ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF SOCIAL SCIENCES

DEPARTMENT OF SOCIOLOGY

THE IMPLICATING OF AIR POLLUTION ON THE SOCIO-ECONOMIC LIFE OF THE COMMUNITY: THE CASE OF KOSHE WASTE DUMPING SITE, ADDIS ABABA, ETHIOPIA

BY

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January, 2022

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A THESIS SUBMITTED TO THE DEPARTMENT OF SOCIOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN SOCIOLOGY

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January, 2022

ADDIS ABABA, ETHIOPIA

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Declaration

I, Mahlet Fassil Mekuria, hereby declare that the thesis entitled: The implicating of Air Pollution on the Socio-Economic life of the Community: The case of Koshe Waste Dumping Site; submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Sociology complies with regulation of the University and meets the accepted standards with respect to the originality and quality.

Name: Mahlet Fassil

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Approval

This is to certify that the thesis prepared by Mahlet Fassil Mekuria, entitled: The implicating of Air Pollution on the Socio-Economic life of the Community: The case of Koshe Waste Dumping Site; submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Sociology complies with regulation of the University and meets the accepted standards with respect to the originality and quality.

Approved By Boards of Examiners and Thesis Advisor

Advisor _____Signature_____Date_____

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Chair of Department or Graduate Program Coordinator

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Acronyms

AQ	Air Quality
COVID 19	Corona-virus
CO	Carbon Monoxide
CDC	Center for Disease Control and Prevention
EPA	United States Environmental Protection Agency
ECA	Economic Commission for Africa
FAO	Food and Agriculture Organization
FGD	Focused group discussion
GBD	Global Burden of Disease
ILF	International Lifeboat Federation
ICO	Initial Coin Offering
ITU	International Telecommunication Union
IDWS	Interim Defensive Weapon System
IMF	International Monetary Fund
MSW	Municipal solid waste
NO2	Nitrogen Dioxide
NIHL	Noise Induced Hearing Loss
OAU	Organization of African Unity
OECD	Organization for Economic Co-operation and Development
PM10	Particulate Matter of 10
PTSD	Post-traumatic Stress Disorder
SBPDA	Addis Ababa Sanitation, Beautification and Park's Development Agency
SD	Standard Deviation
SO2	Sulfur dioxide

SSA	Sub Saharan Africa
UCAR	University Corporation for Atmospheric Research
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
UNHCR	United Nations High Commissioner for Refugees
WASH	Water, Hygiene and Sanitation

Abstract

Air pollution is one of the environmental pollutions. It is caused by harmful emissions of gas from industry, households, waste dumping sites that contaminate the air. Addis Ababa's waste dumping site is located at Koshe landfill. Koshe dumping site is the only dumping site available for the entire capital city with more than three million inhabitants. This study investigates the implicating of air pollution on the residents found at Koshe dumping site. The study used qualitative research methods of in-depth interviews, key informant interviews, and focus group discussion and analyzed the data thematically.

The residences of this study area have been living with toxic environment for decades. Projects have been established at Koshe area that can potentially minimize the pollution by reusing the landfill. The new Reppie waste to energy plant located at the landfill is one of the first wastes to energy incinerator in Africa.

Even though, the Reppie waste to energy plant has a potential to generate 30% of household electricity consumption, however it has been affecting resident's health condition. Finally, this study suggests that Koshe dumping site can be good source of generating income for young people around the place, if the concerned body collaborate with young people and make it formal collecting material from the area.

Key words: Air pollution, dumping site, emission.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

The World Health Organization (WHO) evaluated the extent of urban air pollution according to four main indicators namely PM10, NO2, SO2, and troposphere ozone in 24 megacities of the world. People who are being directly exposed to various harmful gases can be exposed to respiratory and other health hazards, such as asthma, cardiovascular diseases, and reduce the quality and number of years of life World Health Organization (2019). Air pollution became the cause of the death of 6.5 million people worldwide. More than 11% of the deaths were related to air pollution reported by European Federation for Transport and Environment (2020).

The UNICEF report on Africa says outdoor air pollution deaths increased from 164000 in 1990 to 258000 in 2017, and with population, industrial, and consumption growth potentially increasing, the levels of pollution will subsequently increase. Projections estimate that Africa's population will double by 2050 from 1.2 billion. More than 80% of that increase will occur in cities, leading to amplified traffic and therefore air pollution. Population growth will lead to a large number of waste products.

Waste disposal in urban areas of developing countries (Africa) is still largely uncontrolled and large quantities of waste go uncollected. All Sub-Saharan African countries suffer from a lack of continuous air quality monitoring and also a lack of well-maintained and easily accessible data on health indicators perhaps with the exception of countries. East African countries are undergoing rapid economic development, industrialization, and socio-demographic transition, with associated environmental degradation including significant increases in ambient air pollutant levels.

Ambient air pollution is a term used to describe air pollution in an outdoor environment by UNICEF (2017). In 2017 the Global Burden of Disease (GBD) study showed that air pollution is the second highest risk factor for death and disability in Ethiopia. It is likely that 21% of non-accidental deaths were because of exposure to poor air quality, the same as 2,700 deaths annually in the city according to Global Burden of Disease (2017).

World Health Organization states that “air pollution raises the risk of stroke, heart disease, lung cancer, and chronic and acute respiratory diseases, including asthma, increases for the people who live in polluted communities”. Air pollution kills around 7 million people each year worldwide, according to the World Health Organization (Clague, 2017). In 2013, those deaths cost the global economy $225 billion in lost labor. Currently, 9 out of 10 people breathe highly polluted air; following health problems, the productivity of workers might be adversely affected which in turn hamper output levels. Despite the effort of reducing air pollution or improving the air quality in developed countries, the mortality and morbidity rate has not decreased on a global level.

Addis Ababa is the capital city of Ethiopia and diplomatic capital for Africa (OAU, ECA), regional headquarters like UNDP, UNICEF, UNHCR, FAO, ILF, ICO, and ITU has a rapid population growth rate of 3.8% resulting in a rise of approximately 5% of urban waste generation per year (Addis Ababa City Administration, 1998). IDWS-Addis Ababa's considerable amount of waste ends up in an open dumping site (Koshe), polluting both surface water and groundwater quality. This damping site can create flooding which creates diseases and carriers for pests.

The word Koshe stands “dirty” in the Amharic language. This area covers an estimate of 36 hectares with piles of garbage as deep as 40 meters according to the UNDP’s office.

There are residences that support themselves and their family by picking up waste at Koshe landfill. In this location hundreds of squatters, residences depending on the 50-year-old dumping site for their livelihood. The toxic smell of different pails of garbage collected from different areas of the city causes several health problems and can affect the productivity of that individual. The residents of Koshe area are victims of different health problems (PTSD, 2018).

Air pollution already affects human health and leads to a range of other impacts. According to Lu's (2018) air pollution has critically influenced the economic and social implications. Societies with lower socioeconomic status are vulnerable to air pollution and are more victims of severe health impacts. This study examines the implicating of air pollution on the socio-economic life of the community in Koshe waste dumping site. Koshe creates a poor environmental quality and take away residents good quality of life as it influence their health as a result, adversely affect the socio-economic life of the community.

1.2. Statement of the problem

Environmental pollution is physical and biological contamination of the earth's atmosphere that highly affects the normal environment process. It may broadly be classified into Natural pollution and Man-made pollution. Natural Pollution is polluted often by natural phenomena, such as earthquakes, floods, drought, cyclones, etc. Man-made pollution is a human cause for environmental pollution such as consumption, industrial production, waste disposal, transportation, and energy generation. Population growth in developing countries like us has huge influences on our quality of air.

This is due to a large dependency on agriculture; in addition to that rapid population growth has affected land-use and food production systems, leading to ecologically damaging challenges due

to intensive production and consumption patterns (Preston, 1996). A study by Berhanu (2012) on the major environmental issues affecting Ethiopia, stated that in Ethiopia soil erosion and land degradation, deforestation and forest degradation, water scarcity, biodiversity loss, and various types of pollution occur frequently. The study conducted by Mekonnen (2009) the landfill sites in the city including the existing open dumpsites that cannot match or meet even the minimum scientific criteria, which can cause fire hazards around the sites if not properly handled. He also discussed the solid waste management activity in Addis Ababa that garbage is collected in two manners. The first one is collecting from door to door and transporting the solid waste to the transfer station. Secondly, it is transported from the transfer station to the dumping site located at the "kosher" disposal site. These activities are carried out by the sub-city sanitation administration. These solid waste products collected from a different area of the city are dumped in a non-hygienic form to the Koshe area.

Furthermore, Yonas (2020) conducted research on the assessment of water supply and sanitation problems, which showed that the sanitation facility of the community around Addis Ababa is very poor and it lacks basic requirements. A proper working public sanitation area includes a clean and reliable water supply for hand washing, personal hygiene, and flushing of toilet facilities.

Abera (2009) examined the magnitude of air pollution and daily measurement of ambient carbon monoxide in traffic-congested areas of Addis Ababa, his study focus on the mathematical measurement of air pollution rather than examining the impact that it causes on the community. Wondwossen (2013) explained that there is a little sewerage system in Addis Ababa, which is less than 3% of the population, is provided the standard sewerage system.

