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Assessing municipal waste management in Ethiopia: applying the best practices of the Finnish system

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2017 Laurea

Laurea University of Applied Sciences

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Degree Programme in FM
Bachelor's Thesis
April, 2017

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Abstract

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Year 2017 Pages 44

Waste management is the major service provided and handled by municipal administrations. Because of lack of awareness, continual carelessness, insufficient finance, private company involvement and low community participation, poor waste management techniques are becoming common in developing countries like Ethiopia. The way waste is handled in the country is uncoordinated, unprofessional and not depending on the rules and regulations. The purpose of this thesis project was to assess these problems and possible solutions by considering the best practices of the Finnish waste management system.

This study aims to provide an overview of the current waste management problems of Ethiopia especially the capital city Addis Ababa and to find out potential solutions from the Finnish system. Desk research, field observation, personal and email interview methods were used to collect the required data. The interview was held between Dynamic sanitary services from Ethiopia and the biggest municipal waste management company HSY from Finland. The researcher conducted a field visit in Ämmäsuo landfill located in the Espoo region. By investigating the waste management practices in both countries, the study tries to examine the legal aspects, private sector involvement, effects of poorly managed wastes and the ways to change trash into money. The results of this study show that waste management in Addis Ababa is not given much attention compared to other public services. This negligence can be easily seen from the illegally dumped wastes all over the city streets and notably from the landslide in Reppi and the loss of over 100 innocent Ethiopian lives.

The study offers some suggestions for improving waste management, such as planting bio gas stations, practicing composting methods, creating continuous public awareness and adopting other helpful ideas from Finland. The researcher believes that adopting the proposed ideas will help the country to be cleaner, and go some way to solving existing problems and resolving the issue of waste.

Keywords: Waste management, Types of wastes, Generating income from trash, Reppi landfill

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1 Introduction

Waste: - Cambridge English dictionary defines waste as “unwanted matter or material of any type, especially what is left after useful substances or parts have been removed”. UK environmental protection act 1990, defines waste as unwanted or nonessential materials which should have to be disposed or discarded before contaminating others.

Solid wastes: - can be any non-soluble wastes like gases and non-dissolved materials that doesn´t have any benefit for the holders and discarded as unwanted. These non-liquid materials can include furniture’s, unused machinery, left alone vehicles and their parts too. (Zhu et al. 2008, 3)

Waste management: - is the specific name for the collection, transportation, removal or recycling and controlling of waste. The phrase describes the waste materials produced by human activities and these wastes have their own effect on human health and environment. So, to avoid their effect on anyone they should have to be disposed. (Unnisa & Rav 2013).

Ethiopia is one of the underdeveloped countries in Eastern Africa; with more than 77 million populations and over 12 million are living in cities. Now a day’s the country’s economic growth is showing a little bit growth. But the country is highly challenged by bad waste management system especially in big cities. People coming from rural areas to the capital city are growing rapidly without any developmental actions taken to upgrade the city. It’s been an enormous treat for nationwide growth and government authorities can’t overcome it. Due to the uncontrolled population growth of the country, people are fleeing from rural areas to urban areas especially to Addis Ababa. This rural-urban migration of the population enforces people to live in a more condensed area and that follows the generation of wastes in the city. Because of the development of cities and increase in the number of population; the country is facing boost in waste disposal. (The Ethiopian urban migration study, 2008)

Waste management is a major problem for underdeveloped counties like Ethiopia and lots of people are affected by it. Implementing an effective waste management plan is the main option to initiate the availability of clean drinking water, use of proper toilets and to eradicate the culture of living with dirt. Poor management of waste can develop an unsanitary land which is the major cause of infections and transmitted diseases like diarrhea. Most of the wastes generated in A/A are not collected and disposed properly; rather it´s dumped into drainage lines, street sides and open spaces. Improper collection is not the only problem but also awkward recycling system and lack of sanitary landfill sites are the major obstacles for the sanitation of the city. The cleanliness of the city is going from bad to worse; around 26% of the inhabitants of A/A do not have access to toilets and they are using rivers, road ditch, open spaces and officially invisible places. (UN-HABITAT, 2008)

Reppi solid waste disposal site, which is locate 13 km south-west of A/A is the only waste disposal site of the city. The unmanaged and improper disposal system practiced in the area is

generating air, water and land pollution to the dwellers. The garbage coming from all over the city has been disposed in this place since 1968 without any legitimate processing or treatment of the wastes received at the site. All in all, the waste management system practiced in Ethiopia is so bad for the health and life of the inhabitants. (UNDP in Ethiopia-project Design Document, 2012)

1.1 Aim (objective) of the research

As a general objective, this study is aimed to overview the current waste management system of Ethiopia specifically in the capital city Addis Ababa. The study will find out adequate suggestion on how to reduce, reuse, recycle and dispose wastes in Ethiopia following the Finnish waste management system. From the above main objective, the study aims to identify the types of waste, how waste management service is practiced in Addis Ababa, what kind of methods can be taken from Finland to Ethiopia and the last but not the least is answering and giving core results for all the research questions.
After all, the study will give a clear picture of the Finnish waste management system, how it is working in Finland and how Ethiopians can be benefited from it and there might be some substantial suggestions by reviewing written literatures. Meanwhile, the study will gone give some critical and strong suggestion on how Ethiopian´s can be able to live in a clean and healthy land. The study will offer some bottom line information's for waste management policy makers, waste managers and environmental protection agencies as well. The study will also be used as an important reference for any researchers who would like to oversight the topic and wish to come-up with an extensive and detailed result.

Research question

What are the bottom line problems of improper waste management system in Ethiopia?
Which waste management techniques can be effective in Ethiopia?
What valuable waste management skills Ethiopia can take from Finland?

1.2 Scope & limitations of the research

The study is prepared to examine, assess and give useful suggestions on how to upgrade Ethiopian waste management system by referring the Finnish system. It will cover the theoretical parts of waste management by doing some literature review and then it will assess the practical waste disposal technics in Ethiopia and Finland. The researcher will try to investigate how

private companies are working and evaluate their contribution to the waste which is noticed in Ethiopia. The study will highly concentrate on how Ethiopians can adopt Finnish waste management technics.

The major limitations the researcher will gone face during this study will be lack of enough secondary information regarding Ethiopian waste management system, almost there is data regarding the amount of waste and how the country is managing wastes. It's not simple to get local researches and well documented evidences for reference in Ethiopia. The current political unrest of the country will limit the chance of getting governmental office documents (Ethiopian government declares 6 months' state of emergency starting from October) and the major limitation can be the time limitation due to other study units taken by the researcher.

2 Literature review

Waste management is all about the steps and activities required to manage wastes from the initial to the final disposal point. This process includes all the actions of collecting, transporting, disposing and controlling of waste materials. Usually the term relates to all kinds of waste materials; weather they are formed during the production, processing or final utilization stage of raw materials or by other human activities including municipal, household and agricultural wastes as well. Waste management is designed to minimize the antagonistic consequences of waste on the environment, health and economy of the world. The management of waste can include solid, liquid, gaseous, hazardous or organic substances which have a harmful impact on the society. The practice of managing wastes may differ between developed and developing nations, urban and rural regions and residential and industrial sectors. Local government authorities are taking the responsibility of administering the non-hazardous wastes produced by residents and institutions in metropolitan areas of the region. Although wastes created by the industrial and commercial bodies are taken care by the generators of the wastes. (Unnisa & Rav 2013,)

After a report published by an English worker in 1842, the England government began to work on waste management. They did the citizens to be more responsible not to drop their garbage in the river and the government work on having clean water. Besides these actions the beginning of public sanitation movement was started. This sanitation movement involves keeping drinking water free from dirt and supplying clean water for the population. In 1900 the old horse-drawn vehicles were replaced by simple dump trucks. The waste collection system was held by going to every house, collect the garbage and finally transported to the refuse truck. (Charlotte 2009, 10-12)

