ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES

THE CHALLENGE AND PROSPECT OF SOLID WASTE MANAGEMENTLOGISTICS: THE CASEOF BISHOFTU CITY ADMINISTRATION OF OROMIA REGIONAL STATE.

BY:

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The Challenge and Prospect of Solid Waste Management Logistics: The Case of Bishoftu City Administration of Oromia Regional State.

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DECLARATION

I hereby declare that this thesis entitled “The Challenge and Prospect of Solid Waste Management Logistics: The Case of Bishoftu City Administration of Oromia Regional State”, has been carried out by me under the guidance and supervision of Habtamu Abebaw (PHD).

The thesis is original and has not been submitted for the award of degree or diploma in any university or institution.

Michu Alemayehu

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Signature & Date

St. Mary's University, Addis Ababa

June, 2022

ENDORSEMENT

This thesis has been submitted to St. Mary's University, school of Graduate Studies for examination with my approval as a university advisor.

Habtamu Abebaw (PHD) ----------

Advisor Signature

St. Mary's University, Addis Ababa June, 2022

St. Mary's University
School Of Graduate Studies

"The challenge and prospects of Logistics on Solid Waste Management Practices with a particular reference to Bishoftu City Administration of Oromia Regional State."

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ABBREVIATIONS AND ACRONYMS

MSWM:…… ……Municipal of solid waste management

MILP:…….Mixed Integer Liner Programming

PSWML:…….Performance of Solid Waste Management Logistics

SWM:…….Solid Waste Management

OLS:…….Ordinary Least Square

VIF:……Variance Inflation Factor

ABSTRACT

The purpose of this research is to examine the "challenge and prospects of Solid Waste Management Logistics in the case of Bishoftu City Administration of Oromia Regional State". The study is quantitative in its approach and been able to use descriptive and explanatory research design. They are Five variables to examine the "challenge and prospects of Solid Waste Management Logistics (commitment, intensity of traffic, tonnage of loading, pickup time and volume of waste). A cross-sectional data with a total of 395 sample units were used and these samples were analysed through descriptive analysis and OLS regression. Accordingly five factors hypothesizes were accepted. The study concluded that the challenge and prospects of solid waste management logistics become better with through good commitment, intensity of traffic, tonnage of loading, pickup time and volume of waste. The result of this study reveals that commitment is one of the determinants that affect the challenge and prospects of solid waste management logistics. The commitment of waste management logistics staff is important, so skilled personnel with a passion for the job are required. In addition to this, intensity of traffic has found to be the most important factors that influence PSWML. Hence, there is no way waste management logistics can be effective

***Keywords**: Performance of solid waste management logistics, Commitment, Intensity of traffic, Tonnage of loading, Pickup time and Volume of waste*

CHAPTER ONE

INTRODUCTON

This chapter describes the background of the survey, problems, basic research questions, the purpose of the survey, the importance of the survey, the scope of the survey, and the structure of the survey report. The details are as follows.

1.1. Background of the Study

Waste is defined as unwanted remains, residues discarded and material or by products which are no longer required by the initial user. These materials are by-products of human activities such as process of preparation, manufacture, packing, repacking, unpacking, construction, renovation of structures and mining operations (Shewasinad et al., 2017).

Solid wastes are potential sources of environmental pollution. Environmental pollution is becoming a core issue with regards to its effects on human health. One of the environmental problems affecting the human being is solid waste.

Logistics processes are in general defined as the flow of information and materials (Casper et al., 2018). Flow information from customer to plan and from plan to supplier. Flow material from supplier to plan and from plan to customer.Integrated solid Waste Management can be viewed as a logistic system that aims to face the growing challenge of municipality solid waste in urban cities, especially in developing countries. Solid waste management (SWM) in an urban area is a complex activity that involves the collection, transportation, recycling, resource recovery and disposal of solid waste generated in an urban area (Lemaet al., 2019).

Logistic management has become one of the major strategies that companies are adapting to remain competitive through supplying goods in the current dynamic environment house and (stank 2001).

Though the volume of solid waste generated in Africa is small compared to developed regions, less than half of the solid waste produced is collected, and 95 percent of that amount is either

indiscriminately thrown away at various dumping sites on the periphery of urban centres, or at a number of so-called temporary sites, typically empty lots scattered throughout the city (Godfrey,et al., 2019).Available data show that 125 million tonnes per annum of municipal solid waste were generated in Africa in 2012, of which 81 million tonnes (65%) were from sub-Saharan Africa and this is expected to grow to 244 million tonnes per year by 2025 (Scarlatet al., 2015). The authors also revealed that with an average waste collection rate of only 55%, nearly half of all waste generated in Africa, remains within our cities and towns, dumped onto sidewalks, open fields, storm water drains and rivers. This is because of Land filling, which has become the immediate most possible way of managing waste in most of the African countries and the authorities that primarily bear the responsibility to clean up the cities, towns and residential areas find it easier and time saving to collect the waste and carry it to a landfill rather than sorting out the wastes for recycling and composting (Rotich, et al., 2006).

Ethiopia is one of the low income countries facing the consequence of improper solid waste management, leading to overcrowding and the development of slums and informal settlements with poor waste management practices resulting serious health, safety, and environmental consequences, where in 2016 alone, the country's generation of municipal solid waste totalled some 7 million metric tons (Zhaohuaet al., 2011). Solid waste in municipalities of Ethiopia has experienced traditional practices of collecting, disposing and reusing solid waste, which is not aimed at promoting public health, protection of the environment & other energy sources (Hailemariam &Ajeme, 2014). Proper solid waste management requires the commitment of the town municipality and the active involvement of the community members. There are many initiatives taking place in Ethiopia especially in the capital city. In Addis Ababa the awareness of the community members about solid waste management is enhanced and more than 70% of the community inhabitants were willing to pay for door to door solid waste collection service which is one of the initiatives introduced by the government (Dika et al, 2019).

Bishoftu is an old city with many public and private hospitals, health centers, industries, hotels and small scale enterprise where lots of solid waste is generated. As stated in socio economic profile document of Bishoftu City Administration (2022), as population increased the amount of solid waste generated from households, street sweeping, garages, big installed institutions, cattle fattening enclosures and other commercial establishments have increased. According to Bishoftu

City Administration Solid Waste Management Study Report (2022), the solid waste generated in the year 2017 of Bishoftu City was 583.4598 m^3 and the solid waste generated become 417.724m^3 after five years in 2022. The waste is distracting the image of the city and is posing serious threats to human health. It is gradually becoming a breeding ground for diseases in the city. The city is gradually manifesting unhealthy condition for human dwelling in some locations. In general, the negative impacts on the environment, human and animal health is increasing from time to time. The aim of this study was to assess the status of improper solid waste management, to identify factors for improper solid waste management, to identify the impacts of improper solid waste management, and to assess the role of logistics process in the improper solid waste management activities in BishoftuCity. Therefore, the purpose of this study is to assess Challenge and Perspective of Logistics on Solid Waste Management Practices of Bishoftu City Administration of Oromia Regional State.

1.2. Statement of the Problem

The movement of goods and services is crucial to the economy. Just as the removal of waste is important for the body's digestive system, so also is the evacuation of solid waste from our environment. The historical development believed that in the field of Logistics on Waste Management has been affected by 6 main factors: public health, environment, resource scarcity, waste value, climate change and public awareness. Wrong practices such as methods of collecting and transporting waste using traditional methods and improper disposal methods that often result in emissions of odours and harmful gases have reinforced this development (Di Maria, et al, 2018).

Poor logistics on management of solid waste will result in unsettled solid waste. Logistics by municipal solid waste have induced severe degradation of air quality, water quality, and public health such as respiratory diseases, diarrhea and dengue fever, and also have contributed to climate change (for example, the release of methane gas). To avoid these things it is necessary to find the best solution. Yohanis (2015) described that with economic development and population growth in urban areas results in increased solid waste generation, which demands municipalities in Ethiopia to be prepared for such challenges.

The increasing traffic congestion and the need for preserving the environment (CO2 reduction), make urban logistics on solid waste management an area opportunity to achieve an economic,

social, and environmental impact by reducing urban transport using adequate collection techniques (Dotoli, et al, 2017). The need to control the damage to the population and the environment transforms waste collection in a public and private matter. Therefore, this leads to the need for developing solutions, mainly focused on the administration, collection, and disposal of waste.