Even though the study put the number of people who get the standard sewerage system, it did not address the impacts on the health of the residents. However, previous researchers did not address the implicating of air pollution on the socio-economic life of the community in Koshe waste dumping sites. Therefore, in this study the researcher aims to attempt the implicating of air pollution on the socio-economic life of the community, focusing on the Koshe waste dumping site. Lastly, it is believed that this study would bring new findings that are related to the objective of this particular study.

1.3. Objective

1.3.1 General objective

- This thesis attempt to assess the implicating of air pollution on the socio-economic of the community at Koshe waste dumping site.

1.3.2 Specific objective

- To assess the implicating of air pollution on the socio-economic of the community at Koshe waste dumping site;
- To identify the challenges faced by the residents who are living near to Reppie waste energy plant;
- To describe economical challenges caused by air pollution on the residents of Koshe area;
- To identify health problems caused by air pollution**.**

1.4. Significance of the Study

Koshe dumping site is the only dumping site available for the entire capital city with more than three million inhabitants. It has been located in the southwestern part of Addis Ababa bounded by Nefas Silk-Lafto and Kolfie sub-cities. The area was a dumping ground for Addis Ababa's waste for more 50 years, handling hundreds of rubbish pickers who sell equipment recovered from the waste.

According to World Health Organization (2005) Air pollution is a result of the dangerous smoke emitted from the combustion of biomass fuels, indoor air pollution is accountable for more than 50,000 deaths annually and causes nearly 5% of the burden of disease in Ethiopia. The air quality in Addis Ababa is moderated, this means Air quality is acceptable; however, for some pollutants, there may be a moderate health concern for some people that are sensitive to polluted air.

Current studies have not provided sufficient residential views to assess the role of socio-economic factors upon the evolution of air pollution in Koshe landfill. This work will provide insight up on the relationship between environmental and social-economic factors. Furthermore, this study will provide a much-needed baseline for future air quality improvement interventions in the dumping site located at Koshe. And also the findings of this study will serve as a reference document for other researchers to embark on studies of the pollution or related kinds in other parts of the city.

1.5. Delimitation of the study

The study is confined to Koshe dumping site of Addis Ababa city. Because of this, findings cannot be generalized to other dumping site of Addis Ababa. In order to make the study more manageable, it is delimited in concepts and time. Regarding the concepts, it is delimited to air pollution even if the study area is also vulnerable to other pollutions. On the other hand, this study was a cross-sectional study design which only reflects overview of the current condition of air pollution at Koshe dumping site.

1.6. Limitation of the study

While undertaking the study the researcher faced the following challenges. The researcher finds it difficult to interview participants due to the bad smell of the research area. The other limitation was the unwillingness of participants to have their photos taken. Some participants were not willing to be recorded during the interview. In addition, during the interview, loud noises from the industrial near to the research area made it difficult to communicate with participants. Lastly, while the researcher conducting focus group discussion the researcher infected with Covid 19.

1.7. Organization of the Thesis

The study is organized into five chapters. The first chapter deals with the introduction which comprises the background of the study, the statement of the problem, basic research questions, objectives of the study, significance of the study and delimitation of the study, limitation of the study, definition of key terms, and organization of the study are included further on the study. Chapter two reviews the literature which leads to the development of a conceptual framework. Chapter three also deals with the method of the study. Sources of data and variables, methods of

data analysis are described in this part. Chapter four discusses the results and analysis. The last chapter will include the conclusions and recommendations of the study.

1.8. Definitions of Key Terms

Air pollution: refers to the contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere (WHO, 2021).

Sanitation: is defined as access to and use of facilities and services for the safe disposal of human urine and faeces (WHO, 2018).

COVID-19: is a respiratory disease caused by SARS-CoV-2, a new coronavirus discovered in 2019. The virus is thought to spread mainly from person to person through respiratory droplets produced when an infected person coughs, sneezes, or talks (CDC, 2021).

Respiratory disease: are a disease of the airways and other structures of the lung. Some of the most common are asthma, occupational lung diseases and pulmonary hypertension (WHO, 2021).

Air quality: is described according to the air which is based on the concentration of pollutants present in the air at a particular location (UCAR, 2021).

Methane: is colorless, odorless gas that occurs abundantly in nature and as a product of certain human activities. Methane is the simplest member of the paraffin series of hydrocarbons and is among the most potent of the greenhouse gases (Britannica, 2021).

Decomposition: is the breakdown, by physical and biological mechanisms, of organic substances found in the soil (Encyclopedia of life Science, 2001).

Chapter Two

Review of Related Literature

2.1. Introduction

This chapter briefly discusses the previous studies on environmental conditions, rapid population growth and its contribution to air pollution, studies on the economic and health impacts of pollution and sanitation conditions.

The major environmental issues included are:

- Climate change,
- Pollution,
- Environmental degradation,
- Resource depletion

Environmental pollution has existed for generations. Still, it is the world's greatest problem humankind facing. Pollution is the leading cause of death of thousands of people around the world. Global environmental pollution is caused by industrialization, urbanization, mining, and exploration. Both developed and developing nations share this burden together, though awareness and stricter laws in developed countries have contributed to a larger extent in protecting their environment (Microorganisms for sustainable environment and health). Water pollution, Air pollution, Solid Waste pollution, and Noise pollution are some of the environmental pollutions. Chapter two will focus on air pollution and its related pieces of literature by overviewing previously published works and evaluating available works of literature including the theoretical framework.

2.2. Air pollution

93% of the world's children breathe toxic air every day according to World Health Organization (2018) report. On this report, about 1.8 billion children breathe air that is so polluted which leads them to severe health problems. This study only views the impacts of pollution but doesn't show a significant solution to it. The indoor air quality is much worse than outdoor air quality. According to The United States, Environmental Protection Agency (EPA) states that indoor air pollutants are often 2 to 5 times greater than outdoor levels of the same pollutants. In some cases, the indoor pollutants can exceed 100 times more than the outdoor levels of the same pollutants.

Jerry's (2015) study on Air pollution states that air pollution is a mixture of solid particles and gases released in the atmosphere, finely divided solids, or finely dispersed liquid propellant gas at rates that exceed the natural capacity of the environment to absorb them. These toxic substances can cause unhealthiness and affect economic growth. Pollution can be caused by numerous factories. Focusing on the cause of air pollution, there should be more studies on the improvements of air quality which result in the increase in life expectancy and lowers mortality and morbidity rate all over the world.

Rapid population growth and environmental pollution are intertwined on sustainable development. Air pollution is the cause of death for estimated seven million people worldwide every year. WHO data shows that almost all of the global populations (99%) breathe air that exceeds WHO guideline limits containing high levels of pollutants, with low- and middle-income countries suffering from the highest exposures.

Very few studies focus on the relationship between them. Population growth has two impacts; the first one is; humans are consumption of resources (land, minerals, water…) and secondly, humans are waste producers. Dr. Kumar's (2010) study on consumerism states that the waste product caused by consumption is air and water pollutants, toxic materials, and greenhouse gases. Consumerism refers to the consumption of resources by the people. While early human societies used to consume much fewer resources, with the dawn of the industrial era, consumerism has shown an exponential rise. It has been related both to the increase in the population size as well as the increase in our demands due to change in lifestyle.

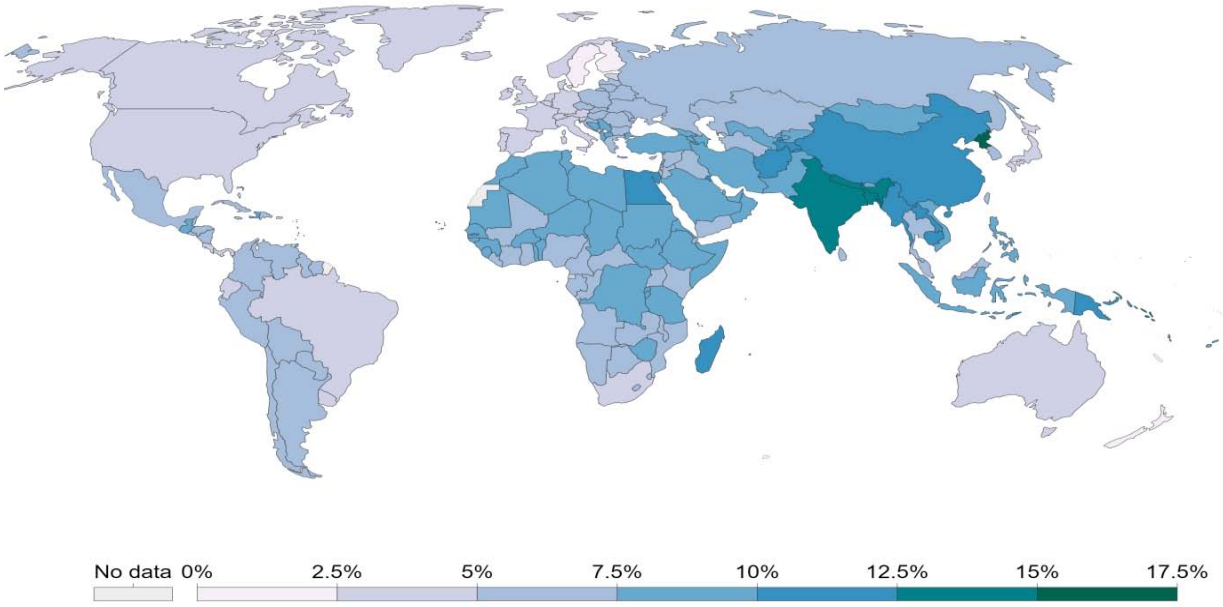


Figure .1 In the map shown above shares the deaths attributed to air pollution across the world in 2017.

