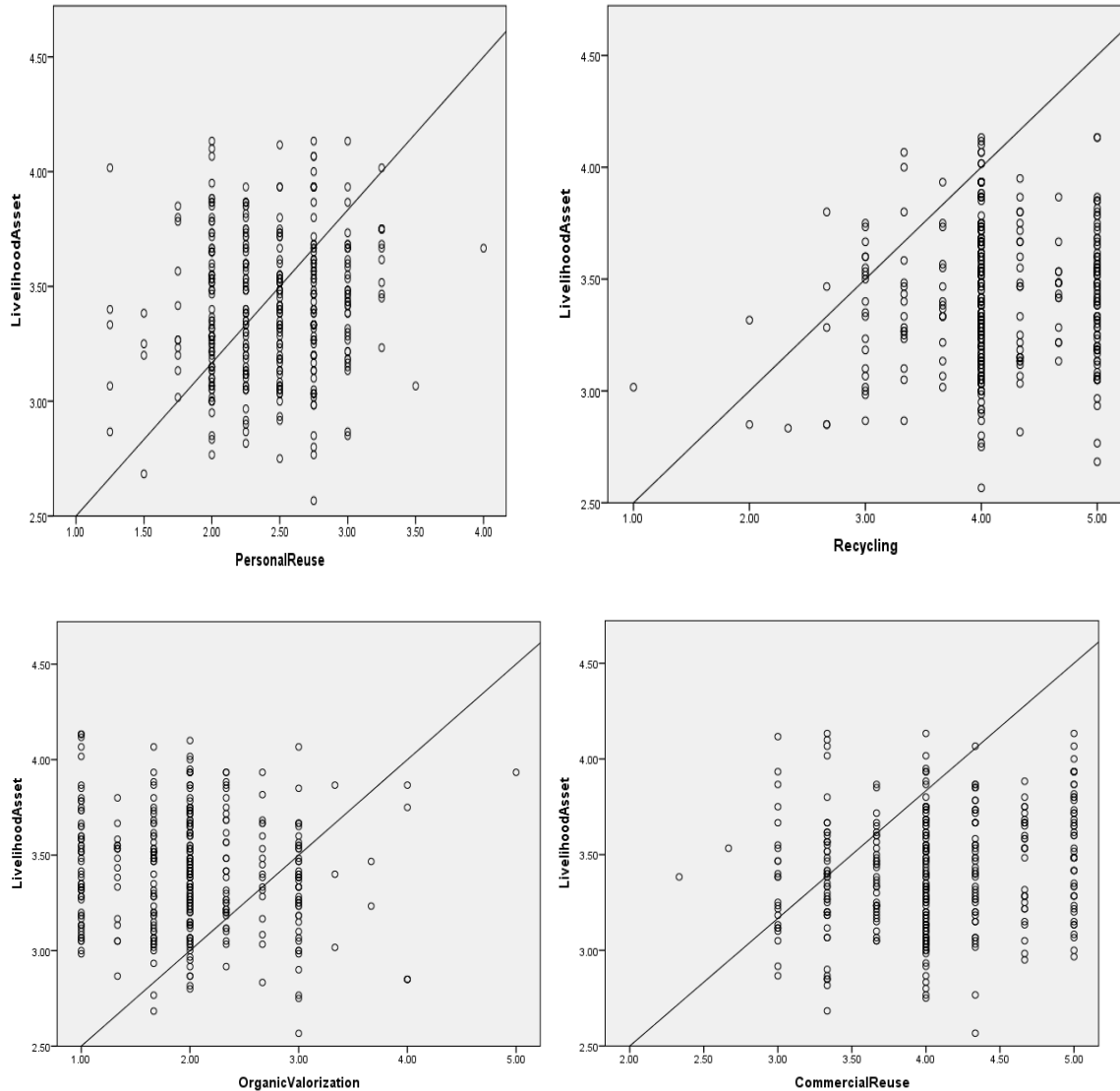
4.6.1.1. Regression Assumption Tests

Testing the basic assumptions are prerequisite for regression analysis. These basic assumptions are linearity, multicollinearity, independence of residuals, homoscedasticity, normality of residuals and outliers. The scatter plot of the standardized residuals and normal probability plot (P-P plot) are also tested to examine assumptions of the regression analysis. Following is the presentation and discussion part of these assumption tests:

Assumption of Linearity

This assumption assumes that the relationship between the independent (IVs) and the dependent variable (DV) can be characterized by a straight line. Checking the relationship between the two variables is, therefore, the first assumption test which can be checked by producing scatterplots of the relationship between the IVs and the DV. The result shown in figure 8 confirmed that the assumption of the linearity test is more or less met.

Figure 4. 11: Scatterplot of the Reverse Logistics Dimensions



Source: Field survey, 2020

Assumption of Multicollinearity

The assumption of multicollinearity is another important assumption that should be met. This assumption checks if the predictor variables are not too highly correlated. A common approach to examine and evaluate this assumption is by examining the correlation coefficients and the variance inflation factor (VIF). In order to meet the assumption of multicollinearity, the correlation should be a score less than 10 and the score of tolerance to be above 0.2 (Fritz and Morris, 2012). Accordingly, Table 23 confirmed this test is met.