Waste can include any items which are no longer in use by the people and substances which must be discarded properly. In addition to this, waste can be defined as any material which should have to be eliminated; because of its hazardous environmental and health problems. If

there is poorly managed waste in in several places, it might have catastrophic health and environmental consequences. Our daily activities can produce an enormous increase in the diversity and source of wastes. (Ian C. Barker, 2013)
If waste is reduced and managed properly; money and resource can be saved easily. If there is no much waste, there is also less pollution because of the unhealthy content of the waste. Even if minimizing waste doesn´t come free of charge; it will help the population to be healthy and make the environment more moderate. Too much waste is not good for health and there might be pollutions produced from it. Waste minimization is a plan of action aiming to avoid wastes from the source by enhancing the use of resource and energy and by lowering the poisonous effect of materials during and after production. (Charlotte 2009, 5)

2.1 Types of waste

The problem of waste has been a major environmental and health affair throughout the advancement of civilizations. Waste can be generated by human beings in any areas of life; like in food processing, health centres, industrial areas and schools. Without any doubt whenever human beings exist, there will be waste at the same time. The industrial and technological enhancement of people´s life is complicating the types and effects of waste. (Jayarama 2011, 1)
Types of wastes can be defined in many ways but as a guide to the green revolution book clarifies, they can be summarized as follows;

2.1.1 Municipal solid waste (MSW)

These kinds of wastes can be generated by everyday activities of households, schools, hotels, businesses and institutions. These wastes are collected and treated by municipalities; that's why they are called municipal solid wastes. Much of these wastes include unwanted and useless materials includes street clean-up (plastic, metals, packaging, bottles and others), leaves, food waste, agricultural, commercial, construction and office supplies. (Charlotte 2009, 28)
As Shangai Manual's definition, cities are the major contributors of environmentally unhealthy substances to the environment. Because of the lack of infrastructure, unsustainable share of municipal budget, having informal waste pickers and many other cases, municipal wastes are poorly managed in under developed countries. Poor quality of waste management is seen in developing countries and their waste collection is less than 70 percent. Surprisingly from

these poorly collected wastes, more than half of it is eliminated through unrestrained landfills and processed through unsafe and unhealthy recycling methods. Municipal waste management is becoming a world-wide challenging issue especially in developing countries. The high risks in poor management and uncontrolled disposal of wastes are seriously affecting low and middle income generating countries.

Figure 1 : Composition of MSW by nation income (unep.org, 2011)

2.1.2 Construction and demolition waste

This group of wastes created when there is building of apartments, roads or any kind of infrastructures and demolitions wastes happened when those constructions are distracted. These

wastes include metals, electrical wires, concrete, pipelines, bricks and glasses, insulation materials and many more. Because of high number of CDW generated in EU countries, there is high possibility of recycling as well. (European commission, 2016)
As practical guide to life cycle thinking (LCT) and life cycle assessment (LCA) 2011 explained, to manage the generation of CDW in Europe some methods have been practiced and the systems are more of related to reusing and recycling. Some of the methods can be: -

- Separating soils and rocks to use them again
- Breaking the stones and bricks for rubblework
- Cut in into ribbons all the pieces of woods
- Separate and recycle metals, plastics and glasses
- Burning up (incinerate) all hazardous elements
- Dumping materials which not too much dangerous for the society

2.1.3 Hazardous waste

A type of waste which is toxic or poisonous to human health or the environment and will cause death and serious health conditions is called hazardous waste. These wastes can be in the form of solid, liquid or gases and generated from chemical productions, hospitals, industrial manufacturing, and even there are household hazardous wastes as well. Household wastes which can catch fire without difficulty and easily explode under certain circumstances are considered as household hazardous wastes. They include batteries, oils, antifreezes, insect sprays and cleaners which contain large quantities of toxic ingredients. (Jayarama, 2011)
As Eschooltoday's definition, these wastes can be classified as combustible, reactive, toxic and corrosive. Combustible type of wastes is easily flammable, catch fire and drive fires. Toxic one´s are dangerous to any living things and corrosive items of wastes have acidic base and if they get contact they can easily cause skin irritation and sever health risks too.

2.1.4 Industrial waste

After the industrial revolution, the increase in industrial manufacturing is been showing improvements. Because of this increasing number of manufacturing industries like thermal power plants, paper producing industries, sugar companies, automotive companies, electronic companies, high-tech companies and raw materials manufacturing industries; the risk of being affected by their disposal is increasing too fast. Weather the company is a low-tech, middle-tech or high-tech, there is waste generated from any production stage. These wastes can be

chemicals, trash from the manufacturing place, oil, solvents, integrated iron and many similar wastes also. (Municipal Solid Waste Management, 7)

2.1.5 E-waste

The term e-waste or electronic waste is being used for unwanted electronic materials which are not giving service for the user and needs to be disposed. The materials can be computers, laptops, mobile phones, CD and DVD players and other electronic materials. Because of world-wide technological and industrial advancements, the number of electrical wastes increasing rapidly. (Jayarama 2011, 9)

As the global e-waste monitor, electronic accessories which are not in use and even which can´t be reused by the owner are electronic wastes. These wastes can contain any household or big industrial electronic apparatus which have been working in contact with electric or battery power. Developed countries are the major generators of these wastes compared to developing and underdeveloped countries. As technological advancements show growth these wastes will also show improvements as well.

GLOBAL QUANTITY OF E-WASTE GENERATED			
Year	E-waste generated (Mt)	Population(billion)	E-waste generated (kg/inch.)
2010	33.8	6.8	5.0
2011	35.8	6.9	5.2
2012	37.8	6.9	5.4
2013	39.8	7.0	5.7
2014	41.8	7.1	5.9
2015	43.8	7.2	6.1
2016	45.7	7.3	6.3
2017	47.8	7.4	6.5
2018	49.8	7.4	6.7

Table 1: - Global quantity of e-waste generated (United Nations University, 2014)

2.1.6 Medical waste

"Medical waste, also known as clinical waste, normally refers to waste products that cannot be considered general waste, produced from healthcare premises such as hospitals, clinics, doctors' offices, labs and nursing homes." (Charlotte 2012, 181)

All types of wastes which are generated inside any healthcare facilities such as hospitals, primary health-care centres, burn patient units, veterinary hospitals/clinics, blood banks and medical examination and testing areas are considered as medical wastes. This type of waste also includes a type of wastes generated by patients who are taking medicines in their own home like dialysis, self-taken insulin etc. 85% of the hospital wastes are non-hazardous; which are not different from general household or office wastes including papers, medicines packages, cartons and kitchen wastes. Even if the numbers are too small compared to the non-hazardous one´s, 15% of the total hospital disposals comes from infectious and chemical/radioactive wastes which are generally named as hazardous health-care wastes. (WHO no date, 3)

Waste category	Description and examples
Hazardous medical waste	
Sharps waste	Used or unused sharps (e.g. hypodermic, intravenous or other needles; infusion sets; scalpels; pipettes; knives; blades; broken glass)
Infectious waste	Waste suspected to contain pathogens and that poses a risk of disease transmission (e.g. waste contaminated with blood and other body fluids; laboratory cultures and microbiological stocks; waste including excreta and other materials that have been in contact with patients infected with highly infectious diseases in isolation wards)
Pathological waste	Human tissues, organs or fluids; body parts; fetuses; unused blood products
Pharmaceutical waste	Pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals.
Cytotoxic waste	Cytotoxic waste containing substances with genotoxic properties (e.g. waste containing cytostatic drugs-often used in cancer therapy; genotoxic chemicals)
Chemical waste	Waste containing chemical substances (e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents; waste with high content of heavy metals, e.g. batteries; broken thermometers and blood-pressure gauges)
Radioactive waste	Waste containing radioactive substances (e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources)
Non-hazardous /general health-care waste	
Non-hazardous wastes	Waste that does not pose any biological, chemical, radioactive or physical hazard

Table 2: Categories of health-care waste (WHO no date, 3)

2.2 Effects of poorly managed wastes

WHO explained as environmental disorders are the main contributors of the high-risk diseases in which, human kinds are facing through time. If wastes are not disposed properly there might be an everlasting environmental, health and economic effect. As there is no naturally created waste, human beings are facing a disastrous consequence from their day to day disposals. If these wastes are not disposed properly there will be an extremely large amount of impact. Poor waste management starts from the very beginning of unorganized waste collection system to the poor disposal practices. Human wastes are the major contributors of human health problems by disposing harmful microorganisms; which can contaminate the public.