The figure above indicates on low and middle income countries with high level of pollution exposures.

The combination of outdoor and indoor particulate matter and ozone are the risk factor for many of the leading causes of death including heart disease, stroke, lower respiratory infections, lung cancer, diabetes COPD. World health organization data shows that 9 out of 10 people breathe polluted air which exceeds too many cases. According to Cramer (2002), Air pollution has proved to have significant negative effects on human health, this suggests a model of reciprocal causality with a negative feedback loop; population growth indirectly causes reductions in the population growth rate. Population growth affects the air which leads to affecting the growth rate. But numerous studies confirmed that air pollution is responsible for a low proportion of total deaths, and even if air pollution has a negative impact on fertility rates and reproductive health, there is little evidence or studies indicates that the levels of fertility being affected; which has a controversial result on Cramer's study. People worldwide are increasingly living in urban areas.

Economic growths are noticeable in urban areas compared to rural areas. However, an increase in pollution is the result of large concentrations of people. A recent paper by Muller and Jha (2017) looks at these trade-offs analyzed the population growth, increases in emissions, and economic growth to see if they are linked by stating economic growth measured by GDP (Gross Domestic Product) of metropolitan areas and personal income. In developing countries, there is an alarming population growth rate. With this growth; the economies of developing countries are still growing. However, in developed countries, because they have economic resources; they invest in cleaner fuel sources and technologies that limit emissions. However, air pollution outcome affects the weather condition of the world.

Even if the developed countries are advanced; they are still victims of global warming, droughts, and flooding. So it's unpredictable to fully claim that air pollution affects based on an economical wealth of a country. Africa is home to 1.216 billion people (16.72% of the total world population) based on the latest United Nations estimates. Africa has the world's deadliest air pollution spot. Even if, most of the air pollutants are found in Asia; in Africa; the South part (Mpumalanga) is the largest area infected by the deadly nitrogen dioxide globally; it is the home for dozen coal-fired power stations. Africa is still being an impact of both indoors and outdoors pollution. Africa's indoor air pollution is the impact of economical factors. 3 billion people still cook and heat by using solid fuels.

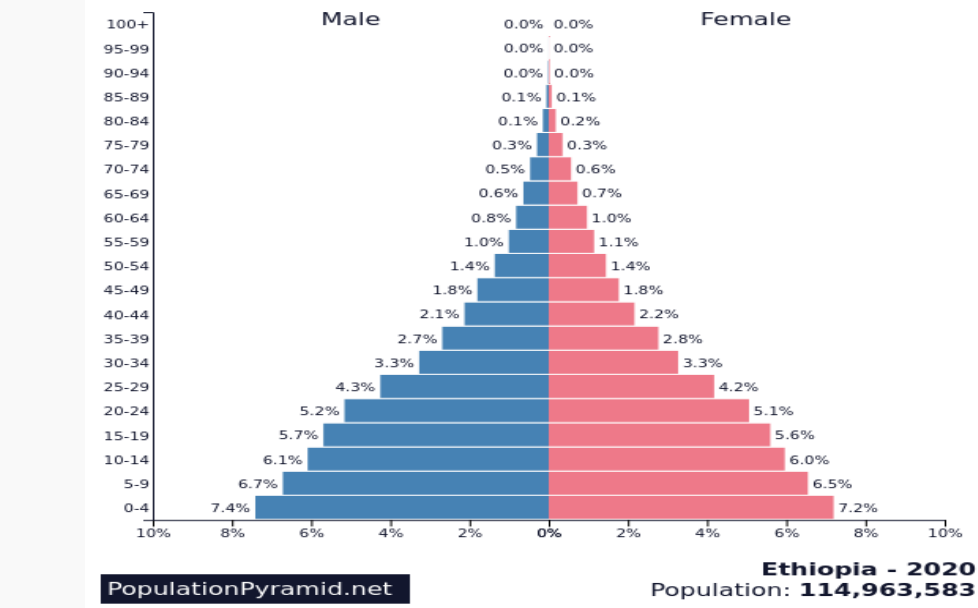
Most are financially poor and live in low and middle-income countries. Such wasteful cooking fuels and technologies make high levels of household air pollution with a range of health-damaging pollutants, as well as small soot particles that breakthrough deep into the lungs. In poorly ventilated dwellings, indoor smoke can be 100 times higher than acceptable levels for fine particles by OECD report (2016).

The exposures to indoor air pollution are particularly among women and young children, who spend most of their time near the domestic hearth. 3.8 million people a year die prematurely from illness attributable to the indoor air pollution caused by the inefficient use of solid fuels and kerosene for cooking. The deaths of estimated 3.8 million people each year are caused by health problems from household air pollution. Inefficiently usage of solid fuels and kerosene for cooking is the primary household pollutants WHO (2016).

According to World Health Organization (2016), deaths from outdoor air pollution in Africa grew by 60%. Urban pollution has different definitions all over the world. The common way of defining urban pollution is when harmful or poisonous substances in the air of the cities. Urban pollution can occur due to natural sources but the most frequently are due to human activities.

A study made by European Commission's science and knowledge service (2015) shows, based on the available information, the main sources that contribute to air pollution in the cities are traffic, domestic fuel burning, combustion and agriculture, industrial activities, and natural dust. Urban outdoor air pollution is accountable for an estimated 49,000 premature deaths annually in Africa (Jackson, 2018). Outdoor air pollution affects the health and life chances of millions of people in Sub-Saharan Africa (SSA) every day. People living with low income are victims of higher contaminated air and tend to suffer health problems. Pollutant emissions have direct and indirect effects with a wide range of contact on human health, ecosystems, agriculture, and materials. Pollution in Sub-Saharan cities appears to be on the rise. The main causes are the use of fossil fuels in transport, the burning of firewood, power generation, industry, and domestic sectors are some of contributing to pollution levels. The study shows the causes of pollution and none on the techniques of solving them.

Ethiopia is located in East Africa with an area of 1.12 million square kilometers. It is a landlocked country bordered by Kenya in the South, Eritrea in the North, Sudan in the West, and Djibouti in the East. The 2007 census preliminary report indicated that Ethiopia has a total population of 73.92 million with 84% rural and 16% urban distribution. It’s one of the poorest nations in the world with per capita gross national income (GNI) of about US$110 in 2004. Ethiopia's population pyramid indicates that there are a large number of children in relation to the working-age population by Dr. K. Tesfaye Fantaye



(2019)

Figure 2. 2019 population pyramid of Ethiopia by PopulationPyramid.net.

Children are venerable to pollution in developing countries like ours are exposed to high concentrations of air pollutants. This will more often develop respiratory ailments which prevent them from developing and learning well which will lead them to suffer in adult life from low levels of qualifications and skills. Ethiopia has rapid urbanization progress which means an increase in motorization and economic activity that leads to increased air pollution.

Ethiopian population policy was issued in April 1993 and aims at closing the gap between high population growth and low economic productivity through a planned decrease in population growth combined with an increase in economic returns. With specific reference to natural resources, the main objectives of National Population Policy are: making population and economic growth compatible and the overexploitation of natural resources unnecessary.

By maintaining and improving the accommodating capacity of the environment by taking appropriate environmental protection and conservation measures by Assefa Hailemariam (2016).

Addis Ababa is the capital city of Ethiopia with a population of 5,005,524 in 2021. The population in the city increasing from time to time; Addis Ababa is considered a major metropolitan city by any developing country standard. Population explosion and the associated anthropogenic activities generate huge amounts of different types of wastes (air, solid and gaseous) that adversely affect the physical environment. According to the study in Addis Ababa by Abera Kumie (2009), the 15-minute mean (+SD) CO concentrations were resolute to have strong evidence that indicates the presence of increased exposure to indoor air pollution respectively observed during the wet and dry seasons of 2007 and 2008.

The World Bank claimed that solid waste management should collect, treat and dispose of waste from all residents. Solid waste can be collected from door to door or by using communal containers. In Addis Ababa, these collected wastes are dumped at a site called Koshe site. Clague (2017) reported that Koshe is a large open landfill with a surface area of 25 hectares which used to receive 300,000 tons of solid waste from Addis Ababa. It is the only dumping site available for more than three million inhabitants of the capital city of Ethiopia.