Table 4. 20: Multicollinearity Statistics

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.809	.171		16.442	.000		
Personal Reuse	.086	.035	.123	2.427	.016	.996	1.004
Recycling	.038	.024	.078	1.535	.126	.980	1.020
Commercial Reuse	.073	.027	.140	2.745	.006	.975	1.026
Organic Valorization	-.031	.022	-.070	-1.369	.172	.982	1.018

a. Dependent Variable: Livelihood Asset

Source: Field survey, 2020

Table 4.20, the VIF values are all less than 10 and all the tolerance scores are above 0.2 suggesting that the assumption of Multicollinearity test has been met. The below correlation table 24 shows that the predictor or dimensions of the independent variable are not highly correlated. We can check this by looking the correlation scores i.e. correlation of more than 0.8 may be problematic. If this happens, we have to consider removing one of the independent variables. The result of the correlation score as shown from table 23, however, indicates that all the scores are less than 0.8 suggesting that this assumption is met.

Table 4. 21: Correlation

		Livelihood Asset	Personal Reuse	Recycling	Commercial Reuse	Organic Valorization
Pearson Correlation	Livelihood Asset	1.000	.130	.103	.163	-.088
	Personal Reuse	.130	1.000	.021	.050	.027
	Recycling	.103	.021	1.000	.117	-.086
	Commercial Reuse	.163	.050	.117	1.000	-.105
	Organic Valorization	-.088	.027	-.086	-.105	1.000
Sig. (1-tailed)	Livelihood Asset	.	.006	.022	.001	.044
	Personal Reuse	.006	.	.341	.168	.304
	Recycling	.022	.341	.	.011	.047
	Commercial Reuse	.001	.168	.011	.	.021
	Organic Valorization	.044	.304	.047	.021	.
N	Livelihood Asset	376	376	376	376	376
	Personal Reuse	376	376	376	376	376
	Recycling	376	376	376	376	376
	Commercial Reuse	376	376	376	376	376
	Organic Valorization	376	376	376	376	376

Source: Field survey, 2020

Residual Independence

The third assumption test is residual independence and we can use the Durbin-Watson statistics to check if our residuals are uncorrelated or independent. This statistics can vary from 0 to 4. In order to confirm whether this assumption is met or not, we need the value to be close to 2. On the other hand, values below 1 and above 3 are concerning and may result in the data analysis to be an invalid.

Table 4.22 below shows that the Durbin-Watson statistics shows 1.929 which confirms that the residuals are independent or uncorrelated suggesting the assumption is met.

Table 4. 22: Residual Independence Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.230 ^a	.053	.043	.29097	1.929

a. Predictors: (Constant), Organic Valorization, Personal Reuse, Recycling, Commercial Reuse

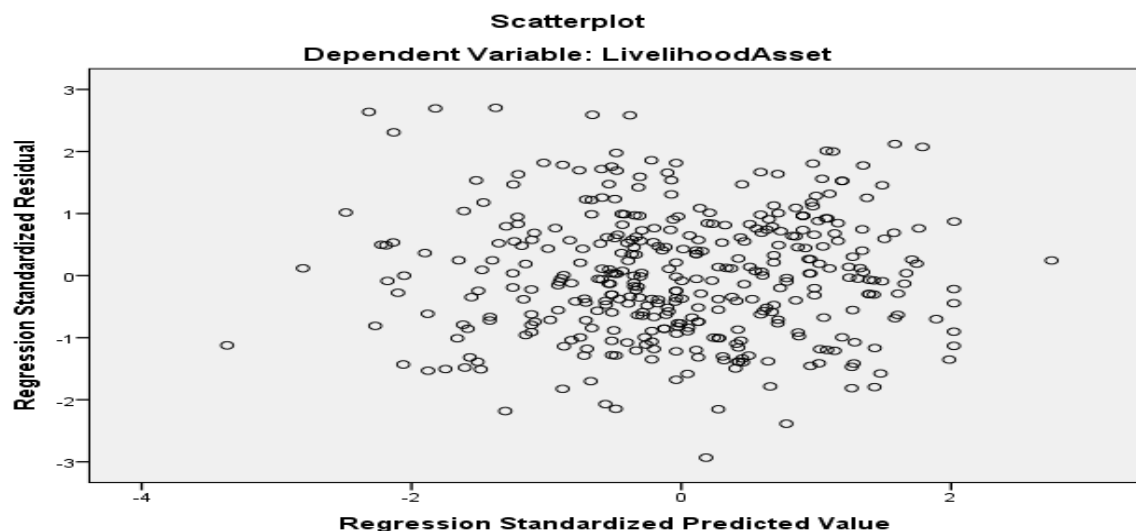
b. Dependent Variable: Livelihood Asset

Source: Field survey, 2020

The Variance of the Residuals is Constant (Homoscedasticity)

To test the fourth assumption (homoscedasticity) checks whether the variation in residuals or the amount of error in the model, is similar at each point of the model. We need to look at the final graph of the output. The graph plots the model prediction of the standardized values against the standardized residuals obtained. There should be homoscedasticity before the residuals are normally distributed and that the residuals have constant variance. The assumption passes the test if the graph looks like a random array of dots, while the assumption is not met if it looks like a funnel shape.