There are several impacts regarding to poor waste management; these impacts can range from economic uncertainty to life time health risks. If waste is managed accurately it can be part of the economy because most of the time, it's the consequence of economic growth. When there is industrial, technological or household growth there might be increase in the number of waste created. Global warming, ozone layer depletion, acidic rain and bad smelling of the city can be considered as the results of awkward waste management. (Jayarama 2011, 11)

2.2.1 Health effects of waste

Waste which is not properly disposed has many side effects on water, air and land as well. Because of inefficient human resource and lack of infrastructure most of the waste might not be collected and transported properly to its final sanitary landfill. Health impacts of waste can range from contamination of drinking water and can cause infections and transmitted diseases. The infections caused by poorly managed wastes can be skin and blood infections, eye and respiratory infections and intestinal infections which can be a serious problem for the public. Explosion of gases coming from decayed organic wastes like methane; can make the inhabitants living area to be a nasty place. Insects which carry germs especially from improperly organized landfills can cause biological contaminations, injuries to wild life and some simple health problems. (Vermon, 22)

As Development for Environment, Food and Rural Affairs defines people who in high risk of been affected by improper waste disposal can range from the whole population living near to

the place where is no good waste disposal systems, people who are working in waste management, children and elderly people. If some specific chemicals like mercury, which are highly toxic and their exposure may lead serious diseases and finally death.

Infections	• Skin & blood infections resulting from direct contact with waste and from infected wounds. • Eye & respiratory infections resulting from exposure to infected dust especially during landfill operations. • Different diseases that results from the bites of animals feeding on the waste. • Intestinal infections that are transmitted by files feeding on the waste.
Chronic diseases	• Incineration operators are at risk of chronic respiratory diseases including cancers resulting from exposure to dust and hazardous compounds.
Accidents	• Bone and muscle disorders resulting from the handing of heavy containers. • Infecting wounds resulting from contact with sharp objects. • Poisoning and chemical burns resulting from contact with small amounts of hazardous chemical waste mixed with general waste. • Burns and other injuries resulting from occupational accidents at waste disposal sites or from methane gas explosion at landfill sites.

Table 3: Municipal solid waste management (adopted from UNEP report, 1996)

2.2.2 Environmental & economic effects

Wastes that carelessly disposed and end up everywhere can poison and contaminate the entire world. These contaminations can be surface water contamination, soil contamination, air and water pollution and global warming. Poorly collected or improperly disposed wastes can have a dangerous impact on the environment. Open dumps can seriously damage the environment. Chemicals which are found in trash can run away into soil and water and these chemicals will damage plants and fish living in lakes. Fires often break out in old tires or dry trash and poisonous smoke goes into the air. A decayed waste which is changed into liquid and mixed with rainwater falling on the dump called leachate. Leachate is poisonous and it contains dangerous germs and chemicals which can make people and animals very sick. It is more hazardous if this mixture gets into water supplies. Inadequately managed landfills may cause air and other environmental pollutions. (Charlotte 2009, 14)

As EU environment waste studies identifies, waste management has diverse impacts on the environment apart from climate change. These effects can be noise, odour and traffic jam from vehicles transporting wastes from and to landfill sites, risks of water pollution from leachate formed as waste decomposes and emissions of dangerous gases. (Waste management options and climate change, 2001)

Eschooltoday made clear that, besides environmental and health effects, waste has economic effects too. If a city is not clean, fresh and healthy anyone won´t be eager to live there. There are costs related to waste including collection, transportation, disposal, separation and treatment. Costs most commonly related to waste disposal are arranging infrastructure, work materials and labour costs of those employed within the waste management system. A city with so much bad smell and uncontrolled wastes can´t attract business investors, tourists and even locals. Because of these reasons the area will not show good economical improvements.

2.3 Waste management and minimization concepts

Cutting down the amount of the wastes generated by individuals or public in an area is called waste minimization technique. Waste minimization involves the attempt used to minimize the use of energy and resource in production time. If small amount of resource is used, the result will be less waste. Waste minimization always requires knowledge of the production process, the starting and ending point of materials and detailed understanding of the structure of wastes. Investment is needed in waste reduction techniques and it can be compensated by the savings. Nevertheless, waste minimization in one part of the production process may create waste generation in another part of the process. (Charlotte 2012,)

There are lots of widely accepted waste management methods which have been practiced for long time. From those methods extended producer responsibility is the first concept which is more concerned on giving meaningful responsibility for waste producers from starting to end (disposal) stage. EPR is meant to enforce accountability over the entire lifecycle of products. In this system, the costs of used materials are covered by producers and consumers instead of the society and the external environment. Producers and polluters pays for their own waste, whether financially or physically including the end-of-life disposal costs. (Municipal solid waste management 10, 2011)

The second method which is highly practiced by many countries is waste management hierarchy. It is a hierarchical diagram shows the most preferable to least preferable waste management strategies. The least accepted practices produce an enormous negative impact on the environment and all over the society. Prevention, recycle and reuse are from the most preferable practices, however, open burning and dumping are not recommended for the proper waste minimization strategy. (Municipal solid waste management 10, 2011)

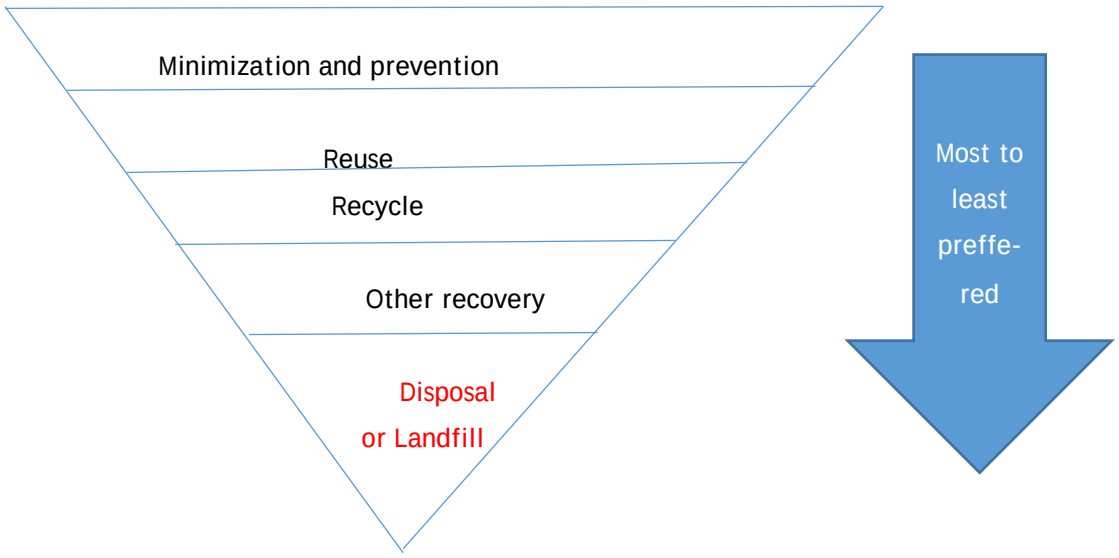

Figure 2 : Waste minimization hierarchy (European Commission, 2010)

3 Research methodologies

This chapter of the study clarifies the research methods used to gather relevant information which will help to answer the research questions. It deals with the background information of the research companies (HSY and Dynamic Sanitary Services), data collection methods and

procedures. By considering how it can be very helpful and easy to describe and get appropriate data from both countries the researcher decides to use descriptive qualitative research type. In this study both primary and secondary data collection methods were used. To gather the primary data the researcher used observation, email and face-to-face interview and for the secondary sources desk research and comparative studies on both countries have been used.

Data collection methods

Primary and secondary data sources have been used to collect significant information's related to the study topic. The waste management systems and waste legislations of both countries were explained through both sources. Regarding interview both email and personal interview was held in Ethiopia and Finland respectively. Email interview was chosen because the researcher is living in Helsinki and the research company Dynamic sanitary services is based in A/A. Because of bad internet connection and some other personal problems of the company person, it wasn't easy to get the response on time. But finally, he answered all the interview questions in professional way. Personal interview was held with a person in charge of Helsinki metropolitan area waste management and transportation department in HSY. By using this face to face question and answer session the researcher could gain clear data about the Finnish waste management system in detail.