Solid waste management is one of the important areas where the problems arise from time to time. Municipal bodies are unable to provide a 100% efficient system and even are not able to reach to the efficiency of 60%. Logistics on solid waste management frequently suffers more than other municipal service when budget allocations and cuts are made. The provision of collection and disposal services for municipal refuse is not perceived as deserving higher priority. Efforts of people employed to collect, dispose and recycle wastes are rarely appreciated. The existing situation is not satisfactory and often there are complaints by the public which adds anxiety to the concerned officials involved in the management. The real problems are mainly of organization, management and planning, yet the favoured solutions involve more mechanization (Aurobindo, 2013).

Ethiopia, all urban level governmental bodies are taking the responsibility for SWML services but these services are only focusing on collection of wastes from dumping areas (Muhdin et al., 2016). Ministry of health, hygiene and Environment Department (2014) shows Addis Ababa`s` per capital solid waste generation rates is 0.45 kg/c day and more than 200,000 tons of waste is collected each year. From this amount of waste 76% produced from households, 18% from institutions, commercial centres, factories and hotels and the rest 60% is from street sweeping. The rapid and mostly uncontrolled demographic growth and spatial expansion of large cities in developing countries often results in considerable damage to environmental sanitation. This particularly true in Oromiya region, Eastern shewa zone,Bishoftu town (Biniyam, 2015).

Number of reasons may be listed behind the complaints on the logistics service delivered by the municipal, but the aforementioned problems are very critical to mention worth. In general, whatever the reasons may be, once the population is dissatisfied, it would be very difficult to get their trust back (Gashaw, 2011). Thus, in this regard, a research should be carried out to urge a major reform, to assesses the root causes of the problem and get the problem rectified.

While there are vast growing bodies of empirical studies at the international level on the Logistics on Solid Waste Management Practices, to the researcher best knowledge, few studies have been conducted in Ethiopia. Studies by Ngiste and Mequanint (2022), Eshetu (2021), Endalkachew et.al (2018), and Fasil et.al (2017)are at most to mention. Some of these studies have used descriptive statistics while the rest have used OLS. However, the challenge and prospects of Logistics on Solid Waste Management Practices to the context the researcher is working with had not yet been empirically explored using combination of factor analysis and multiple regressionmodel (OLS). Moreover, to the best memory of the researcher, little study was conducted on the topic under investigation in the study area. The underlying study therefore intends to uncover this gap with an overarching objective of challenge and prospects of Logistics on Solid Waste Management Practices with a particular reference to Bishoftu City Administration of Oromia Regional State.

1.3. Research Questions

i. What are the existing SWML practices of Bishoftu City?
ii. What are factors influencing for proper logistics on solid waste management?
iii. What are the prospects of logistics on PSWML?

1.4. Objectives of the Study

The study has both general and specific objectives.

1.4.1. General Objectives of the Study

The general objective of this study is to examine the challenge and performance of Logistics on Solid Waste Management Practices with a particular reference to Bishoftu City Administration of Oromia Regional State

1.4.2. Specific Objectives

i. Assess the existing SWML practices of Bishoftu City
ii. To identify factors influencing for proper logistics on solid waste management
iii. To assess the prospects of logistics on PSWML.

1.5. Significance of the Study

This study is expected to be useful in three main points. First, the study will contribute to a better theoretical understanding of the overall features of municipal solid waste and problems faced in the process of municipal solid waste management. Second, it give some guideline information to policy makers, public administrators, solid waste managers, municipal leaders, researchers and environmental protection agencies who seek to improve existing solid waste management and to minimize related problems and also to see the practices in the study area. The study also important in putting baseline information to the next work as a springboard for researchers who would like to conduct detailed and comprehensive studies either in the city or another study area.

1.6. Scope of the Study

One of the obvious delimitations is that the sample used in this study is drawn only from local level, i.e. Bishoftu City. Hence, the subsequent findings cannot firmly be generalized to whole country in the world in general and particularly in Ethiopia. To address these issue further comprehensive studies on the topic with much larger sample size and broader coverage of area throughout Ethiopia is required.Moreover, although both liquid waste and solid waste are demanding subject to study, this study was dealt only Municipal Logistics on Solid Waste Management Practices of Bishoftu City Administration of Oromia regional state of Ethiopia. Another methodological caveat of the present study is that SWML are multi-dimensional and contingent upon various set of variables. While this study examined the pertinent variables of SWML, yet there are certain additional variables that are excluded from our model specification because of measurement issues. Therefore, future studies could possibly examine a wider host of factors to improve the generalizability of the results.

1.7. Limitations of the Study

It stated that solid waste management is become the hot issue and the one that encourage the research and development institution across the globe. Especially, in developing nations including Ethiopia, inadequate and inefficient management system of household wastes are observed as the evidence of conducted research. However, due to the time and financial constraints of the researcher, this thesis concentrated on one specific zonal city. Therefore, its output will not represent the solid waste management system of other geographical area. In this study some aspects of logistics management of municipal waste are described. Waste management will focus

more on the collection process. So that integrated management in other processes is hampered. The study didn't include some private sector because we didn't get their address during our study period and another limitation the municipality that used as a technology composting site not included in the study period due to time burden. The term improper solid waste management is broad. Separation of waste is also relative as there is no standard regulation of solid waste separation practiced in the community. In general, a holistic approach must be adopted to achieve a meaningful and lasting solution.

1.8 Definitions of terms

Solid waste management: is literally the process of managing waste material .it involves the collection, transport processing and /or disposal of waste materials.

Logistic Management practice

It is the management process that integrates the movement of goods, services, information, and capital, right from the sourcing of raw material to the consumer (Springlike and Waldenburg, 2012**).**

Intensity of traffic: study is based on counting the number of vehicles passing through a fixed section, such as a road, in a specific time unit.

Volume of Waste: Waste volume (or weight) data are normally collected by WCAs for reporting and performance management purposes.

1.9. Organization of the Study

This research has five chapters. The first chapter deals with background of the study, statement of the problem, objective of the study, research questions, significance of the study, scope of the study, limitation of the study and organization of the study. The second chapter has based on the related literature written before, which reviews theoretical and empirical literature on the key variables of the study. The third chapter has discussed on the design and methodology of the

research study. It includes methods of data collection determining the target population sampling design and data analysis methods. The fourth chapter has presented the study's research findings. The last: fifth chapter which is about the research conclusions and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 The Concept of solid waste and its Generation

Waste is often found as a liquid or solid form (ILO, 2007). It is a by-product of human activities that tends to increase with the rate of urbanization, changing patterns of consumption and the improvement of living standards (ENPHO, 2008).

"Wastes are materials that are not prime products (that is products produced for the market) for which the initial user has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded" (MacBride, R., Waste, C. & Idaho, C.P. 1953. P.89 as Cited in Alireza and Mahmoud, 2014)

The World Bank (1999) defines Solid waste (SW) as unwanted, thrown away or discarded as useless materials by human. These materials are non-liquid, non-hazardous, non-gaseous and consist of organic matter (that is easily degradable) and inorganic (non-biodegradable, for instance, metals, plastics, bottles and broken glasses). Solid waste, as stated by (Arukwe, 2012; Patwary et al., 2011; Zhang et al., 2010), are materials originate from households, commercial establishments, institutions, markets, and industries.

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

In Ethiopia, according to the Federal Democratic Republic of Ethiopia Proclamation No. 513/2007, Solid Waste Management Proclamation, "Solid Waste" means anything that is neither liquid not gas and is discarded as unwanted. The ever increasing amount of solid waste generated which is exacerbated by lack of proper waste management system is of growing environmental and public health concern worldwide and in major towns and cities of Ethiopia (Endrias& Solomon , 2017).

Solid wastes generated are different from country to country or region to region which means the management system also varies. Solid waste is generated due to a lot of factors which includes the abundance and type of natural resource available, the lifestyle of citizens as well as their living standards. Solid waste is embarrassing and difficult to discuss with reason that policymaking and political discussions must deal with taboos in various locality which affects the process of arriving at achievable goals (UN-HABITAT, 2010).

Solid Waste Management (SWM) could be defined as the art of managing garbage in a specific location which may include; waste collection, recycling, treating and disposing in accordance with the agreed national or international standards (Nathanson, 2000).

In Ethiopia according to the Federal Democratic Republic of Ethiopia Proclamation No. 513/2007, Solid Waste Management Proclamation "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.

EU Waste Directive 2008, also defines waste management as "the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker" The human activities which take place in this world create waste. The wastes could be both solid and liquid types; and the way they are going to be handled, stored, and disposed can expose the environment and public health to risks (Zhu et al, 2008). SWM includes all activities that seek to minimize health, environmental and aesthetics impacts of solid waste.