Figure 4. 12: Homoscedasticity Scatterplot

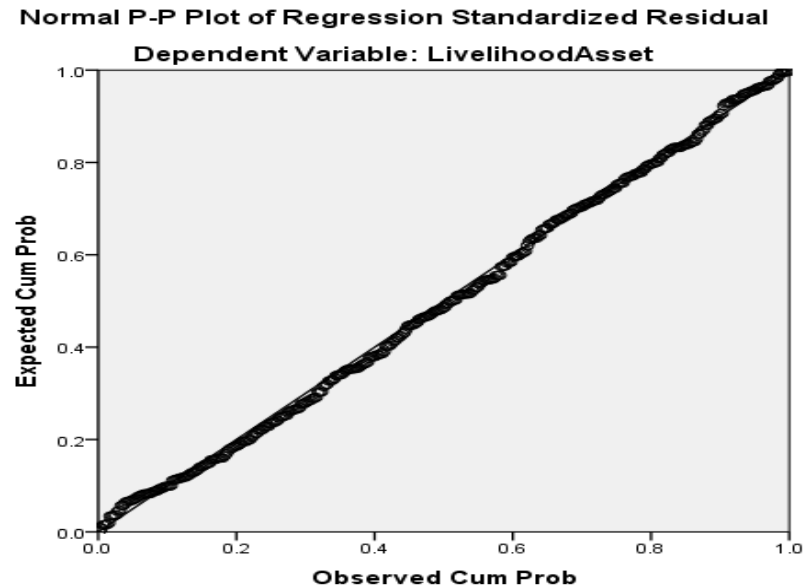


Source: Field survey, 2020

Normality of Residuals

The assumption of normality of residuals is tested by P-P plot for the model i.e. if the dots lie closer to the diagonal line, the closer to normal the residuals are distributed. Again, this assumption is met as shown in figure

Figure 4. 13: Normality of Residuals (P-P Plot)



Source: Field survey, 2020

Absence of Influential Cases biasing the Model (Outliers)

The presence of significant outliers and influential data points can place undue influence on the model. This makes the data less representative as a whole. The final assumption test is to check if such outliers exist in the data. To check the assumption of outliers in the data, we check Cook's distance statistics values for each participant. Accordingly, values over 1 are likely significant outliers and should be removed as they influence the model.

The Cook's distance statistics recorded below one, hence, confirming this test as well is met.

4.7. The effect of Solid Waste Reverse Logistics on the livelihood Assets

One research question the study would answer is to identify and examine which solid waste reverse logistic activity highly contribute to the livelihood asset of collectors. To this end, a regression analysis is required to identify which solid waste reverse logistics activity contributes highly to the livelihood of collectors. A detailed presentation and discussion of the description of the regression result is presented as follows:

The result of the analysis indicate how well are the activities of the four solid waste reverse logistics able to predict the effect on the livelihood assets of collectors. It further shows how much unique variance in the dependent variable is explained by each of the dimensions (latent variables) of the independent variables. The independent variable is the solid waste reverse logistics with four latent variables i.e. personal reuse, recycling, commercial reuse and organic valorization while the dependent variable is livelihood assets.

Table 4. 23: Model Summary of the Effect of Solid Waste Reverse Logistics on Livelihood assets of collectors.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.230 ^a	.053	.043	.29097

a. Predictors: (Constant), Organic Valorization, Personal Reuse, Recycling, Commercial Reuse

b. Dependent Variable: Livelihood Asset

The regression analysis shows that the model was able to significantly predict livelihood assets. As depicted in table 4.23, the r square indicates 5.3% of variance in the measurement of livelihood assets is explained by personal reuse, recycling, commercial reuse and organic valorization while the remaining 94.7% are explained by other variables other than these four reverse logistics activities. The possible explanation for this could be either the absence of organic valorization practice in Addis Ababa (which could have contributed significantly to their livelihood assets had they been practicing it as 64.8% of the capital's daily solid waste is organic) or the existence of individual informal collectors (aka, refuse collectors or scavengers) who collect plastic solid waste before it reaches the hands of the organized collectors. It could also be as a result of the limited opportunity available in the

solid waste to salvage for personal reuse or a combination of the above reasons. As the solid waste associations were organized by AASWMA, there is a market linkage between them and Reppie Waste to Energy Plant. The collected solid waste is, therefore, transported to the plant without valorizing it optimally. Hence, too much value could have been created, had there been not for the above mentioned possible explanations.

Table 4. 24: The effect of Solid waste reverse logistics on Livelihood Assets - ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.760	4	.440	5.198	.000 ^b
	Residual	31.410	371	.085		
	Total	33.170	375			

a. Dependent Variable: Livelihood Asset

b. Predictors: (Constant), Organic Valorization, Personal Reuse, Recycling, Commercial Reuse

Source: field survey, 2020

As shown from table 4.24, the significant level on the ANOVA table is .000, which indicate the degree of prediction on the dependent (outcome) variable.

The study aims to identify which of the solid waste reverse logistics variable contribute to the livelihood asset of collectors. This can be obtained by identifying which variable makes the most prediction on the dependent variable by investigating the Standardized coefficient Beta. Standardized coefficients is obtained by converting the value for each of the different variables to the same scale so that they can be compared (Pallant, 2010). Hence, the next phase requires the function of Beta coefficient (*b*) or standardized regression coefficient of each predictor or independent variable. The regression coefficient explain the average amount of change in dependent variable that is caused by a unit of change in the independent variable. The larger value of the Beta coefficient an independent variable has, the more important determinant it becomes in predicting the dependent variable.