Apart from these methodologies, the researcher used field observation in Ämmaässuo landfill located in Espoo region. The field visit helped to observe the real Finnish waste handling system, bio-waste treatment system, private cars sorting station, composting process, landfill and poisoned soils treatment methods, waste separation and management methods used to minimize trashes and waste to energy plants used in this sanitary landfill. The field visit was supported by professional explanations and answers from HSY staff member.

Other than these, secondary data were gathered from different published and unpublished materials including magazines, books and internet sources. As these sources are already done by other researchers and publishers, it wasn't that much difficult to get online printed books, documents from government offices and administrative bureaus. But when it comes to Ethiopian documents, it wasn´t easy to get well recorded data's and the researcher suffers a lot to get genuine information's. In general, all the research methodologies were mainly designed to assess the current WM systems of Ethiopia, how it is possible to find out and adopt the best fitted practices from Finland to Ethiopia and basically to answer all the research questions.

Dynamic sanitary services

Dynamic sanitary service is the pioneer private waste management company in Addis Ababa which was established in 1999 G.C. The service started in hired vehicle by employing 4 staff members and the transportation was limited to the neighbouring Governmental skips. After a year time, they stopped the hired vehicle and started delivering the service by using push-carts. With this method, the company can serve more clients and become able to reach new service areas. By utilizing 25 pushcarts they can hire more than 100 unemployed and destitute youth throughout the capital city.
In 2002 by importing one standard compactor garbage truck from Europe and enabled to serve hotels and other enterprises besides households. In 2005 more 3 garbage trucks were imported and the waste management duty service changed to only organizational level and household collection left to the youths by supplying the pushcarts and another basic sanitary material's. To this end the change was not made by the company's plan rather it was a government policy. In fact, Dynamic's intention played a vital role to organize the service in such manner; therefore, in the entire Addis Ababa the youth collect household garbage and dump to the nearby governmental skips and skips finally transported to the dumpsite by the Governmental trucks. Now a day the company can serve Addis Ababa's big hotels like Sheraton, Hilton, Marriott, Radisson Blu, Breweries, factories, international and governmental organizations through 16 standard garbage trucks and around 68 permanent employees participated in the waste management service of Addis Ababa city. Currently 90% of the company's income is coming from solid waste transportation service and the rest is from providing recyclable items to respective factories.

HSY (Helsinki Region Environmental Services Authority)

HSY is a municipal authority that provides services for which more than a million dwellers of the city can be benefited. The predominant responsibilities of the company belong to supplying pure drinking water, purifying wastewater, cost effective and environmentally friendly waste management service and give information about climate change and air quality of Helsinki area. The company started the service in collaboration with Espoo, Helsinki, Vantaa and Kauniainen cities waterworks, Helsinki metropolitan area council of waste management and regional environmental data. There are around 740 people employed in the company and 131 of them are working in waste management department. In 2016 the average revenue of the company was 364 million € with operating costs of 178 million € and 166 million € average investment money.

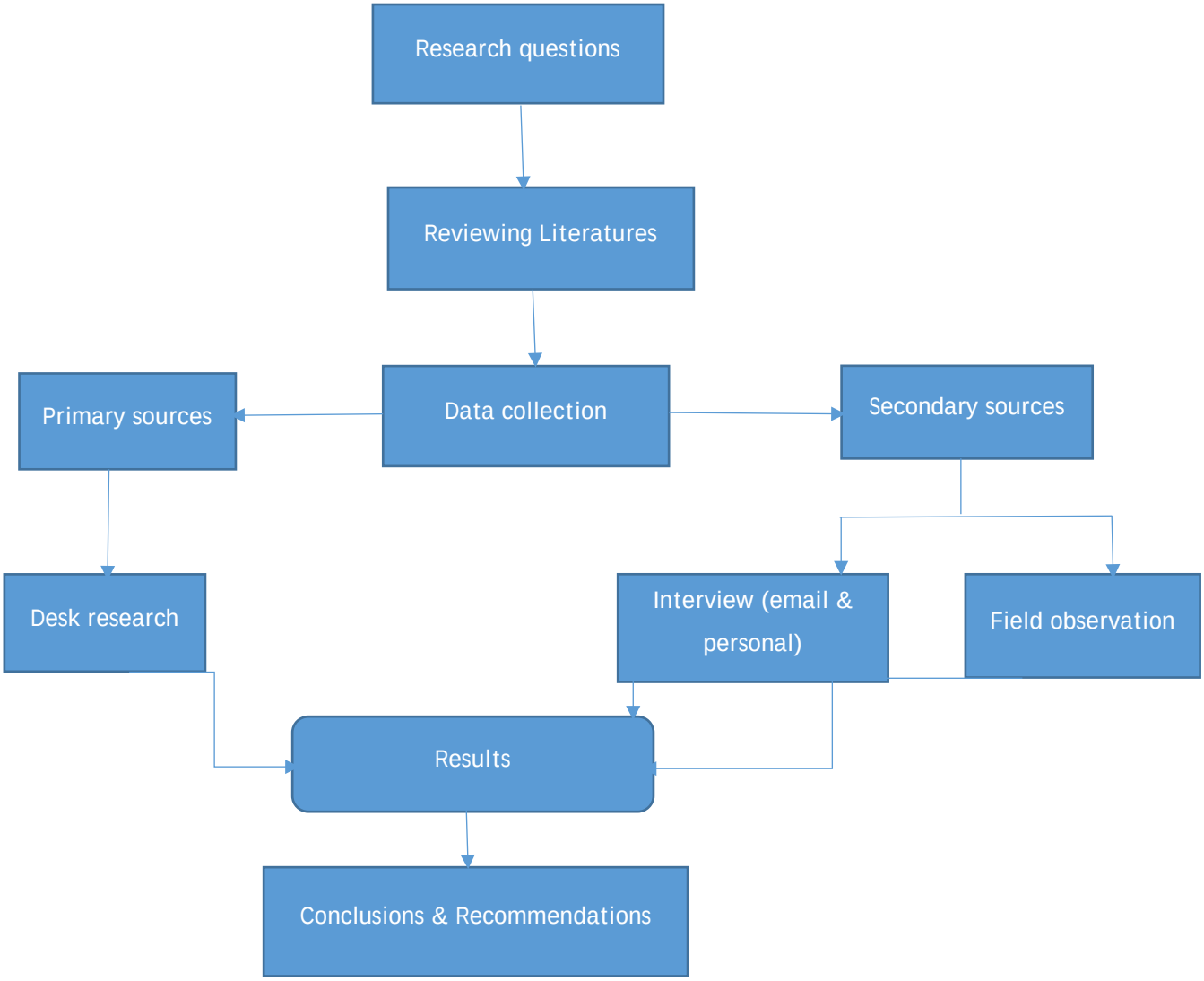

Figure 3 . Own drawing for research methodologies

4 Background information's about the study area

As bbc.com reported, Ethiopia is the only independent and the second largest populous country in Africa. The country is land locked and bordered by Djibouti and Eritrea in the north, Somalia in the East, Kenya in the south, Sudan and South Sudan in the west. Ethiopia is serving as a head quarter, founder and member of the Organization of African Unity (OAU) since May

25, 1963 and other international organizations as well. The capital city, Addis Ababa is home for more than 6 million people in 540,000 hectares. The city administrative structure has three levels which are the central city administration at the top, 10 sub-city administrations in the middle and 99 kebeles at the bottom. (UN 2010)
Now a day, Addis Ababa which means "new flower" in Amharic is showing tremendous advancements in different fields. The growth of new industrial fields, rapid growth of road construction and building of new housing makes the city to become one of the advanced cities of Sub-Saharan Africa. Because of the high number of rural-urban migration the population of the city is increasing very quickly. This increased number shown in the population is facilitating to generate more and more wastes. Because of lack of knowledge and technologies, it couldn't be easy to handle all the wastes generated in the city. (IGNIS, 2012)