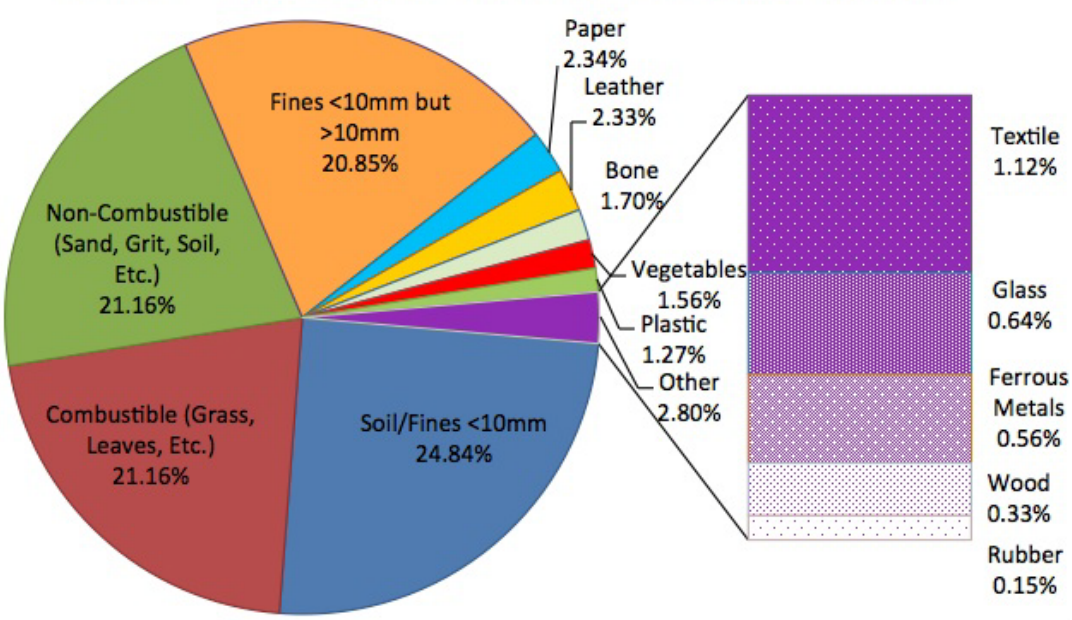


Figure 3. Waste combinations in Addis Ababa, Ethiopia 2010

Koshe is located at the south west of Addis Ababa. It is under the Nifas Silk-Lafto and Kolfie sub cities administration. The Koshe site existed for over 50 years and has been a home for hundreds of residents; which some earn income from picking rubbish that sells materials recovered from the dumping site.

With a large number of population in the city; Addis Ababa's current waste management system first collects waste at bins placed throughout neighborhoods then collects and transports this waste to the landfill.

2.3. Economical and Health impact of air pollution

In Ethiopia; there are very limited studies that focus on air pollution in general. However, the few available studies show worrying morbidity and mortality impacts of ambient air pollution in the country.

According to the recent Global Burden of Disease (2019) states that an estimates of 5.5 million premature deaths globally are caused by air pollution both indoor and outdoor combined. Beside air pollution causing lung and other respiratory dysfunctions; it has great influences on the ecosystem. Limited researches were given to the role played by air pollution on the amount of agricultural production. This will affect economic growth as well as welfare.

According to the overview solid waste management system in Addis Ababa report (2010) anticipated the daily solid waste generated in Addis Ababa City is about 765 tons with a daily per capita generation of 0.45 kg. Of the total solid waste generated, 76% is from residential sources, 9% from commercial areas, 6% from street sweeping, 5% from industries, 3% from hotels and 1per cent from hospitals. There is very low solid waste segregation, re-use or recycling, with up to 80% of waste being disposed without any re-use or recycling. Only 65% of the daily solid waste generated is collected, 5% recycled and 5% composted. The rest of solid wastes collected are transported to the dumping land fill at Koshe. These solid wastes are connected to the drainage channels which causes problem on the environment. Open burning of refuse in backyards and other open places also remains a major problem in the city. It is difficult to locate a hygienic public sanitation in the city; this leads to environmental pollution.

However, the waste management situation in Addis Ababa is expected to improve particularly with the new 50MW Reppie waste to energy plant that is expected to incinerate approximately 1,400 tons of waste per day (Global Burden of Disease study, 2019). The rate of urbanization is increasing fatly from time to time. The natural and rural-urban migration is the significant increasing the urban population which indirectly demands the urban transport facility.Various studies indicated the growth of private and freight mobility in Addis Ababa have expanded the role of transport as a source of emission of pollutants and their multiple impacts on the natural environment.

Literatures of different countries show that across Africa, increased motor vehicle use, industrial growth and dust storms coupled with wood-fired cooking stoves is resulting in air pollution that is choking the continent's inhabitants**.** Climate change is the major environmental issues affecting east Africa countries. It is caused by soil erosion and land degradation, deforestation and forest degradation, water scarcity, biodiversity loss, and various types of pollution published by World Wide Fund on climate change in East Africa (2006).

In developing countries, where the possibility of measuring the concentration of indoor air pollutant is very limited, the use of proxy factors is very useful Levy et al (1998). In Ethiopia, it is mainly caused by vehicles, followed closely by industry, then by domestic emissions. Air pollution in Ethiopia is characterized by the burning of biomass in household stoves and the use of adulterated liquid fuels. The magnitude of indoor air pollution is commonly assessed indirectly by measuring proximate factors such as fuel and stove type or directly by measuring the level of indoor air pollutants.

Generally, any fuel with complete combustion generates heat (energy), CO2 inefficiency, complete combustion is not at all possible under any circumstance where fuel is commonly used. The principal products of combustion include carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter and volatile organics. All of these can be categorized into three types: gaseous, particulate matter, and volatile substances (World Health Organization, 2005). According to Abera (2009) there is strong evidence that indicates the presence of increased exposure to indoor air pollution. The use of biomass fuel in the households, and the increased NO2 concentrations indicating higher value than the international practice, suggest that household members are highly exposed to indoor air pollution in the rural settings of Ethiopia. Thus level of understanding regarding health.

2.4. Sanitary status of Addis Ababa

One of the most critical challenges facing the city of Addis Ababa today is the provision of adequate and reliable sanitation services to its populace. According to the CSA Welfare Monitoring Survey (2012) an estimate of 72.27% of Addis Ababa residents lacks access to adequate toilet facilities. The current sewerage system of Addis Ababa city is not adequate hence large segments of the city rely mostly on pit latrines and septic tanks. The current standardized sewage system only covers about 10 per cent of the population hence urgent need to scale up investments in sewage infrastructure for both solid and liquid. According to the Addis Ababa Health Bureau (2000) water and sanitation related diseases are responsible for much of the morbidity in hospitals. In the year 2000, approximately 66,618 numbers of cases were caused by sanitation related diseases. Mean a while residents study by Aklilu (2002) on whether households in Addis Ababa are willing to pay for improved solid waste management taking by using two-stage stratified sampling, a total of 430 households were interviewed.

Econometric models are fitted to identify factors determining the willingness to pay and factors that determine it. The survey result showed that a great deal of the population is overwhelmingly dissatisfied with the existing service. They feel that households have to cooperate (including in financing) with the government to improve this condition. This study are available for the bureau but has got that much of attention. The year 2000 was the most recent study that is available which doesn't indicate the current conditions. Another study by Fisseha (1997) states that majority of the households who were randomly selected are willing to pay a higher tariff for a better service system. It lacks behind why the sector hasn't been improved. With rapid urbanization in Addis Ababa, the lack of proper public sanitation infrastructure provision is an enormous problem and is certain to become much higher. This study will assess the troubling that the residences at Koshe landfill face on their daily life.

2.5 Theoretical Framework

Waste Management Theory is founded on the expectation that waste management is to prevent waste causing harm to human health and the environment. The proper definition of waste is crucial to constructing a sustainable agenda of waste management. It is largely the case that current legislation attends to existing waste. Waste management options such as recycling, composting, incineration and landfill (koshe) impact health and well-being in profound ways, particularly for people who work directly with waste or live and work around waste sites. Lox.F (1994) defines waste as either an output with ('a negative market') 'no economic' value from an industrial system or any substance or object that has 'been used for its intended purpose' by the consumer and will not be re-used. Metals, plastics, clothes and other items from the Koshe landfill are collected and recycled and sold as a form of income.

Chapter Three

Research Methods

This chapter covers description of the study area especially it deals with overview of the waste dumping site at Koshe area, map of the study area, research design and approach, sampling technique and procedure, methods of data collection, types of data and their sources, methods of data analysis.

3.1 Description of the Study Area

Koshe site is located at south west of Addis Ababa**,** Latitude and longitude coordinates: 38.5325105, 8.0151289. It is 13 km away from the center of the city; bounded by Nifas Silk-Lafto and Kolfie sub-cities. The area has a surface area of 25 hectares and it was a dumping ground for Addis Ababa's rubbish for more than five decades, hosting hundreds of rubbish pickers who sell materials recovered from the waste. The site is getting full due to surrounded housing areas and institutions. More than 200 - 300 waste pickers per day work continuously and obviously living nearby the site and interfering the operation of the work for collection of salvageable materials.