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

2.1.2. OBSTACLES FACING LOGISTICAL OPERATIONS

The most important obstacles can be summarized in the following points:

A. Waste collection: Reliance on technologies and special logistics for collection and transportation policy is insufficient and not given the real importance. In addition, the participation of the private sector in Waste Management is unsatisfactory (Omran, et. al, 2018). In fact, rubbish

bins are almost non-existent in the streets, and therefore citizens find it difficult to dispose of waste. Even if they find these bins, they are mostly old and damaged.

In front of the houses, the garbage is often placed directly on the road without placing it in special bins given for the use from the owner of the house, which causes difficulties in the collection and in the final transport due to the reliance on traditional collecting tools (by hands), In addition to the environmental damage that results from this situation, especially when the municipality is late in transporting these wastes (Omran, et. al, 2018). The fleet of vehicles used for collection is, for the most cases, the same as that used for transportation to the final landfill which reduces transportation efficiency. In addition, poor infrastructure and roads within cities make the movement of trucks difficult (Omran, et. al, 2018). Also, this fleet is mostly old, worn out and often breaks down, lacks maintenance and spare parts, which disrupts maintenance operations, and makes them ineffective in the final transportation process.

B. Waste transportation: Most cities suffer from the lack of intermediate collection points. Mostly there were middle points but in recent years they have been closed due to people's pressures (land owners). These pressures came due to the environmental effects of these transhipment points like the unpleasant odours they cause and distorting the general landscape. The exact description of these points is open dumps within the population centers. This is reflected in the transportation processes, which are taking a long time to reach the final dumps.

C. Final disposal: It can be said that only 1% from the total solid waste generated in Libya is recycled and 3% are what is composted from this waste (Badi et. al, 2020 and Sawalem et. al, 2015). The rest of the practices or methods that are followed for solid waste the final disposal, including demolition and construction waste, and medical waste in Libya, 95% of which is dumping in landfills, about 67% are open dumps managed by the authorities, in a primitive way, and 30% are random open dumps that are not controlled by the authorities concerned with the management of these wastes (Rada, 2017). These dumps are usually located at far distances from cities, mostly due to resistance of the residents. The transportation cost becomes difficult for a country like Libya, with its vast area of about 1.8 million square kilometres and sprawling cities with a relatively low population density. In addition, these dumping sites are not considered sustainable, and there are no strategies or scientific bases for their selection, as most of them do not take into account any criteria, but rather rely on temporary a solution, which causes

environmental, economic and social damage to the areas in which these landfills are located (Badi et. al, 2020).

2.1. 3 Source and Types of Municipal

Solid waste Solid waste classified based on its origin, risk potential, or characteristics. Based on origin, solid waste can be classified in to food waste, rubbish, ashes and residues, agricultural waste, municipal service, industrial process waste, and demolition and construction wastes. With regards to characteristics, it is also classify as biodegradable and non – biodegradable. In addition, based on its risk potential, is again it can be categorized in to hazardous and nonhazardous wastes (CED, 2003). However, solid wastes are usually classified based on their sources (from which they emanate). Based on this bench mark, it can be categorized in to domestic or household, commercial, institutional, industrial, municipal services, construction and demolition, agricultural wastes (Hoornweg&Bhada-Tata, 2012). The explanation of each type of waste summarized as follows:

Table2. 1 Source and type of municipal

Source	**Typical waste generator**	**Types of solid wastes**
Residential	single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g. bulky items,

		consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plant	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, hospitals, prisons, government centers	Same as commercial
Constructionanddemolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches, and other recreational area, sludge
Process	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing	Industrial process wastes, scrap materials, off specification products, slag, tailings
All of the above should be included as "Municipal Solid Waste."		
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms	Spoiled food wastes, agricultural wastes,

		hazardous wastes (e.g. pesticides)

Source: (Hoornweg&Bhada-Tata, 2012)

2.1.4 Factors that affect Municipal Solid Waste Management in Developing Countries

A typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities. These public health, environmental, and management problems are caused by various factors which constrain the development of effective solid waste management systems (Ogawa, 1996). These factors, according to (Ogawa, 1996), can be categorized into technical, financial, institutional, economic, and social constraints. Each of these constraints is discussed below:

i. Human and Technical Constraints

In most developing countries, there typically is a lack of human resources at both the national and local levels with technical expertise necessary for solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management. Without adequately trained personnel, a project initiated by external consultants could not be continued. Therefore, the development of human resources in the recipient country of external support is essential for the sustainability of the collaborative project. Another technical constraint in developing countries is the lack of overall plans for solid waste management at the local and national levels. As a result, a solid waste technology is often selected without due consideration to its appropriateness in the overall solid waste management system. In some cases, foreign assistance is given to a component of a solid waste management system for which the use of resources may not be most cost-effective. For instance, an external support agency provided its support to improve a general disposal site. However, the coverage of solid waste collection service is so low that solid waste generated is

dumped at many undesignated sites (e.g., open areas, water channels, streets, etc.). As a result, improving the disposal site, although it may not be a bad project, would have little impact on the overall solid waste management effectiveness. In such a case, the low collection coverage is a bottleneck in the overall solid waste management system in the city, and it would be most cost-effective to provide resources to upgrade the collection service (Ogawa, 1996).

ii. Financial Constraints

In general, solid waste management is given a very low priority in developing countries, except perhaps in capital and large cities. As a result, very limited funds are provided to the solid waste management sector by the governments, and the levels of services required for protection of public health and the environment are not attained. The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak. This weak financial basis of local governments can be supplemented by the collection of user service charges. However, users' ability to pay for the services is very limited in poorer developing countries, and their willingness to pay for the services which are irregular and ineffective is not high either. An effective strategy for raising funds needs to be searched in any collaborative project to ensure its sustainability. In addition to the limited funds, many local governments in developing countries lack good financial management and planning. For instance, in a town in a developing country, over 90% of the annual budget provided for solid waste management was used up within the first six months. The lack of financial management and planning, particularly cost accounting, depletes the limited resources available for the sector even more quickly, and causes the solid waste management services to halt for some periods, thus losing the trust of service users (Ogawa, 1996).

iii. Institutional Constraints

Several agencies at the national level are usually involved at least partially in solid waste management. However, there are often no clear roles/functions of the various national agencies defined in relation to solid waste management and also no single agency or committee designated

to coordinate their projects and activities. The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programs. The lack of effective legislation for solid waste management, which is a norm in most developing countries, is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of coordination among them (Ogawa, 1996).

iv. Economic Constraints

Economic and industrial development plays key roles in solid waste management. Obviously, an enhanced economy enables more funds to be allocated for solid waste management, providing a more sustainable financial basis. However, by definition, developing countries have weak economic bases and, hence, insufficient funds for sustainable development of solid waste management systems. Local industry which produces relatively inexpensive solid waste equipment and vehicles will reduce, or in some cases could eliminate totally, the need for importing expensive foreign equipment/vehicles and therefore foreign exchange. Such local industry can also supply associated spare parts, lack of which is often responsible for irregular and insufficient solid waste collection and disposal services. However, the lack of industry manufacturing solid waste equipment and spare parts and a limited foreign exchange for importing such equipment/spare parts are the rule rather than exception in developing countries. Also in small developing countries, waste recycling activities are affected by the availability of industry to receive and process recycled materials. For instance, the recycling of waste paper is possible only when there is a paper mill within a distance for which the transportation of waste paper is economical. The weak industry base for recycling activities is a common constraint for the improvement of solid waste management in developing countries, such as those in the Pacific region where a large volume of package waste is generated (Ogawa, 1996).

v. Social Constraints

The social status of solid waste management workers is generally low in both developed and developing countries, but more so in developing countries then developed countries. This owes much to a negative perception of people regarding the work which involves the handling of waste or unwanted material. Such people's perception leads to the disrespect for the work and in turn produces low working ethics of laborers and poor quality of their work. Because of insufficient resources available in the government sector, collaborative projects often have attempted to mobilize community resources and develop community self-help activities. Results are a mixture of success and failures. Failed projects with inactive communities usually did not provide people in the community with economic as well as social incentives to participate in activities. The social incentive is based on the responsibility of individuals as part of the community for the improvement of the community, and is created by public awareness and school education programs. The lack of public awareness and school education about the importance of proper solid waste management for health and well-being of people severely restricts the use of community-based approaches in developing countries (Ogawa, 1996).