4.1 Current waste management systems in A/A

Addis Ababa City Beautification, Park and Cementer Development Agency (AACBPCDA) which was formerly known as Sanitation and Beautification Agency was formally established in 2010. The agency was established with a vision to make AA's green development and beauty one of African superior city for dwellers and foreigners. Approximately 72% of the waste generated in the city is collected but 18% is dumped in open spaces without proper disposal methods. From the overall collected waste 90% is landfilled in Repi landfill site, 5% recycled and 5% composted. Even if there are good changes recognized, the city confronts so many problems related to bad waste management practices. (addisababa.gov.et)
In accordance with IGNIS 2012, the city's recycling method is not showing advancement and about 60% of the municipal organic waste is collected and disposed at sanitary landfill. Because of unprofessional collection and disposal of wastes, the A/A is encountering huge trouble by greenhouse gas emissions. People are suffering from health issues resulting from GHG which are generated from improperly managed wastes and bad disposal system. (future-megacities.org)

4.1.1 Waste generation in Addis Ababa city

Since it was hard to get the exact and updated number of wastes produced in the capital city A/A, here are some figures about the percentage of wastes produced in the city. Most of the information's and documents are used repeatedly without revising the old facts and this shows how much attention is given to the waste management industry of the country. From

the general waste generated in the city, about 76% comes from household wastes, 18% from institutional waste and 6% is from the city streets. The daily waste production in A/A is around 0.4 kg/capita/day and from this much amount of waste only 550 tonnes/day is collected. The amount varies depending on season, income and incidents happen on that time. Collecting wastes is the major responsibility of the Addis Ababa city administration office. Because of this reason the municipality is spending large amount of money on gathering, transferring and disposing of the city wastes. (Environmental policy review 2011: waste management in Ethiopia)

Constituent	Percent (%)
Vegetables	1.93
Paper	2.90
Rubber	0.19
Leather	0.41
Wood	2.89
Plastic	1.58
Textile	1.39
Ferrous metals	0.69
Aluminium	0.0
Glass	0.79
Combustible (leaves, grass, etc.)	26.26
Non-combustible (sand, grit, soil, etc.)	26.26
Soil/Fines 10 mm	30.82
Fines 55 but 10	25.87
Total	100%

Table 4. Physical composition of solid waste in Addis Ababa (globalmethane.org, 2011)

4.1.2 Collection system

As stated by Tesema 2010, looking so much inadequately disposed and uncollected wastes all over the capital city is becoming normal in the day to day life of the people. Even if the waste collection rate is increased by the city administration from 60% to 80% but the effects of those uncollected wastes is generating much more effect for the inhabitants. The munici-

pality is trying to collect 200,000 tons of wastes per year from entire city, which is approximately 550tons per day. The remaining wastes are disposed and left uncollected in the waterways, streets, drainage, tunnels, open spaces and unauthorized areas.

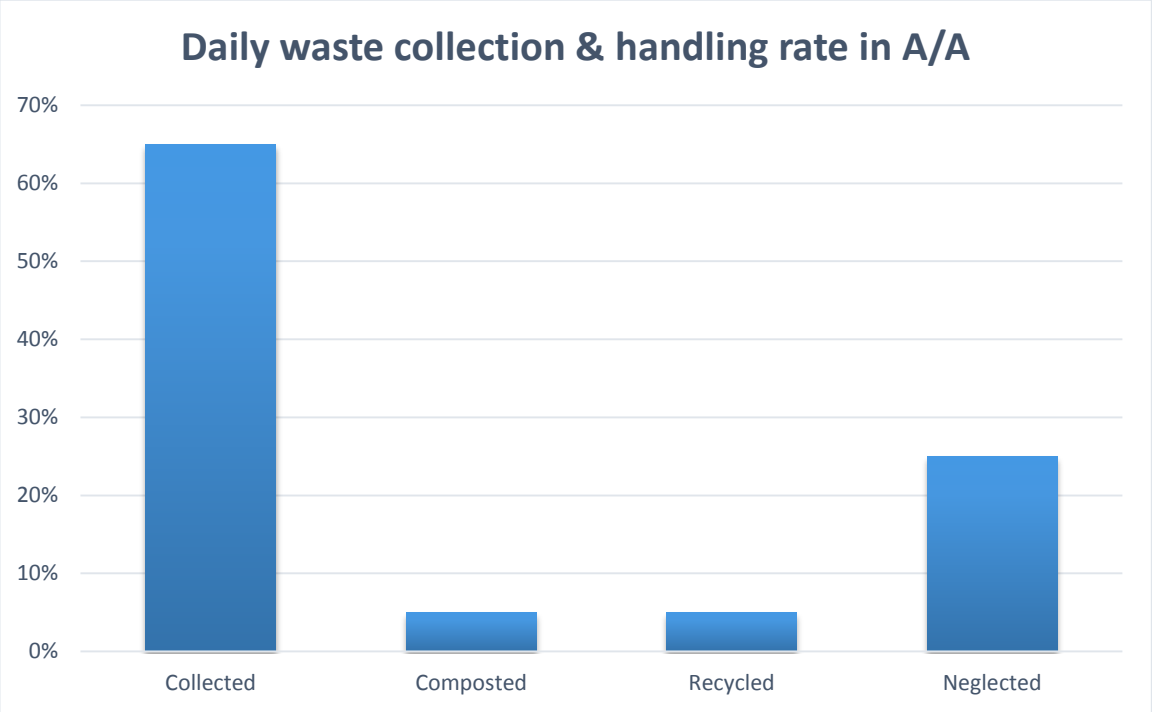

Figure 4. Clean and Green Addis Ababa Society, 2004

There are two main waste collection systems practiced in A/A which are primary and secondary waste collection systems. The primary collection is accomplished by micro and small scale enterprises. For primary collection, dwellers are divided into 549 zones (districts) and each zone is accountable to help 800-1000 households. There are about 520 small scale and micro enterprises established for pre-waste collection and most of them are working with middle and high- income residents. The gathering mechanism used in this system is door-to-door collection and communal container collection by using compacting trucks with a volume based payment of 30 ETB per meter square which is approximately US$ 1.35. The door-to-door collection system which gathers 33% of the municipality wastes are handled by young people who're organized by MSE. Workers should go house to house, knock doors and ask for wastes. The responsibility of the households is to assemble their wastes in a bag and left it outside their yard or in pedestrian area. Finally, the collectors take and transfer the garbage into the municipality containers by using the push cart. Because of shortage, frequent breakdown and not giving attention for the service, it's been normal to see wastes deluged from the communal containers. Even if huge amount of wastes which is around 67% is handled by containers; there are still criticisms about the service related to collection schedules, shortage and location and many other related issues of the municipality containers. The secondary collection is

managed by the city administration trucks by picking up the containers and take all the wastes to the disposal site Repi. (SBPDA, 2003)

4.1.3 Transporting and Disposal of wastes

As described by SBPDA 2004, the waste transportation system of the city covers both from the primary generating areas to the common collection sites, which are the communal containers and from the shared containers to the final disposal place. Most of the containers found in the city are in poor condition and they are not abundant for the population living in the town. Both municipality and private companies are taking care in transporting wastes to the communal collection sites. But transferring trashes to the final disposal site which is Reppi land fill is the responsibility of the municipality. Because of lack of proper maintenance and negligence many vehicles, compactors and trucks which can be used for waste transportation are not in use. The municipality of Addis Ababa is facing a problem in poor quality of waste disposal system as well. Most of the wastes end up in unprotected areas before collected and transported to the sanitary landfill. As reported by SBPDA 2004 less than 60% of the municipality's waste is not transferred to the sanitary land fill while the rest is making the city dirt. Addis Ababa has only one landfill site which has been giving service for more than 50 years.

Figure 5. Illegally disposed wastes in living areas (Photos taken by researcher)

4.2 Repi landfill site

Reppi is the only sanitary landfill in the city of Addis Ababa established in 1964; which is located around 13 km from the down town. It's an open dump site serving around 4 million people of the municipality and encircled by the city dwellers, business areas and even schools. All the wastes collected and transported from all over the city is disposed in this site without considering any environmental and health factors. Because of being on duty for so long time, the site is full of waste and it's almost out of control. There is no sewerage system to capture the discharge of liquid wastes, the site is not closed off on all sides to protect the illegal penetration of the nearby residents and its daily not covered with soil. These and many more related reasons make the place to be a threat for human health and flow of poisoned gases. Approximately 10 million cubic meters of wastes per day are dumped in Reppi landfill which is only 30 hectares by area. Because of urbanization and increasing population in Ethiopia, the inhabitants are living even inside the junkyard with no hesitation. Apparently more than 2,000 waste picker's life is dependent on this noxious disposal site. Most of them have poor economic history and their sources of income rely on the materials they can collect and sell from the site. No one is concerned about the safety and health of these people; even most of the time they lost their life when they scramble to collect stuffs.