Figurem 4. 2020 Map of the 11 sub-city in Addis Ababa, Ethiopia

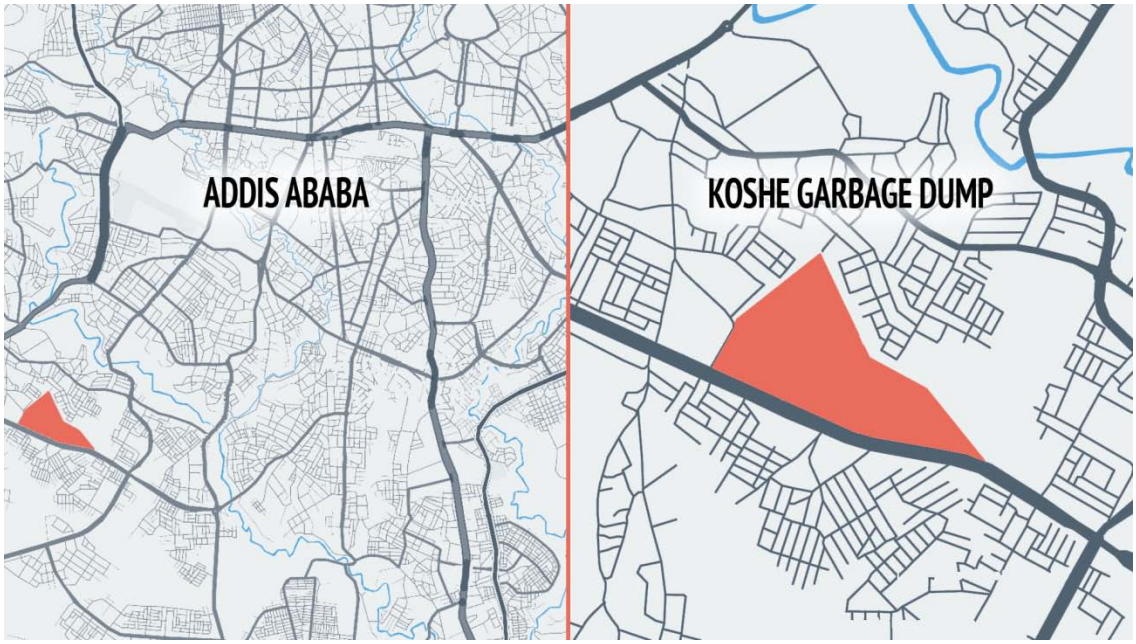


Figure 5. Kolfe Keranio, which is Addis Ababa's most populous sub city; Koshe is a sprawling landfill, spanning about 1 kilometer along its longest side.

The study area of this research was selected purposively. The study area is located in Addis Ababa which is bounded by Nifas Silk-Lafto and Kolfie sub cities; these are two of the 11 sub cities of Addis Ababa. The study was conducted at Koshe (dirt), a huge open landfill with a surface area of 25 hectares which used to receive 300 000 tons of solid waste from Addis Ababa, the capital of Ethiopia (Gordis, 2008). Koshe is still the dumping site available for the entire capital city with more than three million inhabitants. It has been this way for the past five decades. There are permanent residents and people that continue their livelihood by hosting hundreds of rubbish and sell materials recovered from the waste. Air pollution, Fires, Soil contamination, Waste overflow, Surface water pollution / decreasing water (physico-chemical, biological) quality are some of the environmental impacts in Koshe area.

3.2. Research Approach

To get more reliable information from the selected sources, the researcher used qualitative research. By conducting a field research; a qualitative approach is based on collecting and analyzing non-numerical data to understand concepts, opinions, or experiences. There is a important insights to be gained from qualitative approach. It provides deeper understanding of the research problem. An in depth interview, key informant and FGD was used for maintain high level of reliable and validity of the study.

3.3. Research Design

This study implemented exploratory research design approach since, studies related to the implicating of air pollution on the socio-economic life of the community have not been addressed and additionally, previous studies did not cover the issue. To gather data, the study employed exploratory qualitative research design approach which provides a better result to the objective of the study. In terms of time span, the researcher employed a cross-sectional research design. Therefore, the researcher collected the data at a particular time.

3.4. Sources of Data

To make the study certain, both primary and secondary data sources are obtained. Both data sources of information provide sufficient information on the implicating of air pollution on the socio economic of the community at Koshe dumping site.

3.4.1 Primary Sources of Data

The data used for the study was collected by fieldwork that was carried out in July of 2021. The primary data was collected from a sample of the residences through in depth interviews, focus group discussion, observation and key informant interviews prepared for the study. This is employed to make this research more reach in information and valuable.

3.4.2 Secondary Sources of Data

The study also compiled various published and unpublished documents: books, journals, empirical studies which are related to the implicating of air pollution on the socio economic of the community at Koshe dumping site.

3.5. Method and instruments of data collection

3.5.1 In-depth interview

In-depth interviews are used in this research, because it is believed that it would be practical to use in-depth interviews when one wants comprehensive information about a person‘s thoughts, behaviors and wants to examine new issues.

In-depth interview was conducted with twenty five purposely selected participants, who are residents of the study area. The researcher used in-depth interview. Qualitative research seeks detailed information about the topic and as such plans to use the method of an ‘in-depth interview’. An in-depth interview was chosen as a method because of the need to collect a vast amount of information from respondents and it would be difficult to get all information needed by using other methods like questionnaires and other related methods. An interview also helps the researcher get a deeper understanding of the issue under study and also allows the respondents to explain their thoughts regarding the interview questions. In addition, it minimizes the chance of unanswered questions, which is a problem in method like survey (questionnaire).

3.5.2 Focus group discussion

Focus group discussion is a qualitative method of data collection approach. This method will allow the researcher to get in-depth information of the social issue. FGD needs to have a purposely selected representative of the community in study.

Focused group discussion involves gathering people from similar background (Koshe area residences) or experience together to discuss a specific topic of interest in this case the impact of air pollution.

It is the form of qualitative research where question are asked about their perspective, beliefs opinion and idea. Focus group discusses are free and open discussion that participant can freely talk. FGD helps to generate data at community level and involves a small group of respondents to discuss on issues forwarded by the facilitator who is a skilled moderator focusing on key issues of the research topic (Mwanje, 2001). It is believed that by using focus group discussion new information would be extracted which may not be raised in face to face or in-depth interviews. Accordingly, one focus group discussion with five participants was implemented.

3.5.3 Key informant interviews

Key informant interview is a qualitative method of data collecting approach. It is used to interview a person that has experience and knowledge of the issue under study. These community experts, with their particular knowledge and understanding, can provide insights on the nature of problems and give recommendations. The researcher used unstructured interview method because of its flexibility and makes clear any time when there is indistinctness. This study used Face-to-Face format to conduct the interview. The researcher conducted key informant interview with dry waste manager of Nifas Silk Lafto Sub city and Woreda 2 waste management sector.

3.5.4 Field Observation

Field observation is a defined as a qualitative method of data collection that aims to observe, interact and understand people while they are in their environment. Observation is helpful and additional tool that can support the data obtained from other tools.

In this method, the behavior or outcome of the situation was not interfered by the researcher. It helped the researcher to have a contextual data on people, situation and the surroundings. Field observation is widely used in public setting. This study has implemented direct observation in the residence of Koshe area.

3.6 Sampling technique

Sample is a subset of individuals from a larger population; by selecting the group that can provide the information it provides data for the research. When the research was conducted on a group of people, it's rarely possible to collect data from every person in that group. Instead, the researcher selects a sample. To draw valid conclusions, the researcher carefully selected a sample that is representative of the group as a whole. The two types of sampling techniques are called probability and non- probability sampling. This study implemented non probability sampling technique.

3.6.1 Non probability sampling

As Creswell (2014) explained qualitative research is different because the researcher can purposefully select the place of the research and people who participate in the research, which can help the researcher, better understand the objective of the research.

The participant's in the population won't have equal chance unlike probability sampling. The researcher selected respondents using purposive sampling technique in the study area. In non-probability sampling, units are deliberately selected to reflect particular features of or groups within the sampled population.

Non probability sampling is well suited for small-scale, in-depth studies. Since the study looking for the implicating of air pollution on the socio-economic life of the community, participates were selected based on the experience and knowledge which is related to the pollution that is occurring at Koshe.

3.7 Criteria's for Sampling

- Age 18-65, doesn't include children's and elderly
- Resident at Koshe landfill
- Work place located around dumping site
- Daily activity involves passing through or walking through the dumping site

3.8 Data Analysis

After collecting the necessary data the researcher reviewed and transcribed the collected data. After transcribed the data was coded. Coding can be explained as a categorization of data. A code can be word that can represent the data. By identifying their themes and organizing, the researcher interpreted and summarized.

3.8.1 Review and Transcribe

Creswell (2003) stated that basic principle of a qualitative research is that, it is an ongoing process involving continual reflection about the data, asking analytic questions and writing memos throughout the study.

During the data collection, the researcher used audio recording to collect data from all participants using in-depth interviews. Face-to-face interviews using a pre-prepared interview guides.

After conducting all the interviews, the researcher translated and transcribed audio recorded sounds and notes directly from Amharic in to English by listening participant's Amharic voices. What is represented in the transcript (e.g., talk, time, nonverbal actions, speaker/hearer relationships, physical orientation, multiple languages, and translations); who is representing whom, in what ways, for what purpose, and with what outcome; and how analysts position themselves and their participants in their representations of form, content, and action (Green & Dixon, 1997).

In this research transcription was conducted from, key-format interview, in-depth interview and focus group discussion, by writing exactly respondents answer word by word. After identifying meaningful and rich quotes from transcripts by deciding what belongs where according to the research objectives was done. Moreover, sentence based coding was implemented to categorize themes.

3.8.2 Coding and Themes

Gibbs, 2007 stated coding as how you define what the data you are analyzing. The Researchers identify key words and then systematically search the corpus of text to find all instances of the word or phrase. Each time the words are finding, by making a copy of it and its immediate context. The purpose of thematic analysis is to identify patterns or themes evident in several cases after pre-coding, coding, categorizing and theme development processes was formulated, the analysis was made on the findings and main themes described in line with the objective and research questions to be addressed. Lastly, the major findings of the study will be presented and discussed.

3.8.3 Ethical consideration

In this study, the researcher started gathering the data, after obtaining formal letter from Addis Ababa University, department of Sociology, additionally; Informed consent was obtained with signatures of participants before data collection. Participants were informed that the data would serve only for academic purpose and would have no negative consequence on them. Ideas and assumptions which are taken from other books, journals and researches are properly cited and acknowledged.