2.1.5 Effects of Solid Waste

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

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

- Uncollected wastes cause blockage of drains, which result in flooding and unsanitary conditions.
- Flies and Mosquitoes breed in some constituents of solid wastes, and flies are very effective vectors that spread disease.
- Waste dumps are good shelter for rats. Rats consume and spoil food, spread disease, damage electrical cables and other materials.

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

2.2. Empirical Review

This part of the study asses and summarize the different studies conducted by different researchers in different time and setting regarding the study under investigation.

2.2.1. Review of local studies

Ngiste A. and Mequanint B. (2022) investigated Solid Waste Management practices and Thriving Condition of Logistics in Tepi Town. Accumulation of wastes, transportation, recycling and removal reduce the impact of improper solid waste. Data collected from 450 near house places and 549 survivals. The collected data analyzed through system dynamics software. The result obtained is modeled by system dynamics cause and effect relationship diagram.

Eshetu G. (2021) examined the state of solid waste in Addis Ababa during 2016–2020 to provide implications for achieving green architecture concepts through better management of solid waste and its economic contribution. The result reveals that most solid waste is generated from households, followed by commercial centers, street sweeping, industries/factories, hotels, and hospitals, respectively. From 2016 to 2020, an average of 80.28% of solid waste is collected, whereas 19.72% of the waste is not collected. There are little or no efforts made to segregate solid waste at the source. The generated waste is disposed of in the Reppi open landfill.

According to Endalkachew et.al (2018). Assessment of Municipal Solid Waste Management Practices: a case Study of Bishoftu City Administration. In the study, researcher questions the existing MSWM practices look like and factors affecting MSWM system of Bishoftu City. The findings of the study revealed that the main types of MSW in Bishoftu are peels of vegetables, ash, plastic, paper and cardboard, garden trimmings or leaf and the physical composition of MSW in the city is composed from both biodegradable and non-degradable components, the current MSWM practice of City is weak and also there is a problem on solid waste reduction strategy: segregation, reuse, recycling, and resource recovery. According to the results three main factors that aggravate the existing poor status of MSWM practice in the city. These are: socio-cultural, technical and institutional factors.

Research study conducted by Fasil et.al (2017) Assessment of Solid Waste Management Trends of Bishoftu Households Community. It was a descriptive quantitative cross-sectional study applied to total of 403 residents of Bishoftu. The result shows open dump inside the yard was the most popular method of waste disposal known to the respondents. Majority of the residents had a positive attitude towards proper waste management, even though there was evidence to the contrary considering the discovery that the most prevalent methods of disposal were open dumping inside the yard and open burning. Strict adherence to appropriate waste management practice in any community will insulate the inhabitant from detrimental and hazardous environmental conditions and improve the living standard of the people.

According to Abebe et.al (2009), Ethiopia is still struggling to deal with the problem of proper management of solid wastes. With the current rate of urbanization municipal solid waste collection, transportation and disposal have been a major problem of municipalities in most of the Ethiopian cities. Collection of municipal solid waste in most of the cities is difficult and complex

because the generation of residential, commercial and industrial waste is a diffuse process that takes place in every house, every building and every commercial and industrial facility as well as in the streets, parks and even in the vacant areas available within the community. In addition to this, as stated by (Abebe et.al 2009; Yukalang, 2017), many cities face problems such as lack of manpower and equipment and financial constraints

2.2.2 Review of similar studies in other countries

Mustafa et.al (2021) conducted research on logistical challenges facing solid waste management in Libya. Municipal solid waste logistics management is necessary to take care of the growing stream of waste and the need to act on this issue through an effective logistics management system. Logistical operations include collection, transportation, and handling and intermediate storage in addition the final disposal. Many developing countries are still struggling to provide these services. There is no doubt that many obstacles and challenges stand against its adequate management. This paper aims to clarify the most important challenges and logistical obstacles in managing municipal solid waste in Libya, and concluded that all stages of this administration face fundamental challenges, starts from the obsolescence of the mechanisms used and poor collection processes and the lack of intermediate collection points, which most of them have been closed, because they are open temporary dumps, and ends of the far final dumps and their non-conformity with specifications. The local authorities are responsible to give this issue the right attention because of the environmental impact it represents, in addition to the associated direct and indirect costs.

A study by Jania et.al (2019) assesses the Collection of Solid Waste in Municipal Areas: Urban Logistics. The collection of solid waste in municipal areas aims to grant green spaces and recreation areas for the citizens. Although an outstanding effort has been made by the government to provide an adequate service, there are still gaps in the application of correct tools that guarantee efficiency in operations and continuity in services. This article presents a proposal to improve the planning of the design of territories for the cleaning, weeding, and collection of solid waste in municipal areas, using two MILP (Mixed Integer Linear Programming) models. The main contribution of the adaptation of this model is the application to the weeding and waste collection service municipality of the Monterrey Metropolitan Area, which considers important factors among which are the amount of waste, frequency, and service coverage.

Another study by Boye et.al (2018), examined the relationship between waste management logistics and identified metrics for waste management logistics performance. Secondly, the study assessed the various challenges inhibiting the performance of LAWMA in the State. The results established that the volume of solid waste and commitment of staff are crucial to waste management logistics and one factor that strongly affects waste logistics is traffic in the metropolis. Conclusively, waste collection turnaround must be increased and government and private investors should provide enabling infrastructure and trained personnel for effective solid waste management in Lagos metropolis.

Sinare M. (2017) conducted a study on logistic and solid waste management in ambajogai city. The problem of solid waste management is prevailing in the city environment of Ambajogai city also. Therefore, there is an urgent need for the improved planning and implementation of comprehensive solid waste management systems for upgrading the environmental scenario of the city. It requires detailed information on the quantity and character of solid waste generated and their effects on environment. This present study is to investigate the problems and effects of solid waste in the Ambajogai City. The investigation includes the methods of practices associated with sources, characteristics, quantity generated, collection, transportation, storage, treatment technologies and disposal of solid waste in the Ambajogai City. In this work, it is intended to collect the data using the field visit, and interaction with inhabitants and the city authorities. This work will evolved appropriate solid waste management strategy based on the principles of refuse, reduce, reuse and recycle.

2.3. Conceptual Framework

According to Chimwani et al. (2014), a conceptual framework is a research tool intended to assist a researcher to develop awareness and understanding of the situation under scrutiny and to communicate this.

Independent variables **Dependent variable**

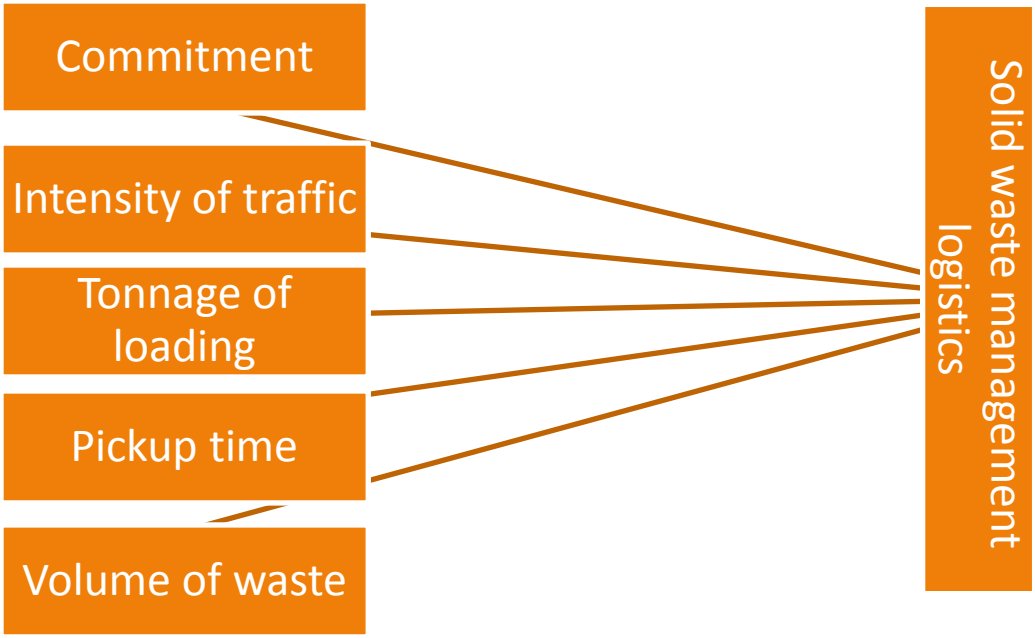

Figure2. 1 Conceptual model frame work developed based on prior scholars (Boye and Olusegun, 2018)

2.4 Formulation of Research Hypotheses

H_1:Commitment of personnel has significant effect on solid waste management logistics.