As New York Times reported on March 20 2017, the old sanitary landfill in A/A which is Reppi/Koshe became the reason for the loss of over 100 innocent and poor Ethiopians. Many people are still missing because of the landslide at the landfill. It makes the residents to become homeless and their houses were swallowed by the heavy landslide occurred on March 11, 2107. Many people were living inside and around the sanitary landfill as scavengers and they get money by selling the collected wastes. Because it's hard to afford home rent money other places of the city, lots of people were living in the landfill by building small houses from sticks and mud. Officials are expecting more bodies to be found inside the garages. Children's, women and elders are the majorities affected by this massive landslide in Koshe sanitary landfill. (The New York Times 2017)

Figure 6. Reppi landslide and rescue operation given for affected people (New York Times, 2017)

4.3 Private waste management company's involvement (PPP)

In Ethiopia, private sectors involvement in waste management is done rarely. Most of the participants in this specific business area are jobless youngsters, who suffered from lack of financial income. Even if privatization was at its beginning stage, in 2004 Addis Ababa City Administration bureau started formalizing small scale private waste collectors and this action was

an eye opener for the inhabitants to recognise waste collection as a means of income rather than thinking it as a shameful job. Before 2004 the city´s waste was collected by informal individuals with the interest of the households. In this time the collectors were street children's, shoe shine boys or other poor people driven by poverty just to get small money for their daily livelihood; not to keep the environment clean. Because those reasons the wastes were collected from interested households and nobody cares about where they are disposed. So, the collectors dispose those refuses in rivers, invisible public places and even around main streets. But now a day, the growth of micro-enterprises in the field of waste collection is playing a great role for the cleanliness of the municipality.

After recognizing the drawbacks coming from poor waste management technics and inadequacy of private sectors involvement, the city administration bureau decided to work with medium and small scale enterprises for a common benefit of cleaning the city. For this reason, kebeles gather waste collectors and help them to form small scale enterprises. The problem is most of these youngsters are not educated, experienced and even well organized to do their job professionally. They collect and separate wastes by hand without safety gloves and they use push carts, wheelbarrows and even carry the wastes on their back and disposed it to the communal containers.

Being involved and working in waste management activities is thought as a shameful act by most of the Ethiopian's. Because of this many people look down, showing no interest and disrespect the waste collectors and even the waste management business in general. Many workers in this field of business have economic problems, large family and even no option to manage their daily life. Without getting sufficient incentives and motivation even from the government they managed to do the job.

In contrary to the above-mentioned types of private sector waste collectors, there are few private companies equipped with experienced staffs and materials. Even if large number of groups started to work in waste management area and vanish immediately, there are some pioneer private company's still working on the business.

4.4 Legalization aspects

Significant changes have been seen in Ethiopia regarding to waste management systems and technics. The country practiced various rules and regulations to fulfil the international environmental protection proclamations and policies. Ethiopian constitution is the first and remarkable source to other national environmental laws and regulations. As clearly stated in FDRE 1994, articles 44.1, 92.1, 92.2, 92.3 and 92.4 give special attention for environmental protection and people's right to live in clean area.

Article 44

Environmental Rights

1. "All persons have the right to a clean and healthy environment."

Article 92

Environmental Objectives

1. "Government shall endeavour to ensure that all Ethiopians live in a clean and healthy environment."
2. "The design and implementation of programmes and projects of development shall not damage or destroy the environment."
3. "People have the right to full consultation and to the expression of views in the planning and implementation of environmental policies and projects that affect them directly."
4. "Government and citizens shall have the duty to protect the environment." (The constitution of FDRE,1994)

In the national level the Federal Environmental Protection Authority (EPA) has full responsibility to regulate and control activities which has negative environmental consequence. The authority has power on climate change policies and it also serves as a central point for the Global Environmental Facility (GEF) in Ethiopia. The 1997 environmental policy of Ethiopia, which was issued by EPA includes directly or indirectly waste management ideas and technics. Among all other parts of the policy, part 3 which focuses on sectorial environmental policies and part 4 which explains about cross-sectorial environmental policies gives special attention on environmental protection and waste management regulations. The policy highlights on educating the community about environmental protection, motivating the public-private partnerships, teaching the population about modern waste minimization and recycling systems and many more valuable thoughts.

On February 12 2007, Solid Waste Management Proclamation NO. 513/2007 was released with a major goal of promoting public participation to improve the advantages and to minimize the impacts of solid wastes. By having five major parts, the proclamation defines what waste means, about solid waste management planning, inter-regional waste movement, transportation and disposal of wastes and many better ideas of waste.

Solid waste management activity	Law or Act	Description
Source reduction/ segregation households	Solid Waste Management Proclamation, Article 11.1	Households shall ensure that recyclable solid wastes are segregated
Collection and storage	Solid Waste Management Proclamation, Article 11.2	Urban administration shall ensure that adequate HH solid waste collection facilities are in place of marked waste bins by streets and in other public palaces guaranteeing the collections of solid waste from bins with sufficient frequency

Transportation	Solid Waste Management Proclamation, Article 13.2	Urban administration shall set the standards to determine the skills of drivers and equipment operators and prevent overload of solid waste
Treatment	Environmental Pollution Control Proclamation, Article 5.1	All urban administrations shall ensure the collections, transportation, and as appropriate, the recycling, treatments or safe disposal of municipal waste through the institution of an integrated municipal waste management system
Disposal/Landfill	Solid Waste Management Proclamation, Article 14.15	Construction of solid waste disposal sites and auditing existing solid waste disposal waste
Recycling and reuse	Solid Waste Management Proclamation, Article 7.1	Manufacturer or importer of glass container or tin cans shall…collect and recycle glass or tins
Hazardous waste	Environmental Pollution Control Proclamation, Article 4.2	Any person engaged in the collection, recycling, transportation, treatment or disposal of any hazardous waste shall take appropriate precaution to prevent any damage to the environment or to human health or well/being

Table 5. Environmental policy review 2011: Waste Management in Ethiopia

5 Background information's about Finland

With an average temperature of 6 degree Celsius and between 60 and 70-degree latitude, Finland is found to be one of an independent European country. In 2017 the country celebrates 100 years of independence. Within these freedom years' lots of economic, social demographic and economic changes has been seen from deferent angels of the country. (Statistics Finland)

5.1 Finnish waste management system

As OECD waste management services explains, municipal solid waste management practices in Finland are handled by municipalities. There are different responsibilities expected to be done by those municipalities. Some of them are: -

- Managing all municipal solid wastes generated in any area of the city.
- Overseeing all activities related to waste management costs and tariffs. These charges include costs incurred in waste collection, transportation, disposal, recycling, purchased materials, maintenance and many more.
- Controlling how the waste management system is practiced.
- Consulting and arranging a central administrative body when municipalities want to gather and form a regional waste management company.

In Finland preventing wastes from their starting point is the primary action in which the municipality gives more attention and if wastes are already generated the second step might be reusing those wastes in professional manner. The next step in Finnish waste management hierarchy is recycling and by using this method it will be easy to use wastes as a means of energy and there might be a chance of getting income from wastes as well. The Final step in waste management order is landfilling those refuses. (Ministry of the environment, 2016)

5.1.1 Waste generation and prevention in Finland

Ec.europa.eu clarifies waste prevention is a method which helps to minimize and even eradicate the production of wastes in an area. By adopting and practicing a good prevention system municipalities can be benefited from reduced amount of negative effects coming from trashes and can minimize the amount of hazardous wastes.
In 2007 Finland generated an estimated amount of 74 million tonnes of waste. The amount of waste produced is increasing from time to time and it needs more attention from the municipality and the dwellers as well. Construction and demolition wastes have the leading number all over Finland. Around 40% of municipal collected refuses were renewed as materials and energy. In this same year, the amount of municipal waste generated was 4% and 35 million tonnes of biodegradable wastes.
As planned in waste act reform 2013, at least half of the municipal wastes generated in all over Finland should have to be recycled in 2016. In accordance with this act, 70% of the construction and demolition wastes will be recovered and use as raw material in 2020.