Table 4. 25: Regression Analysis Summary for Predictor (independent) Variables

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.809	.171		16.442	.000
	Personal Reuse	.086	.035	.123	2.427	.016
	Recycling	.038	.024	.078	1.535	.126
	Commercial Reuse	.073	.027	.140	2.745	.006
	Organic Valorization	-.031	.022	-.070	-1.369	.172

a. Dependent Variable: Livelihood Asset

Source: field survey, 2020

Table 4.25 shows, both commercial reuse at significant level of (Sig= .006) and personal reuse at significant level of (Sig= .016) showed a significant association with livelihood assets. The nature of relationship for three of the constructs i.e. Personal Reuse, Recycling and Commercial Reuse are positive with (Beta=.086), (Beta=.038), and (Beta=.073), respectively, while Organic valorization showed a negative relationship with (Beta= -0.031). The positive slope shows that the livelihood asset for collectors increases as the constructs increase. Relatively, the highest increase occurs with commercial reuse and personal reuse i.e. an increase in one unit of commercial reuse results in 0.073 on the livelihood asset of collectors. This means, the more effort the collectors exert on commercial reuse, the more their livelihood asset increases. For the other two constructs i.e. recycling and organic valorization, the case may not work at (Sig= 0.05 or less).

5. Chapter Five - Summary, Conclusion and Recommendation

5.1. Introduction

This chapter of the study presents the important findings, key summaries and the conclusions drawn from the findings of the study. Furthermore, the chapter also includes the possible and practical recommendations from the researcher based on the findings of the study. This chapter has three major sections namely i) Summary, ii) Conclusions and iii) Recommendations (that includes managerial implications of the findings and recommendations for further study).

5.2. Summary

The study was about the effect of the solid waste reverse logistics on the livelihood assets of collectors. There are three solid waste collection systems residential, commercial and street waste collections. The residential waste collection system is the responsibility of micro and small enterprises organized under associations in all Woredas of Addis Ababa. These collectors earn their living performing and operating solid waste collection by performing practices which fall in the realm of solid waste reverse logistics i.e. personal reuse, recycling, commercial reuse and organic valorization. There are around 6,400 individual collectors in Addis Ababa on the residential solid waste collection system. The research sampled 376 of the collectors in all sub-cities to get their reply on the practice of solid waste collection, on which solid waste reverse logistics practice as well as how these practices contribute on their livelihood assets were studied. Furthermore, primary and secondary data were also collected from AASWMA, sub-cities and from the share associations as well. From the findings, the most important one has to be the collectors' livelihood predominantly supported by collecting the solid waste and transporting it to Reppie waste to energy plant instead of the four solid waste reverse logistics practices. As per the regression analysis, only 5.3% of the their livelihood assets is the four practices while the remaining 94.7% of their livelihood assets are explained by other variables other than these four reverse logistics activities. This is a huge finding, especially in light of the more than 3,200 tons of daily solid waste generation in Addis Ababa and their livelihood could have been better supported with the practice of the four practices.

5.3. Conclusion

Addis Ababa has three solid waste collection systems which are residential, commercial (private) and street collection systems. The residential collection system consists of associations and association members which have 6,400 individual collectors who earn a living by solid waste collection. The private collection system includes 40 private organizations while the street collection system has more than 5,000 street sweepers.

The unit of analysis for this study is the 6,400 individual collectors of the residential collection system. Both primary and secondary data were used to collect data. The discussion and interpretation of the findings are based on the empirical findings and previous secondary works relevant to the study. Regarding the practice of residential solid waste collection practice in Addis Ababa, the below conclusions can be drawn:

Women individual collectors represent the majority of residential collectors as per the semi structured interview with officials of AASWMA. The finding of the study also confirmed this claim as 58.2% of the sample respondents are women. Regarding the educational level of collectors, majority of the respondents are either not attended any form of formal education or attended up to second cycle education, while although in significant, there are also diploma holders in the work of solid waste collection. The age of collectors is also diverse i.e. from the lowest 20 up to the highest 76 years. On the other hand, there are collectors who stayed in the business for 15 years while the shortest work experience is 1 year. Almost all of them earn a monthly average income of more than ETB 2,500 plus a monthly saving of 20%, while majority of them earn a monthly average salary of greater than ETB 4,000 which is more than the mean average earnings of the total paid urban employees in Ethiopia in the year 2018 (CSA survey, 2018).

Majority of the respondents confirmed that they are the sole bread winners of their family and have access for credit facility and they do not face social stigma and marginalization due to their job. They can easily be a member of any social network like “Edir” and “Equb”. Furthermore, most of them agree that their job affects their as well as their family’s health. The collectors also agreed that natural capital i.e. land and water access to undertake their operation is not sufficient.

Regarding how each solid waste reverse logistics contribution on the livelihood assets of collectors, commercial reuse, personal reuse and recycling all have positive and small correlations, which indicates an increase in either of them results in an increase on the livelihood assets of collectors. Organic valorization on the other hand, do not contribute on the livelihood assets of collectors. This is could be as a result of the absence of organic valorization practice in Addis Ababa.