H_2:Intensity of traffic has significant effect on solid waste management logistics.

H_3:Tonnage of loading has significant effect on solid waste management logistics.

H_4:Pickup time has significant effect on solid waste management logistics.

H_5:Volume of waste has significant effect on solid waste management logistics.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Description of the study area

3.1.1 Location

According to Bishoftu City Administration FED Office, 2022 Bishoftu City Administration which is located at East shewa zone of the Oromia National Regional State situated between 8°45¹ - 8°47¹ N and 38°56¹ -39° E longitude. It is located at a distance of 47 km south east of Addis Ababa and 52 km from Adama to the North. The foundation of Bishoftu was directly connected with the starting of Ethio-Djibouti Rail way in 1917. (Bishoftu City Administration FED Office, 2022).

The name Bishoftu is derived from the Afan Oromo language which means "BISHANOFTU" that refers to, "the land of excess water body". Literally speaking, the word Bishoftu is given to the city based on the locally available many crater lakes such as Bishoftu, Hora Arsadi, Cheleleka

/seasonal/, Kuriftu, Kilole, Green Lake and Babogaya. Therefore, the name Bishoftu is derived from many water bodies that surrounded the town at a near distance. Administratively; regarding its growth the city becomes the administrative center of AdeaLiban woreda from 1935 to 1982 E.C. From 1983-1994 E.C it was the administrative center of Adea woreda. Beginning from 1995 to till now, it is the 1st level city (city administration) which is administrated by Mayor. The city has a total area of 18,278 hectors. There about total of 14 kebeles in the City of which 5 kebeles are Rular kebeles (Bishoftu City Administration FED Office, 2022).

3.1.2 Demographic characteristics

The population of the city is rapidly growing from year to year at an average growth rate of more than 2.9 % per annum. Population dynamics of a given settlement area is the result of fertility, mortality and migration. In urban environment, migration (rural to urban) / urban to urban/ has predominant role in changing the population characteristics and reflects the urbanization rate.

The 2007 national census reported a total population for Bishoftu was 99,928, of whom 47,860 were men and 52,068 were women but according to the data obtained from the population projection made by Bishoftu plan and Economic development office, the city has a total population of 205,858 by the year 2021. From the total population 48% are males and 52% are females including the rural kebeles currently incorporated under the administration of the city (Bishoftu City Administration FED Office, 2022).

3.2 Research Approach and Design

The typology of the underline study was survey research. This study adopts quantitative approaches for data collection (quantitative data) and analysis. This is mainly due to the fact that all the research questions and objectives the researcher has set previously was thoroughly addressed through the aforementioned approaches. Moreover, the study uses a combination of descriptive and explanatory designs to answer the research objectives.

3.2.1 Sample Size and Sampling Procedures

The required sample size for this study is determined by using the formula developed by Yamane (1967) below by considering the level of acceptable margins of error at 5% (or 95% confidence interval) :-

$$n = \frac{N}{1 + N(e^2)} = \frac{32103}{1 + 32103(0.05^2)} \approx 395$$

Therefore, the sample size for this study was 395 respondents.

In order to select respondents among 9 kebeles of the Bishoftu City, the sample kebeles were selected using purposive sampling technique based on population density, commercial activity and location. As a result, kebele 01 (heavily populated), kebele 06 (commercial center), kebele 09 (city outskirt) and kebele 13 are selected. With regard to the sample households a total of 395 respondents were selected proportionally using stratified random sampling as shown in table 3 below:

Table3. 1Sample size from selected kebeles

Sample Kebeles	**No of Households**	**Sample Households**	
		Frequency	**Percentage**
01	15827	195	49
06	2085	25	7
09	5982	74	19
13	8209	101	25
Sub Total	**32103**	**395**	**100**

3.2.2 Source of data

Both primary and secondary sources of data were utilized. Primary data was collected from sample respondents of each sample Kebeles who are currently getting waste collection service to the

municipality. To collect primary data, a total of 14Kebelesthat exist in Bishoftu City was chosen. Copies of a questionnaire were sent to sample selected Kebeles in a city and enumerators was used to collect data from respondents. In addition, secondary data was collected from documents such as journal articles, the institution (municipality) document, and other relevant internet resources will be reviewed.

3.3 Method of data collection

In the present study, structured questionnaire was employed and the questionnaire was prepared using Amharic, Oromic and English languages. The questionnaire was composing two parts. The first part of questionnaire was designed to collect demographic characteristics of the respondents. The second part of the questionnaire designed to capture the measurement scale that includes factor affecting the performance of solid waste management attributes and attributes of independent variables adopted from prior studies (Boye and Olusegun, 2018).

3.4 Reliability and validity of data collection instruments

In order to check the reliability of the factors, a Cronbach alpha was calculated. It is assumed that a Cronbach alpha value of greater than or equal to 0.70 is considered acceptable for the factor to be reliable. In the present study, all the variables and the overall reliability coefficient had satisfactory values of Cronbach alpha. The Cronbach alpha value for each of the independent and dependent variables exceed 0.70 implying that the items to measure the independent and dependent variables were reliable. This is considered good in the reliability interval. Thus, the variables are reliable and the data collection instruments (questionnaires) are standard.

The questionnaire has mid-point Likert scale and this showed that it is reliable (Madden &Klopfer, 1978), Eden, (2018) and satisfactory (Krosnick, Narayan, & Smith, 1996).

Table3. 2 Summary of the reliability and validity of data collection instruments

Variable name	Number of items	Reliability coefficient
Commitment	6	0.81
Intensity of traffic	6	0.73
Tonnage of loading	4	0.71
Pickup time	5	0.73
Volume of waste	4	0.78
SWML	7	0.81

Source: Survey data, 2022

3.5 Method of Data Analysis

3.5.1 Measurements of Variables

In the present study, both descriptive and inferential analyses were employed. The descriptive statistics was used to summarize data into percentages, frequency tables and to compute summary statistics such as means and standard deviations. In addition, Pearson's correlation coefficient was executed to determine the relationship among dependent variable and independent variable.

In this study, the dependent variable (performance of solid waste management logistics) was be measured by computing the mean score values of items constructed using five point Likert scale. Concerning the measurement of independent variables, the following scales was used. Commitment, intensity of traffic, tonnage of loading, pickup time and volume of waste measured by computing the mean score values of items, constructed using five point Likert scale.

A multiple linear regression (OLS) data analysis was used for this study. Procedurally, this study initially identified the factor affecting performance of solid waste management logistics items and performance of solid waste management logistics variable attributes using Stata software. Then multiple linear regression analysis (OLS) was conducted based on earlier finding from the mean score computations. Hence, independent variable (Commitment, intensity of traffic, tonnage of loading, pickup time and volume of waste) items and performance of solid waste management logistics variables (I was used Likert scale as a measurement unit) that come out of the mean score calculations was treated as independent and dependent variables for the subsequent OLS regression analysis, respectively.

3.5.2 Model specification

In this study, we has used OLS regression model and the general functional form of the model is specified as follows.

$$\boldsymbol{SWML_i = \beta_0 + \beta_1 COMM + \beta_2 INTR + \beta_3 TOL + \beta_4 PICT + \beta_5 VOWA + \beta_6 SEX + \beta_7 MS + \beta_8 OCC + \beta_8 INCL + Gu_i (1)}$$

Where $\boldsymbol{SWML_i}$ = stands for the dependent variable, representing Performance of solid waste management logistics βi = slope of the independent variables (COMM, INTR, TOL,PICT and VOWA)

Where,$\boldsymbol{SWML_i}$ is Performance of solid waste management logistics, COMM is Commitment of perssonel, INTR is Intensity of Traffic, TOL is Tonnage of Loading, PICT is pickup Time, VOWA is Volume of Waste.

$$\boldsymbol{SWML_i = \beta_0 + \beta_1 COMM + \beta_2 INTR + \beta_3 TOL + \beta_4 PICT + \beta_5 VOWA + \beta_6 SEX + \beta_7 MS + \beta_8 OCC + \beta_8 INCL + + Z_i + u_i (2)}$$

Where $\boldsymbol{SWML[_i}$ = stands for the dependent variable, representing Performance of solid waste management logistics for household headi. The vector $Z_i$includes demographic, socio-economic and institutional independent variables. Rewriting equation 2 into a standard regression form gives the following general equation.

$$\boldsymbol{SWML_i = X'\beta + u (3)}$$

3.6 Ethical considerations

Participants of the research were informed about the major objectives of the research emphasizing that the data will be used only for academic purposes. The data was collected using questionnaire

and doing with the full willingness of the participants. A statement that indicates their participation is only voluntary and they are advised not to include their names and address on the questionnaire. Careful attention was given to respecting the rights, needs, and values of the participants; and maintaining the confidentiality of the data, and acknowledging sources of information.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRIETATION

Descriptive analysis was used in order to explain the demographic and socio-economic characteristics of solid waste generator households involved in the present study.