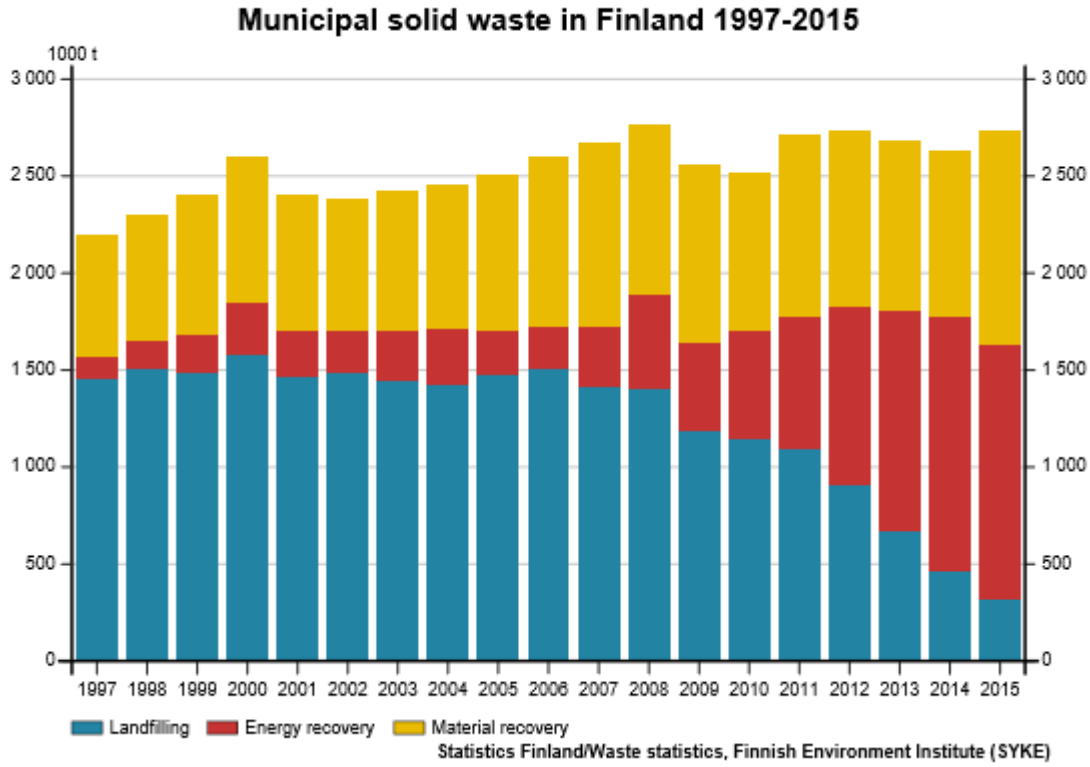

Figure 7. Municipal solid waste in Finland 1997-2015 (Statistics Finland/Waste statistics, 2016)

From the above picture, it's clearly seen that the amount of landfilling is decreasing time to time and energy recovery is taking place of it. In contrast dumping in the landfill sites is replaced by material and energy recovery methods. Reusing discarded materials either for energy or material use will help to manage the negative effects of wastes. (Statistics Finland, 2016)

5.1.2 Waste legislations in Finland

The Finnish waste legislations, which are more of based on European Union waste management hierarchy gives detailed attention for every type of wastes. The policy includes both legislations which are existed in EU legislations and which are not yet included in this act. Finnish waste legislations are tougher than the European Union act and radioactive wastes are governed by different law. (Piipo 2013) There are additional regulations coming from the waste legislation which concentrate on how to prevent the rubbishes, professional waste discharging methods, procedures to follow for the reduction and harmfulness of refuses and how to make clean an area which is already contaminated by unnecessary wastes. (Finnish waste act 646/2011, 195/2012)

Stages	Include
prevention	Using less material in design and manufacture, keeping products for longer, re-use and using less hazardous materials
Preparing for re-use	Checking, cleaning, repairing, refurbishing, whole items or spare parts
Recycling	Turning waste into a new substance or product including composting
Other recovery	Includes anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste; some backfilling
Disposal	Landfill and incineration without energy recovery

Table 6: The stages of the waste management hierarchy, Directive 2008/98/EC (Piippo 2013)

As the Ministry of the Environment suggested and the Finnish government accepted, the national waste plan for 2016 comes to action in Finland. All sectors who are generating waste throughout the country are included in this plan. The major concerns of the policy designed at preventing and minimizing the negative outcomes of wastes resulted from unprofessional management systems. The main goal of the policy is 50% of the municipal wastes generated all over Finland should have to be recycled, 30% of wastes must generate energy and a maximum 20% of wastes could be transported to dumpsites. By targeting to achieve the desired goal of waste prevention, the plan is composed of eight objectives. Below are the objectives sated for the fulfilment of "Towards a recycling society, The National Waste Plan for 2016". (Ministry of the environment, 2009)

i. Increasing the waste prevention by promoting material efficiency
ii. Increasing recycling
iii. Promoting the management of hazardous substances from the waste point of view
iv. Reducing the harmful climatic impacts of waste management
v. Reducing negative health and environmental impacts of waste management
vi. Improving and clarifying the organization of waste management
vii. Developing expertise in the waste sector
viii. Putting trans-frontier waste shipments on a safe and well-managed basis

5.1.3 Producer responsibility and recycling systems

On August 13th 2005 an obligation comes to the Finnish waste management system, which imposes manufacturers and importers to take the accountability of handling their end-products

and it's called producer responsibility. When defining the idea of producer responsibility; it should have to be defined depending on what the law says, every product should have only one responsible body, the law is demanded only in Finland and different importers can import one brand by using similar importing system. Any company which manufacture or import batteries, papers, automobiles, packaging and tyres belongs to this duty of discarding the final product. Municipal wastes generated from public services and household refuses coming from dwellers are handled by the municipality. (Waste act reform, 2013)

	Ämmässuo	Reppi/Koshe
Country of origin	Found in the capital city of Finland, Helsinki.	Based Addis Ababa which is the capital of Ethiopia's only landfill.
Size	200 hectares and serve around 1.5 million people of Helsinki.	30 hectares and the population of A/A is around 4 million. The landfill has been a dumping site for more than 50 years.
Location	Found on the boarder of the cities of Espoo and Kirkkonummi.	Located in the capital city with nearby school, houses and other public and private offices.
Safety	There are no people living inside or around the landfill area. The place is secured and safe.	More than 2000 scavengers and many people live inside and around the landfill permanently in unsafely built houses.
Service	Landfill gas collection, treating bio-waste, treating contaminated soils, stabilizing ashes etc.	All wastes coming from the capital area are dumped, living place for many people, means of income for waste pickers, means of food for poor and in needy people etc.

Table 7. Comparative study on Reppi and Ämmässuo landfills.

6 Recommendation

After investigating the real waste problems of Addis Ababa city and reffering the Finnish waste management systems, the following recommendations are proposed to make the city a more clean and better place for living.

- Practicing the waste management hierarchy

The most preferred rank of the waste management hierarchy is waste prevention or minimization from the source. This method aims at reducing the number of waste produced and is most effective way to handle waste from its generating point. Reuse, recycling and recovery steps comes after prevention and the methods can be suitable for already generated wastes. The last and the least preferred step is landfilling which is highly practiced in Ethiopia. Because of it's lifetime effect this method of waste management is not recommended to be used by any country and have an enormous effect. It would be good to practice this hierarchy.

Waste management methods	Strategies to be taken
Prevention & minimization	Awareness creation and continuous public education
Reuse	By training on how to reuse used materials.
Recycle	Offering facilities and teaching how to recycle
Recovery	Building incinerators (waste burning machines)
Disposal	Outsourcing solid waste service to private companies and initiate PPP.