Regarding the solid waste reverse logistics practice and their contribution on the livelihood asset of collectors, all the respondents on average disagree valorizing solid waste for personal reuse is not common. Likewise, the value of recycling stream of the solid waste is highly dependent on whether it is segregated at the source. However, despite what the solid waste proclamation number 513/2007 says, most residential households do not ensure that recyclable solid wastes are segregated from those that are destined final disposal. This compromises the income of collectors that could have been maximized had it been segregated from the source. Furthermore, the Organic valorization stream of the solid waste is another practice which contributes minimal or non-existent on the livelihood assets of collectors. Even if this line of business has huge potential to highly contribute on the livelihood assets (as it contributes the 2,074 tons of the solid waste from Addis Ababa's daily solid waste generation of 3,200 tons), its contribution to their current livelihood asset is minimal or non-existent.

On the other hand, the commercial reuse stream of solid waste on the other hand, highly supports these collectors as all the respondents on average agree on it. Much of the associations' working capital including salary for truck drivers, fuel as well as office rents are supported the commercial stream of solid waste collection.

5.4. Recommendations

From the daily solid waste generation of Addis Ababa, 64.8% of it is organic waste which should have been a bedrock for organic valorization stream of solid waste reverse logistics. The practice, however, indicates that this stream of the solid waste reverse is the lowest (almost non-existent) practice. Given the recent announcement from the city government of Addis Ababa, if organic valorization is given due consideration, it not only improves the

livelihood of collectors, but may also contribute in saving Hard Currency to import artificial fertilizer.

Recycling is another underperforming stream of solid waste reverse logistics. The AASWMA has created a market linkage between the solid waste collection associations and 15 recycling companies. Even if the market is out there to utilize this practice to its fullest, the problem of segregating the plastic solid waste from the source is still a challenge. The AASWMA should, therefore, implement the solid waste proclamation and its regulation in enforcing segregation of plastic solid waste at the source. This could improve the collectors' revenue as they sell the plastic solid waste at ETB 8 per kg for the recycling companies instead of transporting it to Reppie waste to energy plant to get around ETB 132 per m³.

Further on the recycling stream of the solid waste reverse logistics, the researcher recommends that it is better to make an extensive study on the plastic recycling. The industry creates and supports a livelihood for many and gains foreign currency for Ethiopia being part of the global supply chain by exporting "Granules". If further studies are made on it, it may enhance the industry even better with positive ripple effect on the livelihood assets of collectors.

The overall daily uncollected solid waste generation of Addis Ababa amounts 20-30%. According to the discussion the researcher had with some managers of the Sub-city solid waste administration unit, there is still high demand and urge from the unemployed youth to get organized and collect the solid waste. Given the daily uncollected level of solid waste, it is natural to think of organizing these unemployed youth, which in one way supports employment and improves the hygiene status of Addis Ababa on the other.

From the finding, an overwhelming number of collectors are disappointed by the lack of water to keep their hygiene. Furthermore, majority of them are unhappy on working in an overcrowded working space (especially the temporary storage sites). AASWMA long planned to construct a modern temporary storage sites at least one in each sub city, its application, however, is not materialized. This could have improved the hygiene standard as well as improve their revenue as the agency vehicles' do not show-up frequently to collect the solid waste and transport it to the Reppie waste to energy plant.

Finally, the data collected for this study is a cross sectional. There is, however, too much fluctuation operation of solid waste collection in general. The study would be complete with a time series data.

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Annexes

Annex I: Questionnaire (English Version)

Questionnaire Prepared for Sample Respondents who are engaged in Solid Waste Collection of Addis Ababa

This Questionnaire is prepared for an academic purpose for the fulfillment of MA degree in Logistics and Supply Chain Management. The specific objective of the research is to study the effect of Solid Waste reverse logistics on the financial assets of collectors in Addis Ababa. Your Kind response to the fulfillment of the research study is, therefore, very important for the success of the study as all information you would provide will determine the outcome of the research. Hence, you are kindly requested to give your response by selecting your answer from the given alternative choice or describing your opinion.

Please be informed that your response is kept as confidential and you are not required to write your name.

I would like to thank you for your cooperation.

Part I: Background information of the respondents

Instruction: In order to answer the following questions, put a right sign (✓) in the boxes to the question applies:

1. **Sex:** [1] Male ☐ [2] Female ☐
2. **Age:** [1] 18 - 29 ☐ [2] 30 - 39 ☐ [3] 40 - 49 ☐ [4] >50 ☐
3. **Educational level:** [1] No formal education ☐ [2] 1-4 grade complete ☐
[3] 5-8 grades complete ☐ [4] 9-12 grades complete ☐
[5] Certificate ☐ [6] Diploma ☐
[7] First degree and above ☐
4. **Marital Status:** [1] Married ☐ [2] Divorced ☐

[3] Not Married ☐ [4] Widow ☐

5. **Year of Service in the current position:** [1] Below 1 year ☐

[2] 1 to 5 Years ☐ [3] 5 to 10 Years ☐ [4] above 10 years ☐

6. **Family Size:** [1] Bachelor ☐ [2] 1-4 ☐ [3] 5-8 ☐ [4] >8 ☐

Part II: General Questions:

Instruction: Please put a right sign (✓) in the boxes to answer the questions that applies:

1. How much do you earn monthly as a solid waste collectors?

[1] 500 - 1500 ☐ [2] 1501 – 2500 ☐ [3] 2501 – 4000 ☐

[4] 4001- 8000 ☐ [5] >8000 ☐

2. Are you the sole bread winner of the family? [1] Yes ☐ [2] No ☐

3. If your answer to question no. 2 is no, how many bread winners are in the family?

4. Do you get credit facility from the association? [1] Yes ☐ [2] No ☐

5. Do you have insurance coverage? [1] Yes ☐ [2] No ☐

Respondents Address

Sub-city: _____

Woreda: _____

Name of Associations: _____

Part III: Informal Valorization

A. Personal Reuse

(1= strongly agree; 2= Agree; 3= Neutral; 4= Disagree; 5= Strongly Disagree)