Initially the survey data were checked for uniformity and completeness and the researcher found that 395 questionnaires were fully usable. This represents 100% response rate. When a selected household was unwilling to fill the questionnaire, a replacement household was selected randomly, and necessary measures were taken to avoid data contamination.

Table4.1 Percentage Distributions of Respondents by Demographic Characteristics

Characteristics	classification	Frequency	%
Sex of Respondents	Male	246	62.27
	Female	149	37.73
	Total	**395**	**100.0**
	Below 18	35	9.2
	18-50	249	61.6

Age of Respondents	50-65	44	11.4
	Above 65	67	17.8
	Total	**395**	**100.0**
Marital Status	Single	117	29.55
	Married	254	64.38
	Divorced	15	3.69
	Widowed	5	1.32
	Widower	4	1.06
	Total	**395**	**100**
Education level	No education	2	0.53
	primary education	16	3.96
	High School education	28	7.12
	Diploma	104	26.65
	Bachelor degree	181	45.65
	Masters degree	64	16.09
	Total	395	100
Monthly Income	Less than ETB 1000	26	6.60
	ETB 1000-2000	46	11.61
	ETB 2000-3000	45	11.35
	ETB 3000-4000	71	17.94
	ETB 4000-5000	53	13.45
	Above ETB 5000	154	39.05
	Total	395	100

Source: Survey Data, 2022

Table 4.1 The sex composition of sampled households shows out of the 395 valid responses, the sex composition of the respondents indicated that 62.27% of the respondents were male and the remaining 37.73% of the respondents were female, which reflects the dominancy of male

respondents (male headed households) in the sample. The age of sampled household displays the average age of respondents who had participated in the present survey was 32.31 years with the minimum and maximum ages of 18 and 65 years, respectively. This average age of respondents implies that the largest group of household was young adults. The education level of sampled household hints the undergraduate education level was dominant which had the highest response rate (45.65%) followed by a diploma level (26.65%). These were 7.12% and 16.09% of respondents with education levels of high school and postgraduates, respectively. The lowest educational attainment of respondents next to no education was primary education (3.96%).The marital status of respondents depicts that 29.55% were single, 64.38% were married, 3.69% were divorced, while 1.32% and 1.06% of respondents were widowed and widower, respectively. This implies that the vast majority of the respondents were married. The reported monthly income of the respondents revealed that majority of the respondents (39.05%) earn ETB 5000 per month or more, 13.45% earn ETB 4000–5000, 17.94% earn ETB 3000-4000. Similarly, 11.35% and 11.61% of the respondents earn ETB 2000–3000 and ETB1000-2000 per month, respectively. Finally, 6.6% of the respondents earn a monthly income of less than ETB 1000. The result indicates that most of the respondents are getting a monthly income exceeding ETB 5000.

Table4. 2 Sample distributions by Occupational status

Occupations	Frequency	Percent
Paid-employed	303	76.78
Self-employed	57	14.51
Retired	14	3.43
Unemployed	21	5.28
Total	**395**	**100**

Source: Survey Data, 2022

Table 4.2 With regard to the occupation of sampled respondents, 76.78% were paid-employed, 14.51% were self-employed, 3.43% were retired and the remaining 5.28% were unemployed. The occupational distribution reflects that the majority of the respondents were salaried employees.

Table4. 3The frequency of using the collection service

Servicetime	Frequency	Percent
Everyday	0	0
Every other day	0	0
Twice a week	57	14.51
Once a week	149	37.73
Twice a month	91	22.96
Once a month	41	10.29
Other	57	14.51
Total	**395**	**100**

Source: Survey Data, 2022

Table 4.3 shows the frequency that the respondents get the collection service. Accordingly, 37.73% of respondents replied that they get the collection service once a week while 22.96% of the respondents answered that they get the collection service twice a month (fortnightly). There is no any of respondents get the collection service daily also every other day, whereas 10.29% of respondents get the service once a month.

Table4. 4 Respondents satisfaction level

Satisfaction level	Frequency	Percent
Satisfied	222	56.20
No satisfied	173	43.80
Total	**395**	**100**

Source: Survey Data, 2022

Table 4.8 shows that 56.20% of the respondents are satisfied by the current waste collection service and the rest 43. 80% instead, not satisfied.

Table4. 5 Different type of waste

Types of waste	Frequency	Percent
Food waste	251	66.22
Plastics	26	5.28
Ashe	53	11.35
Others	65	17.15
Total	**395**	**100**

Source: Survey Data, 2022

The researcher also analysed the type of waste respondents separate at their home before the collection by the logistics. 66.22% of the respondents separate food waste. The second largest group of respondents (17.15%) responded that they separate other homemade waste. Thus, the findings imply that the majority of respondents generate food waste.

4.1 Analysis of Collected Data

4.1.2Descriptive Analysis For the collected Survey

On the basis of a five points Likert scale, the overall mean (M) score between

- 1 to 2.33 is considered as low,
- 2.34 to 3.67 is considered as moderate,
- 3.68 to 5 are taken as high value (Zaidatol et al, 2012).

Table4. 6 Expected operational challenges of solid waste management logistics

Items	Mean	Std. Dev.
Inadequate service coverage(some people not given service)	3.08	0.872
Lack service qualities (not frequent enough, spill, etc.)	1.97	0.819
Lack of authority to make financial and administrative decision	4.06	0.998
Lack of trained personnel	3.61	1.209
Lack of vehicles	3.82	0.942
Lack of equipment	3.89	1.046
Old vehicle/equipment frequent breakdown	3.97	0.996

No proper institutional set-up for SWM service	3.79	0.985
Rapid urbanization outstripping service capacity	3.67	1.103
Uncontrolled proliferation of squatter settlements	3.77	0.977
Difficult to locate and acquire landfill site	3.95	1.009
Lack of control on hazardous waste	4.10	0.784
Poor response to waste minimization (reuse/recycling)	4.04	0.785
Overall Mean	**3.52**	

Source: Survey Data, 2022

According to table 4.10 the mean score were Inadequate service coverage (some people not given service), (3.08), SD (0.872), Lack service qualities (not frequent enough, spill, etc.) mean score (1.97), SD (0.819), Lack of authority to make financial and administrative decision mean (4.06) , SD (0.998), Lack of trained personnel score (3.61), SD (1.209), Lack of vehicles mean scored (3.82), SD (0.942) Lack of equipment (3.89), SD (1.046) Old vehicle/equipment frequent breakdown (3.97), SD (0.996) No proper institutional set-up for SWM service (3.79) ,SD (0.985) Rapid urbanization outstripping service capacity (3.67) ,SD (1.103) Uncontrolled proliferation of squatter settlements (3.77) ,SD (0.977) Difficult to locate and acquire landfill site (3.95) ,SD (1.009) Lack of control on hazardous waste (4.10) ,SD (0.784) Poor response to waste minimization (reuse/recycling) mean scored (4.04), SD (0.785). In general the overall mean shows (3.52) compare to measurement scale its moderate/good.

Table4. 7 Descriptive statistics of the variables

Commitment	**Mean**	**Std. Dev.**
Solid waste management operators are skilled	3.12	0.0665
Solid waste management personnel are passionate	2.56	0.0655
Feedbacks waste management is immediate.	3.18	0.0609
Solid waste management staff settle complaints promptly	2.95	0.0644
personnel are on-time to their job	2.84	0.0815
The collector will come to a certain place at a certain time.	2.87	0.0668

Intensity of traffic		
Transporting the solid waste to deposit site requires few time.	3.45	0.0625
Transporting the solid waste brings no traffic overcrowdings	2.93	0.0639
The number of transport routes to covey waste are sufficient	3.26	0.0613
The transport routes used to convey waste are appropriate	3.13	0.0684
The solid waste disposal is done on non-rush hours	2.42	0.0994
They collect the sacks/bags to the pre-specified collection route	3.37	0.1474
Tonnage of Loading		
Waste loading trip rate is convenience for customers	3.56	0.0556
Waste loading trip rate is frequent	2.73	0.0710
Sufficient number of trips are made	2.86	0.0637
There is no overflow of waste during conveying	3.27	0.0631
Pickup time		
The solid waste deposit is evacuated rapidly	2.96	0.0660
The solid waste management personnel collect the waste frequently	2.50	0.0639
The time they come to collect the waste is convenience	3.04	0.0584
They collect the waste before it gets accumulated	3.50	0.0556
Waste is collected directly from the house	3.55	0.0541
Volume of waste		
The volume of the solid waste generated is manageable	3.89	0.0498
The municipal has capability to maintain/repair vehicle/equipment	2.73	0.0710
The number of vehicles available are attuned to the volume of waste	2.86	0.0637
The number of vehicles convey the waste are adequate	3.27	0.0631

Source: Survey data, 2022

Furthermore, the descriptive statistics concerning about the average score of the overall solid waste management logistics is computed and the estimated the overall mean score is 3.23 indicating that

the Performance of Solid Waste Management Logistics are moderate with the service which they deliver to the households.