Chapter Four

Data Analysis and Presentation

This chapter presents the analysis and interpretation of the data collected by utilizing qualitative instruments which are: in-depth interviews, key informant interviews, focus group discussion and observation. This chapter classified in to five main parts; the first part reveals the impact of population growth on the air pollution. The second part indicates the economical challenges that the residents faces during their stay at the dumping site. The third part analyses the health challenges caused by the air pollution. The fourth part identifies the challenges that the residents near the Reppie waste to energy plant deal. Lastly the study analyses the challenges the residents deal on public sanitaria options.

4.1. Background Information of Participants

Data were collected through in-depth interview, key informant interview and focus group discussion. In this study 31 participants were purposely selected because of their knowledge and information they can provide to the study. FGD was conducted with 5 purposely selected participants under the household located near the dumping site. A key informant interview was conducted at Nifas Silk Lafto Sub-city dry waste management sector. Additional key informant interview was conducted at Woreda 2 of Nifas Silk Lafto Sub-city dry waste management sector. Koshe landfill and part of Kore is administered under woreda 2 and Kolfie Sub-city.

The table below indicates the socio-demographic states of the respondents that participated both in-depth interview, FGD and key informant interview. The characteristic includes age group, sex, educational background and marital status.

Categories	Interview	FGD (focus group discussion)
No of participants	25	5
Sex	7 male & 18 female	1 male & 4 female
Age	18-50	18-50
Educational background	Primary education- 3 Secondary education- 22	Primary education-1 Secondary education-4
Marital status	Married-9 Not married- 13	Married-3 Not married-3

Table 1 Demographic profile of participants in Indepth interview and FGD

Sex	Age	Educational background	Marital status
Female	32	Bachelor Degree	Not married
Male	36	Bachelor Degree	Married

Table 1 Demographic profile of participants in Key informant interview

Data was collected on 10 observation days from July 30, 2021 through August 20, 2021 from 10:30 pm-12:00 pm.

4.2 The Reppie waste to energy plant

According to an article written by Jeffrey Morris (2021) on burning garbage; states that waste-to-energy is often offered as an efficient solution to waste crises. This method of waste disposal is inefficient. It is harmful to the environment. By burring waste materials whether it's wood, paper or plastic; carbon dioxide will be realized to the atmosphere which will cause green house effect. This effect will warm the earth surface which causes global warming. Converting waste to energy is not common in Africa. Reppie in Addis Ababa is the first waste-to-energy facility on the African continent. Waste-to-energy plants burn municipal solid waste (MSW), often called garbage or trash, to produce steam in a boiler that is used to generate electricity. Municipal solid waste is a mixture of active materials such as plastics, paper, yard waste, and products made from wood.

In-depth interview with 21 years old female respondent who works at female beauty salon in front of the Reppie waste to energy plant responded in following:

> *I am working at women's hair salon for almost two years. My customers and other co-workers complain about the dust surrounding caused by the factory. We did not have this kind of problem before waste to energy plant started working. This occurs after the Reppie incinerator uses the waste garbage's in order to produce electric energy. Waste to energy plant also produces burned wastes after it produce electric power, this wastes cause a problem because the wastes are dumped back to landfill. Evenif thee plant provide electricity, it is still a problem. During the summer; the used waste that got dumped back to the landfill releases toxic dust. When rainfalls, the smell makes it difficult to work and make costumers happy.*

As the in-depth interview implies that one of the challenges Koshe area residents are facing is Air, water, soil pollutions which are caused by Reppie waste energy plant. The residences of this study area have been living with toxic environment for decades. Projects have been established at Koshe area that can potentially minimize the pollution by reusing the landfill. The new Reppie waste to energy plant located at the landfill is one of the first wastes to energy incinerator. It is located at the side of the garbage landfill. In 2013 the incarceration plant was launched by President Mulatu Teshome and other high level government officials. The plant supposed to take 1,400 tons of waste daily, up to about 80% of waste generated by Addis Ababa. The new Reppie waste to energy plant is going to supply the capital with 30% of household's electricity consumption when it accomplish and work at the maximum potential.

The key informant 32 years-old female who works as a manager of Nifas Silk sub city Wereda 2 administration clarified the area in the following way:

> *In the areas called Kore and Koshe there is a landfill site, where the Reppie waste-to-energy plant found and the waste transporter trucks parked. These trucks collect waste tanks from all around Addis Ababa and transport it to the Reppie waste-to-energy plant. However, the community located at Kore and Koshe are affected by the pollution made by the Reppie plant and the landfill. In addition to that, areas like Mekanisa and Ayer tena which are close to the landfill are affected by the trucks which transport the waste. In addition it can be observed that the plants found in between the two way roads from Mekanisa to Kore, which are covered with dust and black smoke from the truck exhaust. This is causing not only pollutes air but also it pollutes the plants too.*

The waste management sector in woreda 02 collects 1200 ton of dry wastes every month. The amount has decreased according to the sector comparing it from last year. This is because of the fast response from the sector every day. The waste management has improved the way of removing as soon as waste is produced. In 24 hours waste disposals are collected from households and transported to the landfill every day. The Reppie waste-to-energy plant takes it as its input product to create electric energy. The plant has its own environmental pollution on the communities that live nearby. These communities that are vulnerable for pollution are low income households. Communities living at Kore and Ketena 6, Mariam neighborhood are facing air pollution and lack of basic access to safe drinking water. These communities also face toxic smell realized from the plant and also sound pollution that the plant makes.

According to U.S. Energy Information Administration (2021) generating electricity in a mass-burn waste-to-energy plant has seven stages:

1. Waste is dumped from garbage trucks into a large pit.
2. A giant claw on a crane grabs waste and dumps it in a combustion chamber.
3. The waste (fuel) is burned, releasing heat.
4. The heat turns water into steam in a boiler.
5. The high-pressure steam turns the blades of a turbine generator to produce electricity.
6. Pollution control method eradicates pollutants from the combustion gas before it is released through a smoke stack.
7. Ash is collected from the boiler and the air pollution control system.

The key informant 32 years-old female who works as a manager of Nifas Silk sub city Wereda 2 administration clarified the area in the following way:

> *The waste management sector in woreda 02 collects 1200 ton of dry wastes every month. The amount has decreased compared from last year. The fast response from our sector every day has improved, we remove as soon as waste is produced. In 24 hours waste disposals are collected from households and transported to the landfill every day. The Reppie waste-to-energy plant takes it as its input product to create electric energy. The plant has its own environmental pollution on the communities that live nearby. These communities that are vulnerable for pollution are low income households. These communities also face toxic smell realized from the plant and also sound pollution that the plant makes.*

This implies that communities living near industrial setting; machinery, construction, and vehicles become the most damaging sources of noise pollution. Residents living near by the street are affected by noise pollution which is caused by vehicles transport wastes from the landfill to the plant. The predominant noise pollution occurs when the Reppie incinerator realizes industrial noise due to vibrating panels, turbulent fluid flow, impact processes, electrical machines, internal combustion engines etc. Noise Induced Hearing Loss (NIHL) is the most common health problem caused by noise pollution. Being exposed to loud noise can also cause on different health hazards, Problems like heart disease, high blood pressure, stress and sleeping disturbances are the few problems. The participants on the FGD have explained that a loud and disturbing noise is realized during the maintenance of the machines inside the Reppie plant. In the Reppie plant there are different machines when one of the machine get fix the entire neighborhood will be disturbed because they use heavy machines to fix the other machine.

Even if the residences of Koshe site can't identify the benefits of the plant. The Reppie project provides 30% of household electricity, prevented the release of toxic chemicals into groundwater, and reduces the release of methane and saves land space.

In contrast in-depth interview with 43 years old male who works at retail shop in front of dumping site:

> *I have lived here for almost 20 years, in my point of view, the Reppie project hasn't provided anything for Koshe residents it has not solved our main problems for example Electricity is still a problem of Koshe residents and water resources are still a problem. In addition to that we are suffering from the loud sound that the plant realizes every morning which we could not get enough sleep the whole neighbor is disturbed by the noise which is come from the plant.*

4.3 Population growth and air pollution

The key informant 36 years-old male who works as a head of Sanitation Administration Office Associations of Nifas Silk Lafto stated in the following way:

> *As the population growths in the city; the amount of waste products increase. One of the major reasons for our area to be polluted is because Koshe is selected as a dumping site of wastes collected from different areas of Addis Ababa and dumped in unhygienic manner. Even if the Reppie incinerator plant uses this landfill as a byproduct for energy production; the problem is escalated because the number of people live in the city increasing rapidly which the area cannot handle wastes from all the households of Addis Ababa, that is the reason amount of the landfill has not decreased despite Reppie waste-to-energy plants.*

As per the data gathered from key informant interview indicate, Addis Ababa's 2021 population is now estimated at 5,005,524. As the population of a city increases, the emissions of air pollutants also increase, but the per capita emissions decrease. Koshe is the dumping site for Addis Ababa. As the population growth; the waste generation increases. Respondents have acknowledged that population growth have a direct impact on the increase of the waste landfill. Wastes are collected from door to door from residents of Addis Ababa city transported and dumped at to Koshe site twice a week. These solid wastes will block the drainage system located underground which will cause a toxic smell. The estimated daily solid waste generated in Addis Ababa City is about 765 tons with a daily per capita generation of 0.45 kg of the total solid waste generated. 76% is from residential sources, 9 % from commercial areas, 6 % from street sweeping, 5 % from industries, 3 % from hotels and 1% from hospitals (Mohammed & Elias, 2014). As it can be seen above the large amount of the solid waste generated from residents which means when the number of people increase in particular place, that directly affect the amount of solid waste in that area. The Reppie incinerator plant uses as a byproduct wastes (80% of the cities) from the landfill with amount of 1,400 tons of waste every day in return it will supplying the city with 30% of its household electricity.