Please tick (√) that apply	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
We find household maintenance items from the solid waste we collect					
We find food for my domestic animals from the solid waste we collect					
We find materials as household inputs from the solid waste we collect					
We find other materials useful for personal use from the solid waste we collect					

B. Recycling

Please tick (√) that apply	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I don't find a recyclable solid waste separated at the source					
I don't find sorted recyclable solid waste at the source					
I process recyclable solid waste					

C. Reuse with Repair

Please tick (√) that apply	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
We find materials to be reused with repair for commercial firms					
There are commercial purchasers of materials which repair materials to be reused					
We find Commercial firms which accept materials					

D. Organic Valorization

Please tick (✓) that apply	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
We find organic garden fertilizer from the solid waste we collect					
We find organic waste to market it as animal feed from the solid waste we collect					
We find organic waste to market it as compost from the solid waste we collect					

Part IV: Livelihood Assets

A. Financial Capital:

(1= Strongly Agree; 2= Agree; 3= Neutral; 4= Disagree; 5= Strongly Disagree)

Please tick (✓) that apply	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
I save monthly from income in solid waste collection					
I earn my income from solid waste collection alone					
I get credit facility from the solid waste collection					
I have access to bank account due to solid waste collection					

B. Human Capital

Please tick (✓) that apply	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
I have the required knowledge and skill for solid waste					
I face health problems due to solid waste collection					
My work affects my family members' health					

C. Physical Capital

Please tick (✓) that apply	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
I have enough equipment to undertake the solid waste					
The vehicles to transport the solid waste are sufficient					
I have modest household physical capital (fixed assets)					

D. Natural Capital

Please tick (✓) that apply	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
I access land to undertake the solid waste collection					
The temporary storage land to undertake the solid waste collection work is sufficient					
I get sufficient water access to keep my hygiene					

E. Social Capital

Please tick (✓) that apply	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
I can be a member of different social networks					
Is it easy for me to be a member of social networks					
I am a member of an association which has a voice and influence					

Annex II: Questionnaire (Amharic Version)

በቤት ለቤት የደረቅ ቆሻሻ መስብስብ ሥራ ላይ ለተሰማሩ ሠራተኞች የተዘጋጀ መጠይቅ!

ይኸ የጽሑፍ መጠይቅ በአዲስ አበባ ዩኒቨርሲቲ፣ ሎጄስቲክስና ሰጥላይ ቴይን ማኔጅመንት ትምሕርት ለማስተርስ ዲግሪ ጥናት ማሟያ የሚውል ምርምር ነው፡፡ ምርምሩ፤ በቤት ለቤት ደረቅ ቆሻሻ መስብስብ ሥራ ላይ የተሰማሩ ሠራተኞች ላይ ያተኮረ ሲሆን፤ ሥራው መተዳደሪያቸው ላይ ያለውን አበርክቶ የሚያጠና ነው፡፡ በመሆኑም ለምርምሩ ውጤት መሳካት የእርስዎ አስተዋፅዖ እጅግ የጎላ በመሆኑ፤ መጠይቁን በመሙላት እንዲተባበሩን፤ ምላሽዎንም ከጥያቄዎቹ ጎን ባሉት ሳጥኖች ላይ የራይት ምልክት (✓) በማስቀመጥ እንዲመልሱ በአክብሮት እንጠይቅዎታለን፡፡

እርስዎ የሚሰጡት ምላሽ፤ ለምርምሩ ሥራ ላይ ብቻ የሚውል በመሆኑ፤ ምላሽዎ ለሦስተኛ ወገን በፍፁም ተላልፎ አይሰጥም፡፡

ጊዜዎን ሰውተው ለጥናቱ መሳካት ምላሽ በመስጠት ስለሚተባበሩ፤ በቅድሚያ እናመሰግናለን፡፡

ክፍል አንድ፡ የመላሹ ግለሰባዊ መረጃዎች

ቀጥለው ለቀረቡትን ጥያቄዎች፤ ከመልስ አማራጮቹ አጠገብ ካሉት ሳጥኖች የራይት ምልክት (✓) በማስቀመጥ ምላሽዎን ይስጡ፡፡ (ማሳሰቢያ፡ መጠይቁ ላይ በወንድ አንቀፅ ለተጠየቀው ጥያቄ ለሴትም ያገለግላል)፡፡