4.2 Econometric Analysis

4.2.2. Econometric Tests

Prior to present empirical results and make discussion on regression coefficients, the researchers need to check the data for the essential diagnostic tests of Ordinary Least Square (OLS) regression. An assessment of the normality of data is a prerequisite for OLS regression. For this purpose, the researcher has used a Shapiro-Wilk test to check out as to whether the null hypothesis that the data come from is normally-distributed or not. Shapiro-Wilk test result shows that the test is below 0.1 and significant values are above 0.05, which reflects that the null hypothesis is accepted and data are assumed to be approximately normally distributed.

As the researcher has used cross-sectional data, the possible trouble worthy looking is the problem of heteroscedasticity (Greene, 2008). The researcher has estimated the robust standard errors to correct the problem of heteroscedasticity because the usual standard errors are unusable test of non-homoscedasticity. Another serious problem lending detection is multicollinearity. The researcher has executed the VIF test to check the existence of multicollinearity for the survey data and the VIF values for all regressors are less than 10%, implies absence of strict multicollinearity among explanatory variables. Another test the researcher has we performed was model specification test. The Ramsey RESSET test result affirmed that the regression model we implemented in this analysis is correctly specified.

4.2.3. Econometrics Estimation Results

In order to run an OLS regression, the researcher has converted Likert scale factors into continuous variables simply by calculating the mean score of each explanatory variable using a Stata. Then, an OLS estimation was made based on these calculated average scores. A model summary statistics indicates that the R-Square of the model is 0.684, which reflects that the five explanatory variables accounted for 68.4% of the variance in performance of solid waste management logistics. This means that 68.4% of the variation in performance of solid waste management logistics can be

explained by the explanatory variable. Moreover, the researcher finds that the adjusted R-Square of the model is 0.673.

The researcher begins the empirical analysis and discussion of findings by presenting the OLS regression results. The researcher estimates the link between regressors and performance of solid waste management logistics in the data by running OLS regression. Nine regressors are included in the estimation drawn from standard theories and empirical studies. Eight of them have been found statistically significant, whereas one regressor is found to be statistically insignificant as tabulated in Table 4.13. Moreover, the result indicated that eight out of ten variables have a positive and significant association with SWML. But one variable have a negative impact on SWML.

Table4. 8 OLS Regression Results

Variables	Coefficients	Robust Std. Err.	t	P>|t|
Commitment	0.1011212	0.0342646		2.950.003***
Intensity of traffic	0.1923638	0.0607424		3.17 0.002***
Tonnage of loading	0.1453566	0.05147		2.82 0.005***
Pickup time	0.1268718	0.0496659		2.55 0.011**
Volume of waste	0.1385633	0.0467181		2.97 0.003***
Constant	1.474331	0.733707		2.01 0.045
R-Square	**0.684**			
Adjusted R-Square	**0.673**			
Observations	**395**			

$Note$:*** $p < 0.01$,** $p < 0.05$, * $p < 0.1$.

Source: Survey Data, 2022

Table 4.8 When looking at the result of the variable that affects SWML, that is, commitment has a positive and significant effect on logistics performance at 1% level of significance. The finding implies that as the commitment of the municipal on managing its solid wastes the logistics performance would increase by 0.101,keeping other variables remain constant. This finding supports the finding of (Boye and Olusegun, 2018)who found that commitment has a positive influence on SWML. Thus, on the basis of the above empirical result, the first hypothesis is accepted.

Next the researcher found that intensity of traffic has a positive and significant effect on SWML at 1% level of significance. The finding reflects that as the solid waste disposal is done on non-rush hours the performance of waste logistics increase by 0.192, keeping other variables remain constant.

Another variable is tonnage of loading and the result shows that tonnage of loading has a positive and significant association with SWML at 1% level of significance. The finding implies that when the municipal made sufficient number of trips and also when there is no overflow of waste during conveying the performance of waste logistics increase by 0.127,keeping other variables remain constant.

The study has further found that pickup time has a positive and significant effect on SWML at 1% level of significance. The coefficient of the estimate was 0.138, which reflects that as the time that the waste management logistics personnel come to collect the waste is convenience the logistics performance would increase by 0.138, keeping other variables remain constant. This finding also supports the empirical finding by (Duguma et, al, 2019) who found that digitalization in the case of Jordan Airline plays a significant role in customer retention and loyalty. Based on the aforementioned empirical result, the second hypothesis is accepted.

Furthermore, the study has found that the volume of waste has a positive and significant effect on SWML at 1% level of significance. The finding indicates that when the logistics manage the

number of solid waste generated and number of vehicles are adequate, the performance of solid waste management logistics increased by 0.138, keeping other variables remain constant.

Finally, the model estimation result reveals that income level has a negative and insignificant impact on SWML. This finding contradicts with several previous empirical findings and supports to declare the rejection of hypothesis 4.

Table4. 9 Summary of Hypotheses Analysis

Hypothesis	Variable	Coefficient	P-value	Result
H_1	Commitment	0.192	0.003***	Significant	Accepted
H_2	Intensity of traffic	0.192	0.002***	Significant	Accepted
H_3	Tonnage of loading	0.145	0.005***	Significant	Accepted
H_4	Pickup time	0.127	0.0011**	Significant	Accepted
H_5	Volume of waste	0.127	0.011**	Significant	Accepted

$Note$:*** $p < 0.01$,** $p < 0.05$, * $p < 0.1$.

Source: Survey Data, 2022

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Solid waste management is one of the important areas where the problems arise from time to time. This study was conducted with an overarching objective to examine the challenge and prospects of Logistics on Solid Waste Management Practices with a particular reference to Bishoftu City Administration of Oromia Regional State. Five variables (commitment, intensity of traffic, tonnage of loading, pickup time and volume of waste) were considered to analyze PSWML. A cross-sectional data with a total of 395 sample units were used and these samples were analyzed through descriptive analysis and OLS regression.

Regarding socio-economic variables, we found that being a female and SWML is positively linked. Moreover, the results further indicate that five variables (commitment, intensity of traffic, tonnage of loading, pickup time and volume of waste) have a positive and significant associations with SWML.

In addition, the results of our investigation verify that from nine proposed hypotheses, five hypotheses have been accepted. The study concluded that solid waste management logistics become better with through good commitment, intensity of traffic, tonnage of loading**,** pickup time and volume of waste.

5.2 Recommendations

Based on the empirical findings, this study comes up with the following far-reaching and applicable recommendations.

- There should be a way to reduce solid waste deposits, perhaps by assigning community representatives, whereby they can have the contact details for the waste collectors or vice versa for rapid evacuation of waste at different identified centers.
- The result of this study reveals that commitment is one of the determinants that affect Solid waste management logistics. The commitment of waste management logistics staff is important, so skilled personnel with a passion for the job are required.
- In research finding, intensity of traffic has found to be the most important factors that influence SWML. Hence, there is no way waste management logistics can be effective unless the traffic usually experienced daily in the metropolis is mitigated.
- Due to financial problem, the municipality faced lack of solid waste collection facilities such as container, adequate vehicle service, waste gown, glove, and adequate carts.

  Therefore, to solve this main problem the municipality should do the following: first, instead of giving a prior emphasis to the other city's developmental sectors, it is better to assign adequate annual budget to the sector by considering like other main sectors that assure the development of the town. Second, like what has been done by ex-officials of the municipality (example, push carts were donated by WHO), it should find out NGOs, government agencies, or others that can participate on solid waste management services, as possible. If this so, at least containers can be placed in some parts of the town (particularly the place where far from the main road, which is not easily served by the private participants), improve inadequacy of vehicle service and some of important facilities also provide to private waste collectors. Thus, the door to door collectors will be

encouraged to do the given assignment with close relation to municipality and will improve the effectiveness of solid waste management at household level.