In-depth interview with 27 years old male who works at Digital studio in front of dumping site responded:

> *I live with my parents and my dad usually burns wastes once a month. He collects papers plastics and put it outside. Sometimes door to door collectors pick them up. Mostly the plastics are taken by the door to door collectors or kurale workers but not the paper products. My works are done at home and I use lots of paper products.*

Sometimes my dad works on the indoor garden of our home and he burns the unwanted plants (Arem) together with the paper wastes.

With a rapidly expanding population Addis Ababa is heading towards mega-city status, but it is also facing severe environmental problems. Migration from rural areas to Addis Ababa, the city suffers from a high rate of population growth. Birhanu.T (2015) study states that about 55% of the population in Addis Ababa use open burning as their primary means of waste disposal. When solid waste gets burned a toxic gas is realized to the air. These polluted airs are inhaled by humans and animals.

Gases such as carbon dioxide create a greenhouse gas that is heating up our earth. According to the Addis Ababa Sanitation, Beautification and Park's Development Agency (SBPDA) 72.4% of the generated solid waste is collected, of which about 90% is landfilled, about 5% recycled and 5% composted, according to the SBPDA. The remaining 17.6% is disposed in open spaces, ditches, rivers, etc. or is burned on the streets or in back-yards.

As per the information gathered from the FGD group discussion, the most severely pollution occurs in the city rivers and river side’s. Especially, rivers that pass through the dumping site are pollution. In woreda 2, the Akaki River is a very polluted and the dry waste management of Nifas Silk sub city administration is working on addressing the issue. Residences in Addis Ababa use different techniques to remove solid wastes. Open burning of waste is a common problem in Addis Ababa owing to lack of an efficient integrated waste management system for the City.

4.4 Economical Challenges

4.4.1 Recycling system

In Addis Ababa; open garbage dumpsite method for as solid waste disposal are common. Besides having a negative impact on the environment; it was a beneficial for economical usage. The informal sectors play a big role on the recycling and reusing system of the city. Most of the wastes generated in the city are organic in their nature. Even if there are few formal recycling system in the city; wastes such as vegetable, bones, wood, combatable, non combatable and other wastes are collected and disposed by the government system. There are informal actors for collecting solid wastes. The recycling system uses these informally collected wastes that include metals, plastics, cloth and glass. These informal actors collect materials door to door or from the dumping site. A korale is a person that works in the neighborhoods by buying peoples' waste that can be fixed up and resell. After they collect and repair they sell their materials at Minaleshi Tera located at Merkato.

The key informant 32 years-old female who works as a manager of Nifas silk sub city Wereda 2 administration explained the practice in the following way:

> *The waste management sector in our Wereda collects 1200 ton of dry wastes every month. However, the amount has been decreasing compared from last year; our sector improved ways of removing, waste which is collected from the households will be removed within 24 hours and transported to the Reppie waste-to-energy plant takes it as its input product to create electric energy.*

International standard of disposing wastes are classified in three based on their contents:

1. *Green garbage cans for decomposing wastes*
2. *Yellow garbage cans for paper products*
3. *Red garbage cans for plastic and hazard materials.*

In our country, we have two ways of disposing wastes.

1. *Yellow for decomposing wastes*
2. *Blue garbage cans for plastic and other hazard wastes.*

Plastics and other non decomposing wastes are transported to the Reppie plant which can be used as an input.

As per the data gathered during the researcher's observation whether there are working trash cans around the main road of Koshe dumping site and Kore. The researcher has not identified any working trash cans. As per the in-depth interview gathered from woreda 2, there are built working trash cans on every bus stop. The Koshe and Kore don't have bus stops or trash cans across their roads.

In Ayer tena and Mekanisa area there are a total of 8 bus stops that have trash cans with yellow and green painting to support the wastes. Working trash cans helps the environment by storing solid wastes and separating recycling products. Functioning trash cans helps to reduce the pollution caused by waste. The woreda 2 waste management sector has two visions.

1. Creating awareness to the community on recycling.
2. Making Addis Ababa without landfill.

In developed countries, wastes are being recycled. No landfills are located inside their capital city. Data gathered from the key informant, within this six month the waste management on woreda 2 has 700,000 birr profit collected from recycling and reselling materials from the landfill.

Additional incomes were collected from cleaning services too. By creating partnership with recycling industries, job opportunities are created. Due to this partnership 14 employees are temporarily working on the sector.

The key informant 36 years-old male who works as a Head of Sanitation Administration Office Associations of Nifas Silk Lafto stated in the following way:

> *Solid waste can have different benefits if it is used properly, solid wastes dumped at Koshe site can be a resource of raw materials. Solid wastes can also used as a fertilizer raw product and for foreign currency. If solid waste products fertilized and used for the purpose of household income, the residents could be benefited. The other purpose of this fertilizer could be providing highly nutrients for the agricultural products. Treating solid wastes properly will improve the environment, increase air quality and protect public health. . In the coming years the sector will be working on additional projects with higher governmental offices. Making Addis Ababa no landfill city can be achieved if the sector works hand to hand with the community. If the community recycles, use disposable wastes as a fertilizing purpose and sell plastic products to collectors or if they don't want to sell, they can give away for collector instead of throwing out.*

The finding as per the key informant at the waste management sector indicates that wastes affect the environment leading to severe hazardous impact on lives. Some wastes may rot, but those that do not will smell and generate methane gas, which significantly contributes to the greenhouse effect. Refuse Disposal by Composting can eradicate degradable organic wastes. It means transforming various organic wastes to bio-fertilizers.

By using wastes as a fertilizer, composting waste helps to ensure environmental sustainability through preventing soil erosion. It helps to keep wastes in a controlled environment and also increase biodiversity in the soil by attracting different insects, bacteria, fungi, etc. Recalcitrant substances, plastics and polythene bags and others, cannot be composted. Residences should give or sell non composting wastes to dry waste collectors.

In-depth interview 38 years-old Female works at clerk also elaborated in the following way:

> *In my opinion the garbage site has benefited the community in different ways some of the community who live around Koshe landfill. There are residences with low income that earn money from the landfill. By collecting materials and reselling like cloth, metal and plastic they convert it to money by taking it to market places. These residences don't have other means of income. Leftover of food products from different hotels are a source of food for people at the landfill and source of food for their dogs, sheep and cows.*

This implies that on the results discussed above, the communities live around Koshe landfills are benefited economically. Some of them based their life on collecting materials from the area like: wood for firewood, metals, nails, clothes and shoes are the major ones. But plastics water bottles are the most ubiquitous material on the dumping site, after collecting the materials they sell them around Merkato the place called Minalesh Tera.

As per the data gathered from the FGD discussion, there are the whole sellers and middlemen who buy materials from waste workers and sell them to industrial actors. The materials are mostly small glass bottles, scavenged materials from the Repi dumpsite, containers, streets and household's small crafts men and whole sellers in Minalesh Tera in Merkato Independent buyers and Factories 19 plastic containers of different sizes and car tires. Then, there are the crafts men who make different kinds of equipment in Menalesh Tera from the waste they buy; and sell their products in market. The most common products made are sandals, ropes, chairs, washing container and metal stoves for charcoal. The informal sector contributes significantly in waste reduction and raw material production. It has also created job opportunities for many. The informal sector contributes significantly in waste reduction and raw material production. It has also created job opportunities for many. Nevertheless, data gathered during the researcher's observation on women's participation on recycling system is low. As per the in-depth interview gathered from woreda waste management sector, 89 employees collect door to door solid wastes from household's every day. 56 are women and 33are man. However, Reselling recycled materials are dominated by man. As per the data gathered from key informant interview indicate, 98 civil workers are working on street sweeping service. Street cleaning services are classified in two manners.

1. Streets that are cleaned twice a day
2. Streets that needs cleaning three times a day

The streets that are cleaned three times a day are:-

1. Three ways roads
2. High flow of traffic
3. Embassy roads

The streets that are cleaned twice a day are two way roads. The Koshe and Kore streets are cleaned twice a day. Two way roads are cleaned in two rounds.

1. From the morning 6:00am to 12:00pm
2. From 12:00pm to 5:00pm

The woreda has six professionals in environmental protection sector. The environmental protection sector prepares daily report on the performances of private owned cleaning service providers. If there is a poor performance and polluting the environment, the sector gives warning letter. If there is no improvement it will get suspended and remove it license and refuses the quality performance authorization. If its industrial based that's under the woreda, the sector has the power to close and banned it. If it's above the woreda control, the sector will transfer the issue to the higher governmental offices.