Table 8. Recommended strategies based on waste management hierarchy

- Legal and policy aspects

Implement laws and regulations which enforce polluters and waste generators to be aware of what they dispose. Ethiopian policy makers can learn and implement from the Finnish system about producer's responsibility or "polluters pay" policy, laws and regulations which promote "zero waste" strategy and implementing regulations which can participate private companies in the waste management business. Ethiopian government should start outsourcing waste management practices to private companies, design adequate money for the sector, participate informal sectors in the waste management process and give some incentives to support

the service. It would be a great opportunity if the city administration can improve the infrastructural facilities of the city by increasing the number dust bins with numerous supervision and emptying those bins frequently.

Using waste as source of income

Almost 60% of organic wastes generated in AA are dumped and become negative effects for the environment and for the population as well. If these wastes can be reused and treated as resources, they can be good sources of income. Below are some usefull methods to make money from wastes.

- Planting biogas stations

There is an increasing demand on energy and power supply in Ethiopia, the biogas power plants will be the best options. The gases generated from wastes in the sanitary landfills can be the primary sources of these energy. AA city administration can build biogas plants which can generate energy from animal's dungs and human latrines. As biogas is one of the renewable energy produced from unwanted wastes, it will be good to use this method even to adopt an environmentally-friendly life besides energy recovery. There are many schools, hospitals, governmental and private companies, hotels and restaurants etc. in the capital city. So, it will be a favourable chance to collect food and latrine wastes to function the power plant. Besides this, brewery, diary and other food related companies can be a great sources of biogas wastes and the number of brewery companies in the country are increasing time to time and it can be a good opportunity to get plenty of biogases. Using wastes as a biogas is a best technique to decrease the number of trees used for cooking and at the same time it will cut the amount of wastes dumped in landfills and it also helps the municipality to make money from wastes.

- Composting

This method of waste management helps to reduce the greenhouse gases emission in addition to getting energy and money from wastes. Now a day just only 5% of the city waste is composted and 90% of it is dumped in Reppi landfill. From this statistic, it's clearly visible that there is a high opportunity to compost the wastes of AA. By arranging a proper waste separation and collection system, the municipality can get enough amount of trashes to be composted. MSSE's can involve themselves in this method and can earn money. There are vegetable markets and food processing companies in the capital city. So, the organic wastes generated from these areas can be composted and used as a source of income and the can help to reduce soil erosion.

Based on the information's and findings of this research, Ethiopia can overcome the bad waste management system by learning the following lessons from Finland.

- Arrange continuous and adequate training and awareness creation programmes for the population.
- Outsource the waste management business for private companies.

- Educate and help manufacturers to produce environmentally friendly materials.
- Being concerned about the infrastructures of the city like by increasing the number of trucks, dust bins and waste management facilities.
- Controlling the illegal dumping and set a high punishment system.
- Encourage CBO's to involve in the waste management system and supply the necessary materials that can help to manage wastes.
- Inspire and encourage the informal sectors by giving incentives like tax reduction, giving place to work and sell the recycle materials.
- Changing wastes to money should be considered as a good business idea and the government must work on that. The system can also help by reducing the number of unemployment.
- Enforce producers to pay for their own waste or take a serious action on producers to dispose their trashes legally and in a professional way.
- Cut down the long governmental offices bureaucracy which are not initiating the PPP in waste management system.
- The municipality should control and oversee the cleanliness of the city and always be alert to make new changes whenever any difficulties happen in the practiced WM system.

7 Conclusion

In general, this research paper targeted to assess the waste management methods applied in Ethiopia, by overviewing the Finnish waste management techniques and finally to recommend effective methods. The study particularly reviewed literatures written about types of wastes, effects of poorly managed wastes, private companies involvement in Ethiopia for waste management business and other minor topics related to the research question. To examine the real problem and find out factual suggestions on waste management practices of Ethiopia the researcher used interview (both email and personal), field observation and reviewing published and unpublished scripts.

Addis Ababa the capital city of Ethiopia is suffering from bad waste management practices. The WM has two stages from collection to disposal. The waste collection system in Addis Ababa is both formal and informal by its type. City government of AA is taking care of the formal sector which is collecting trashes from households and dumping in the landfill but the informal method involves poor and law income inhabitants who used waste as a source of income. The primary stage is where residents, formal or informal employees collect and transport the waste to the communal containers and the secondary step starts by removing the wastes from the containers, transporting and dumping in the dumpsite (Koshe). The formal means of waste recovery method is more of handled by government authorities but the informal method is done in the biggest open market in Africa, which is called Merkato. In this place, there is one recycling market locally called "Minalesh Tera", in which scavengers sell

materials collected from waste sites and some craftsmen made furniture from those materials. Even if the government didn't give attention, the informal sector is contributing positively for the reduction of wastes and reuse of wastes. The sector is creating job opportunities for the unemployed, producing recycled materials, minimize the wastes transported to the landfill and people can generate income by selling wastes and raw materials.

Creating awareness and educating the people about waste management is the primary idea Ethiopian government can learn from the Finnish system. Giving lessons for elder people by using their social and spiritual gatherings and teaching children in schools are the best methods to be practiced. If people's understanding is changed, it will be easy to prevent, reduce, and recycle and even to use waste as a means of income.

As it is clearly seen from the study and collected data's bad waste management can cost a lot for all. By having this in mind the municipality should have to have sufficient manpower, pay satisfactory money for the workers, enforce the rules and regulations, punish who are not working depending on the rule, welcome private investors to invest in the area, decentralise the industry and always be ready to learn and implement new ideas.

At last he thesis pointed out that, Ethiopia can learn and pursue the techniques and methods of how to use waste as a means of income. In Finland waste is not just something to be dumped in landfills but its means of income, energy and even employment opportunity as well. So, it's better to apply the recommended waste management practices, resolve the bad waste management system of Ethiopia and make money from wastes.

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Figures

Tables

Appendix 1 Interview questions

1. Could you tell us about your company? Year of establishment, number of employees, business area (waste collection, transporting…)

Dynamic Sanitary Service the pioneer private waste management co. In Addis Ababa was established in 1999 G.C. The service was started in hired vehicle employing 4 members. And the transportation was limited to the nearby Governmental skips. After a year time, we drop the vehicle we started with pushcarts enabled to serve more clients and service area and to this end we enabled to recruit more than 100 unemployed and destitute youth through 25 pushcarts. In 2002 we imported one standard compactor garbage truck from Europe and enabled to serve hotels and other enterprises besides households. In 2005 more 3 garbage trucks imported and the waste management duty service change to only organizational services and household collection left to the youth by the supplying pushcarts and another basis sanitary materials. To this end the change was not made by our intention it was a government policy and in fact our initiation played a vital role to organize the service in such manner; therefore, in the entire Addis Ababa the youth collect household garbage and dump to the nearby governmental skips and skips finally transported to the dumpsite by the Government trucks. To date we are enabled to serve Addis Ababa's big hotels like Sheraton, Hilton, Marriott, and Radisson… Breweries, factories international and governmental organization through 16 standard garbage trucks and around 68 permanent employees participated in the service

2. Do you have any job description and working manual or guideline informing you how to do your job? If you say NO so how do you learn to do your job?

Yes

3. Do your company cooperate with private collectors (formal and informal) or medium and small scale enterprises (MSE)? If yes in what way? No for the recent period soon there will a relation in recycling activities i.e. to market additional recyclable items

4. Are you satisfied with the level of service being provided by your company? Yes

5. What kinds of problems are limiting the company's performance? Inadequate place to start recycling service

6. What is the company's means of income?

Currently 90 % solid waste transportation service and the rest providing recyclable items to respective factories

7. Do your company get any financial, material or training or other incentives from the government or NGO's? Not yet in fact we got one time support 18 years ago since we engaged in the service which initiates the youth and the service which manage to handle poor sanitary condition of the city.

8. Is there any official union for private waste management companies in Ethiopia? More than 80 unions organized by the government and more than 20 private waste management entities in the city.

9. Do you think the municipality is helping private companies to minimize the waste production of A/A? (Optional question) Currently waste segregation is started in the collection area and it is inaugurated to be started in households too.

10. You can add your idea as well.

We intend to launch paper and plastic recycling activities in collaboration with financial institution, Banks.

Appendix 2 pictures taken by the researcher to show illegally dumped wastes in AA