- To solve the problem of access to private waste collectors‟ services the municipality should encourage the private sectors (organize additional jobless youths) to involve or participate in solid waste management of the town. In addition, since the households indicated as they are willing to pay if they can get regular service; the only thing that expected from the municipality is simply coordinating and/or motivating the households to use the service. Hence, if the municipality has close relation with private participants and encourages them through different incentives, training or cooperation, they could serve all of the households equally. Thus, it will increase the number of households who serve per day and the waste will be disposed of before it creates health problem and environmental pollution. However, arrangement with private sectors has not all been successful; rather the ability of municipal administration to write and enforce an effective contract including the components of competition, transparency, and accountability on private sectors side are determined the success of private participants on waste collection services. Therefore, the municipality should consider these issues when rearrange the formation of door to door waste collectors and should follow actively how they are serving the households and secure the town's aesthetics or environmental health. Even it is very much interesting if the municipality by itself collects service charges (fees) from each user through, either along with tax or directly on the form of waste collection services payment, and paid to the private participants depending on their agreement. If this is so, the follow up of waste collectors‟ performance by the municipal would be easy.
- The effectiveness of household solid waste management can be ensured when community based organizations (CBOs) take active parts in the services. CBOs can support the municipality in different parts such as build public awareness, financial support, mobilizing the community in general to participate in the services and providing any necessary facilities to waste collectors. Therefore, if CBOs (either established by Age, Gender and Occupation like women's associations, farmers associations and youth associations or traditionally established like 'Idir', and 'Ekub') can be involved in the town's waste management services, its effectiveness will ensure with in short period of time.

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ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

PROGRAM OF BUSINESS ADMINISTRATION (MBA)

A QUESTIONNAIRE TO BE FILLED BY HOUSEHOLD

Dear Respondent!

I am conducting a research on "**the challenge and prospects of Solid Waste Management Logistics with a particular reference to Bishoftu City Administration of Oromia Regional State."** for the partial fulfillment of the requirements for the Award of the Degree of Masters of Business Administration. The objective of this questionnaire is to collect relevant information to meet the research objective. The findings of the research will be helpful to the society and also for the government who are striving to meet better environment. The information collected from you will only be used to answer the research questions and be assured that all answers you provide will be kept confidentially. Thus, you are kindly requested to provide your genuine information for all questions according the instructions given below.

General Instructions

- Please feel free as your responses are only used for scholastic purpose.
- You are not supposed to write your name.
- The questionnaire has two sections.
- Please **tick** (✓) in the appropriate boxes according your choice for questions in Section A and **circle** correct numeric response for questions in section B.

We highly appreciate your co-operation in advance!

Annex I, Questionnaires for the household

Section A: Profile of the household

Please read the following questions and answer each of them according to the requirement.

1. What is your age? _____.
2. What is your sex? Male ☐ Female ☐
3. What is your highest level of educational attainment?

   No education ☐ Primary High school education ☐

   Diploma ☐ Bachelor Postgraduate ☐ degrees ☐
4. What is marital status?

   Single ☐ Married ☐ Divorced ☐ Widowed ☐ Widower ☐
5. What is your employment status?

Paid-employed ☐ Self-employed Retired ☐ ☐ Unemployed ☐

6. Family size? _____

7. How often you use the collection service?

   Everyday ☐

   Every other day ☐

   Twice a week ☐

   Once a week ☐

   Twice a month ☐

   Once a month ☐

   When necessary, no specific time ☐

8. How much do they charge per month?_____

9. Do you separate different type of waste at your home? Are you satisfied with your current waste collection service?

   Yes ☐ No ☐

10. Are you satisfied with your current waste collection service?

    Yes ☐ No ☐

Appendix II,

Section B: Challenge and Solid waste Management variables

11. This question contains statements about solid waste management logistics. You can choose from the following aspects of your experience of SWML service by using the following scale, where 5 is the highest degree of agreement and 1 is least degree of agreement. The

answers are based on your perception of the service you get from the municipal, so it cannot be wrong. Thus, please **circle** correct numeric response to each question**.**

	SWM Items	Survey scale: 1=strongly disagree, 2=disagree, 3=Neutral, 4=agree, 5=strongly agree				
Commitment						
1	Solid waste management operators are skilled.	**1**	**2**	**3**	**4**	**5**
2	Solid waste management personnel are passionate to their job	**1**	**2**	**3**	**4**	**5**
3	Feedbacks from solid waste personnel are immediate	**1**	**2**	**3**	**4**	**5**
4	Solid waste management staff settle complaints promptly	**1**	**2**	**3**	**4**	**5**
5	Solid waste management personnel are on-time to their job	**1**	**2**	**3**	**4**	**5**
6	The collector will come to a certain place at a certain time	**1**	**2**	**3**	**4**	**5**
Intensity of traffic						
5	Transporting the solid waste to deposit site requires few time	**1**	**2**	**3**	**4**	**5**
6	Transporting the solid waste brings no traffic overcrowdings	**1**	**2**	**3**	**4**	**5**
7	The number of transport routes to covey waste are sufficient	**1**	**2**	**3**	**4**	**5**
8	The transport routes used to convey waste are appropriate	**1**	**2**	**3**	**4**	**5**
9	The solid waste disposal is done on non-rush hours	**1**	**2**	**3**	**4**	**5**
10	They collect the sacks/bags from houses and shops/offices according to the pre-specified collection route.	**1**	**2**	**3**	**4**	**5**
Tonnage of loading						
9	Waste loading trip rate is convenience for customers	**1**	**2**	**3**	**4**	**5**
10	Waste loading trip rate is frequent	**1**	**2**	**3**	**4**	**5**
11	Sufficient number of trips are made	**1**	**2**	**3**	**4**	**5**
12	There is no overflow of waste during conveying	**1**	**2**	**3**	**4**	**5**
Pickup time						
14	The solid waste deposit is evacuated rapidly	**1**	**2**	**3**	**4**	**5**

	SWM Items	Survey scale: 1=strongly disagree, 2=disagree, 3=Neutral, 4=agree, 5=strongly agree				
Commitment						
15	The solid waste management personnel collect the waste frequently	**1**	**2**	**3**	**4**	**5**
16	The time that the solid waste management personnel come to collect the waste is convenience	**1**	**2**	**3**	**4**	**5**
17	Solid waste management personnel collect the waste before it gets accumulated	**1**	**2**	**3**	**4**	**5**
18	Waste is collected directly from the house	**1**	**2**	**3**	**4**	**5**
Volume of waste						
18	The volume of the solid waste generated is manageable	**1**	**2**	**3**	**4**	**5**
19	The number of vehicles convey the waste are adequate	**1**	**2**	**3**	**4**	**5**
20	The number of vehicles available are attuned to the volume of waste	**1**	**2**	**3**	**4**	**5**
21	The municipal has capability to maintain/repair vehicle/equipment	**1**	**2**	**3**	**4**	**5**
Expected operation challenge						
18	Inadequate service coverage (some people not given service)	**1**	**2**	**3**	**4**	**5**
19	Lack service qualities (not frequent enough, spill, etc.)	**1**	**2**	**3**	**4**	**5**
20	Lack of authority to make financial and administrative decision	**1**	**2**	**3**	**4**	**5**
21	Lack of trained personnel	**1**	**2**	**3**	**4**	**5**
22	Lack of vehicles	**1**	**2**	**3**	**4**	**5**
23	Lack of equipment	**1**	**2**	**3**	**4**	**5**
24	Old vehicle/equipment frequent breakdown	**1**	**2**	**3**	**4**	**5**
25	No proper institutional set-up for solid waste management service	**1**	**2**	**3**	**4**	**5**
26	Rapid urbanization outstripping service capacity	**1**	**2**	**3**	**4**	**5**
27	Uncontrolled proliferation of squatter settlements	**1**	**2**	**3**	**4**	**5**
28	Difficult to locate and acquire landfill site	**1**	**2**	**3**	**4**	**5**

	SWM Items	Survey scale: 1=strongly disagree, 2=disagree, 3=Neutral, 4=agree, 5=strongly agree				
Commitment						
29	Lack of control on hazardous waste	**1**	**2**	**3**	**4**	**5**
30	Poor response to waste minimization (reuse/recycling)	**1**	**2**	**3**	**4**	**5**

SECTION C: OPEN-ENDED QUESTION

12. In what ways do you think the Solid waste management logistics can further improve its service ----------
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End of Questionnaire

Thank you for your cooperation!

Contact me: mechualem@gmail.com