1. ጾታ፡ [1] ወንድ ☐ [2] ሴት ☐
2. እድሜ፡ [1] 18 - 29 ☐ [2] 30 - 39 ☐ [3] 40 - 49 ☐ [4] >50 ☐
3. የትምሕርት ደረጃ፡ [1] መደበኛ ትምሕርት አልተማርኩም ☐ [2] ከ 1 - 4 ኛ ክፍል ያጠናቀቀ ☐
 [3] ከ 5 - 8 ኛ ክፍል ያጠናቀቀ ☐ [4] ከ 9 - 12 ኛ ክፍል ያጠናቀቀ ☐
 [5] ሰርቲፊኬት ያለው ☐ [6] ዲፕሎማ ያለው ☐
 [7] የመጀመሪያ ዲግሪና ከዚያ በላይ ☐
4. የጋብቻ ሁኔታ፡ [1] ያላገባ ☐ [2] ያገባ ☐ [3] ፈት (የፈታ) ☐ [4] የትዳር አጋሩን በሞት ያጣ ☐
5. በሥራው ላይ ምን ያህል ቆዩ ?፡ [1] ከ 1 ዓመት በታች ☐ [2] ከ 1 - 5 ዓመት ☐
 [3] ከ 5 - 10 ዓመት ☐ [4] ከ10 ዓመት በላይ ☐
6. የቤተሰብ ብዛት፡ [1] ላጤ ☐ [2] ከ 1 - 4 ☐ [3] ከ 5 - 8 ☐ [4] ከ 8 በላይ ☐

ክፍል ሁለት፡ አጠቃላይ ጥያቄዎች

ቀጥለው ለቀረቡትን ጥያቄዎች፤ ከመልስ አማራጮቹ አጠገብ ካሉት ሳጥኖች የራይት ምልክት (✓) በማስቀመጥ ምላሽዎን ይስጡ፡፡ (ማሳሰቢያ፡ መጠይቁ ላይ በወንድ አንቀፅ ለተጠየቀው ጥያቄ ለሴትም ያገለግላል)፡፡

1. የቤት ለቤት ቆሻሻ በመሠብሰብ ሥራዎ በወር ምን ያህል ገቢ ያገኛሉ ? [1] ከብር 500 – 1500 ☐
[2] ከ 1501 – 2500 ☐ [3] ከ 2501 – 4000 ☐ [4] ከ 4001 – 8000 ☐ [5] ከ8000 በላይ ☐
2. የቤተሰቡ ብቸኛ የገቢ ምንጭ እርስዎ ነዎት ? [1] አዎ ☐ [2] አይደለሁም ☐
3. ለ2ተኛው ጥያቄ መልስዎ አይደለሁም ከሆነ፤ ስንት የቤተሰቡ አባላት የራሳቸው የገቢ ምንጭ አላቸው? --

4. ከማኅበርዎ ብድር አቅርቦት ያገኛሉ? [1] አዎ ☐ [2] አላገኝም ☐
5. የመድን ኢንሹራንስ ሽፋን አለዎት ? [1] አዎ ☐ [2] የለኝም ☐

የመላሹ የሥራ አድራሻ

ክፍለ ከተማ፡ -----

ወረዳ፡ -----

የሽርክና ማኅበሩ ስም፡ -----

ክፍል ሦስት: ደረቅ ቆሻሻን መልሶ የመጠቀሚያ ዓይነቶች (Informal Valorization)

ቀጥለው ለቀረቡት ጥያቄዎች፤ አምስት የመልስ አማራጮች ተቀምጠዋል፤ እነሱም በደንብ እስማማለሁ፣ እስማማለሁ፣ መካከለኛ፣ አልስማማም እና ፈፅሞ አልስማማም የሚሉ ናቸው፡፡ በዚህም መሠረት ከቀረቡት አምስት የመልስ አማራጮች ውስጥ ስሜትዎን በትክክል ከሚገልፀው ምላሽ ላይ የራይት ምልክት (✓) በማስቀመጥ፤ እባክዎን ይመልሱ፡፡

i. ለግል ጥቅም የሚውሉ ደረቅ ቆሻሻ ዓይነቶች (Personal Reuse)

ምላሽዎ ላይ፤ እባክዎ የራይት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ተጠግነው ጥቅም ላይ የሚውሉ የቤት ዕቃዎችን ከምንሠበሥበው ደረቅ ቆሻሻ ውስጥ እናገኛለን፡፡					
ከምንሠበሥበው ደረቅ ቆሻሻ ውስጥ ለቤት እንሰሳቶች የሚሆን መኖ					
መገልገያ የሚሆኑ የቤት ዕቃዎችን፤ ከምንሠበሥበው ደረቅ ቆሻሻ ውስጥ እናገኛለን፡፡					
ለግል ጥቅም የሚሆኑ ዕቃዎችን ከምንሠበሥበው ደረቅ ቆሻሻ ውስጥ እናገኛለን፡፡					

ii. መልሶ ዕደት (Recycling)

ምላሽዎ ላይ፤ እባክዎ የራይት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
በመልሶ ዕደት ጥቅም ላይ የሚውሉ ደረቅ ቆሻሻዎችን፤ ከምንጩ ተለይተው አገኛለሁ፡፡					
በመልሶ ዕደት ጥቅም ላይ የሚውሉ ደረቅ ቆሻሻዎችን፤ ፋብሪካ በሚገቡበት ደረጃ ተስተካክለው አገኛለሁ፡፡					
በመልሶ ዕደት ጥቅም ላይ የሚውሉ ደረቅ ቆሻሻዎችን፤ እኔ ራሴ በመልክ በመልክ አዘጋጅቼ አስተካክክቸዋለሁ፡፡					

iii. **ኮሌክቲብ (Commercial Reuse or Reuse with Repair)**

ምላሽ ላይ፤ እባክዎ የራዬት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ኮሌክቲቦችን ከምንሠብሥበው ደረቅ ቆሻሻ ውስጥ እናገኛለን፡፡					
ኮሌክቲቦች የሚገዙ ነጋዴዎች ገበያው ላይ አሉ፡፡					
ኮሌክቲብ የሚገዙ ነጋዴዎችን በቀላሉ እናገኛለን፡፡					

iv. **ጠቃሚ ብስባሽ ደረቅ ቆሻሻ (ኮምፖስት) (Organic Valorization)**

ምላሽ ላይ፤ እባክዎ የራዬት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ለአትክልት ቦታ የሚሆን ማዳበሪያን (ኮምፖስት)፤ ከምንሠብሥበው ደረቅ ቆሻሻ ውስጥ እናገኛለን፡፡					
ለከብት መኖ የሚሆን የሚሸጥ ምግብን፤ ከምንሠብሥበው ደረቅ ቆሻሻ ውስጥ እናገኛለን፡፡					
ለሽያጭ የሚሆኑ ብስባሽ ማዳበሪያዎችን (ኮምፖስት)፤ ከምንሠብሥበው ደረቅ ቆሻሻ ውስጥ እናገኛለን፡፡					

ክፍል አራት፡ መተዳደሪያ ንብረቶች (Livelihood Assets)

ቀጥለው ለቀረቡት ጥያቄዎች፤ አምስት የመልስ አማራጮች ተቀምጠዋል፤ እነሱም በደንብ እስማማለሁ፤ እስማማለሁ፤ መካከለኛ፤ አልስማማም እና ፈፅሞ አልስማማም የሚሉ ናቸው፡፡ በዚህም መሠረት ከቀረቡት አምስት የመልስ አማራጮች ውስጥ ስሜትዎን በትክክል ከሚገልፀው ምላሽ ላይ የራዬት ምልክት (✓) በማስቀመጥ፤ እባክዎን ይመልሱ፡፡

ሀ) ገንዘብ ነክ ንብረቶች (Financial Capital)

ምላሽዎ ላይ፤ እባክዎ የራዬት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ደረቅ ቆሻሻ በመሠብሰብ ከማገኘው ገቢ፤ በየወሩ እቆጥባለሁ፡፡					
ገቢዬን የማገኘው ደረቅ ቆሻሻ በመሠብሰብ ብቻ ነው፡፡					
ደረቅ ቆሻሻ በመሠብሰብ፤ የብድር አቅርቦት እንዳገኝ አስችሎኛል፡፡					
ደረቅ ቆሻሻ በመሠብሰብ ሥራ ላይ በመሠማራቴ፤ የባንክ ሂሳብ መክፈት ችያለሁ፡፡					

ለ) ሰዋዊ ንብረት (Human Capital)

ምላሽዎ ላይ፤ እባክዎ የራዬት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ደረቅ ቆሻሻ ለመሠብሰብ በቂ እውቀትና ክህሎት አለኝ፡፡					
ደረቅ ቆሻሻ በመሠብሰብ ሥራ ላይ በመሠማራቴ፤ የጤና እክል					
ደረቅ ቆሻሻ በመሠብሰብ ሥራ ላይ በመሠማራቴ፤ የቤተሰቤ ጤና ላይ ተፅዕኖ አምጥቻለሁ፡፡					

ሐ) ተጨባጭ (አካላዊ) ንብረት (Physical Capital)

ምላሽዎ ላይ፤ እባክዎ የራዬት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ደረቅ ቆሻሻ ለመሠብሰብ የሚረዱ በቂ መሣሪያዎች አሉኝ፡፡					
ደረቅ ቆሻሻ የሚያነሱ በቂ መኪናዎች አሉ፡፡					
ደረቅ ቆሻሻ የመሠብሰብ ሥራ በመሥራት በቂ የቤት ዕቃዎች እንዲኖረኝ አስችሎኛል፡፡					

መ) ተፈጥሮአዊ ንብረት (Natural Capital)

ምላሽዎ ላይ፤ እባክዎ የራዬት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ደረቅ ቆሻሻ ለመሠብሰብ የሚሆን በቂ የመሬት አቅርቦት አለ፡፡					
ደረቅ ቆሻሻ ለመሠብሰብ የምንጠቀምበት የቅብብሎሽ ቦታ፤ ሥራችንን ለመሥራት በቂ ነው፡፡					
ንፅህናችንን ለመጠበቅ የሚያስችል በቂ የውሀ አቅርቦት አለ፡፡					

ሠ) ማኅበራዊ ንብረት (Social Capital)

ምላሽዎ ላይ፤ እባክዎ የራዬት ምልክት (✓) ያድርጉ፡፡	በደንብ እስማማለሁ	እስማማለሁ	መካከለኛ	አልስማማም	ፈፅሞ አልስማማም
ደረቅ ቆሻሻ በመሠብሰብ መተዳደራ፤ የተለያዩ የማኅበራዊ አደረጃጀቶች (ለምሳሌ ዕድር፤ ዕቁብ ወዘተ...) አባል ከመሆን አያግደኝም፡፡					
ደረቅ ቆሻሻ በመሠብሰብ ሥራ ላይ መሠማራቴ፤ በማኅበራዊ ግንኙነቴ ላይ ምንም ዓይነት ክፍተት አልፈጠረብኝም፡፡					
ደረቅ ቆሻሻ በመሠብሰብ ሥራ ላይ መሠማራቴ፤ የተሰማና ጠንካራ ማኅበር አባል እንድሆን አስችሎኛል፡፡					

Annex III: Various Attachments

Attachments will be submitted in with the hard copy of the research document.