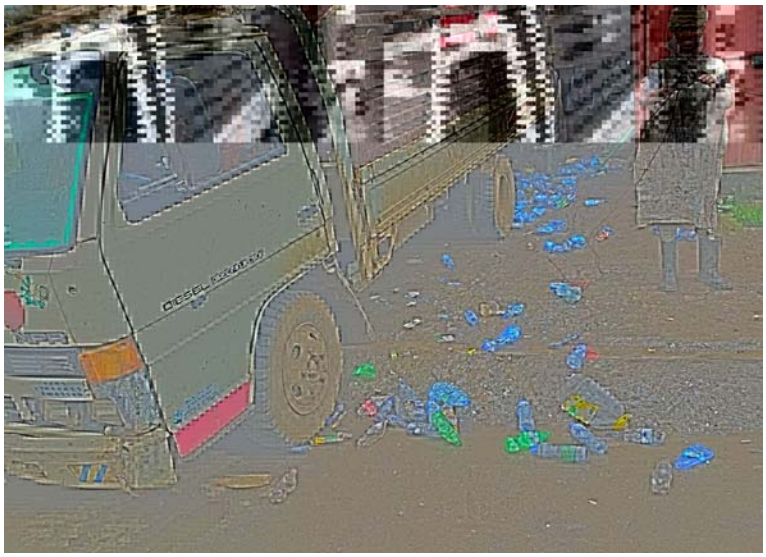


Figure 4.2 Collector of recycled material at Koshe site

4.4.2 Job opportunities

As per the data gathered during the researcher's observation, Households at Koshe area has started cleaning their surroundings with their family and neighbors once in a week. The community started this act after the government provided safety net donations. As per the in-depth interview gathered from residences, the residents at Koshe and Kore deeply supported the above statement. In 2005 the government administration of Addis Ababa focused on waste collection and disposable activity. The sector of the governmental affiliated corporation under the small scale enterprises was responsible of the activity. Currently, waste collection, transportation and disposal are processed by the government affiliated organizations together with the community.

The key informant 32 years-old female who works as a manager of Nifas silk sub city Wereda 2 administration explained how the job opportunity is created as follows:

> *People living around the dumping site are low income communities. They depend on reselling materials by refurbishing them to different factories. The Wereda has created jobs opportunities for the communities who are willing to collaborate and work with our sector. There are individuals and organizations who work with us for example; there are 3 cars that are providing service in this sector 2 of them are owned by the community, and one of the trucks is from private sectors which get paid according to its performance. In this woreda 89 employees collect door to door solid wastes from household's every day. 98 civil workers are working on street sweeping service.*

Nifas Silk Lafto Sub-city head of sanitation administration office associations includes 4 compactor vehicles and 13 sewage sucking trucks. A single truck can work in 2 or 3 woredas. One of the pollutants in the woreda and around the land fill is from the trucks. Responsible for the hygiene of the trucks that transport waste to the dumping site are the driver and the assistant. The must:-

1. Cover the top of the tank before driving.
2. Car washing and servicing the trucks.
3. Cleaning the tubs and the storage tanks.

Data gathered from the key informant with the head of Sanitation Administration Office Associations located at Nifas Silk Lafto revealed that more than 6000 employees are signed for door to door collecting activity for all woreda under our sub city. The formal waste management sector is characterized by the primary collection, carried out mainly by pre-collector associations, the secondary collection, and final disposal, mostly carried out by the government. Addis Ababa Cleansing Agency has 172 trucks in total assigned for collection and transportation. However, only 143 of these trucks are functional the rest are out of service.

Employees that are at the formal sector are responsible to collect solid waste from households along with the street sweepers, and dump at the containers for final disposal by the waste management agency. In most of the containers, wastes are non-recyclable products. Once these are full, trucks dispose of this waste at the landfill at Koshe area. From the key interview from the head of Sanitation Administration Office Associations located at Nifas Silk Lafto revealed that more than 6000 job opportunities are created.

Data gathered from the in depth interview and FGD revealed that; the city government lacks capacity providing adequate services: there are no enough and hygienic waste containers and vehicles make are the mean pollutant of the environment instead of serving the community. In addition to that, containers are not hygienic, unprotected from rain and sun that leads them to have an unpleasant smell which affects daily residential activity. The biggest problem that intensified the smell was the opening of garage places on the road of Kore. All the trucks and the containers are aliened at the road until they are fixed.

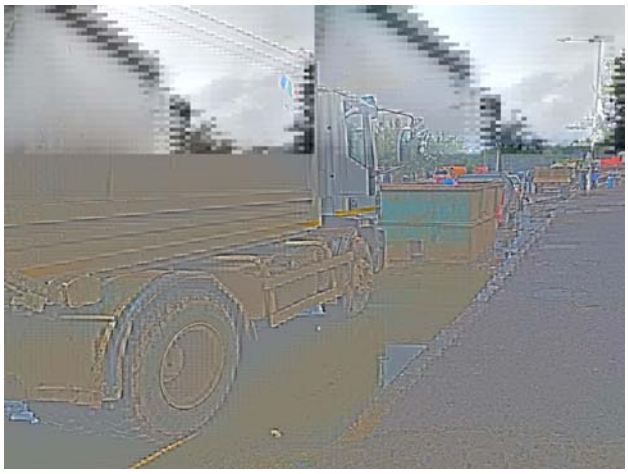


Figure 4.3 Containers and out of service trucks at Kore Road

4.5 Health challenges

Human wastes have been influencing our environmental condition for many generations. Wastes that are not biodegradable cannot be recycled are filling our small rivers that cross the city. Waste picker and rag collectors are a victim to various infectious and chronic diseases. Being vulnerable to high levels of air pollution will be a reason for variety of adverse health outcomes. It enhances the possibility of respiratory disease, heart disease and lung cancer.

More than two hundred households surround the landfill site, while some families live on the garbage pile itself in makeshift shelters constructed from plastic, cardboard and wood. They are directly exposed to chemical wastes that are realized on to the environment causing diseases. Asthma, COPAD, cancer and birth defects are some of the challenges that are faced by residents living at Koshe dumping site. Residents in this site absorbed the contaminated air which can cause respiratory disease. One respondent acknowledged that:

In-depth interview 45 years-old Female works at door to door garbage collector also elaborated in the following way:

> *When I started working as garbage collector at Koshe area I had good physical appearance, I felt good inside However after I have started this job, my health changed because of the environment of my work place. It also affects my food interest, every time I smell food or prepare one I get sick. My day to day activity is affected. As you can see me I have been under weight since I started this job. Every time I worry about my children. There are diseases that I might bring home.*

She also said that the medical complications caused by door to door waste collected affected her daily activity. She further said that it affected her food appetite that caused for different health challenges. A study conducted by Selin (2013) reported that discarded solid wastes can have severe health effects on residents due to its infectious, toxic or radioactive nature. According to Kimani (2021), in conjunction with the United Nations Environmental Programme (UNEP) the public health effects from municipal wastes include severe illness among residents, including skin disorders, respiratory abnormalities, abdominal and intestinal problems, dental disorders, ear infections, skeletal muscular systems (back pain), central nervous system (neurological

impairment), eye infections, blood disorders (anemia), malaria, chicken pox, septic wounds and congenital abnormalities, cardiovascular disease and lung cancer.

The key informant 32 years-old female who works as a manager of Nifas silk sub city Wereda 2 administration clarified the health challenges in the following way:

> *Wereda 02 waste management sector has been working on fixing closed sewage systems and also has been working on cleaning sewage tunnels. Previously most of the sewage tunnels which are located at Koshe and Kore areas were blocked by dry wastes that were disposed every day, this caused a toxic smell around the area. Our sector is responsible on opening the tunnels and cleaning services to maintain the flow of waste; this can contribute and improve the environmental conditions at the landfill areas.*
>
> *The other problem we are facing is air pollution which can cause different health problems such as respiratory disease and other air born diseases. The waste management sector is working with health and education sectors. We organize the program by collaborating with health sector which mainly focuses on creating awareness to the community on proper way of disposing household wastes. Our sector also organizes program by collaborating with the education sector, the programs takes place at schools considering that if we create awareness to children at schools they can also inform their parents this entire program supported by health professionals.*

As per the data generated from key informant interview with the head of sanitation administration office, the physical environment at Koshe is affected both by chemical and non biodegradable materials; which contaminate underground water and soil. This polluted environment can affect the agricultural products and wild life. The exposure to contaminants and emissions can have direct contact, inhalation or ingestion of contaminated food and water. Participants in the study elaborated that, finding clean and safe water is hard they only get clean water once in a week (Sunday), which makes it hard to keep their hygiene. Considering the place and the environment it is important to provide clean water to the residents unless they will be to different health problems which are resulted from poor hygiene. According to Bhat, R.A (2018) the environmental and health impacts of wastes will be described subsequently. Wastes pollute the air, water, and soil. Air pollution includes odor, smoke, and dust. When solid wastes are burnt, greenhouse gases such as carbon dioxide and nitrous oxide are released; these lead to ozone layer depletion and greenhouse effect Hydrogen sulfide and methane are also released into the air.

These substances are toxic to human lives. Moreover, the data generated from Key informant at Head of Sanitation Administration Office, the Reppie plant collects wastes from the landfill located at Koshe and when garbage decomposes, it gives off methane gas. This is called landfill gas. This gas is applied on the power plant to create electricity. After they convert the waste to energy; they dispose the burned waste back to the landfill which causes troubling smell to the environment. These harmful gases pose a risk to human health in nearby residences. Burning trash releases dioxin, lead, and mercury. The residence of Koshe dumping site especially around the Reppie incinerator plant were complaint about the toxic dust that comes down from the landfill.

4.6 Sanitarily Challenges

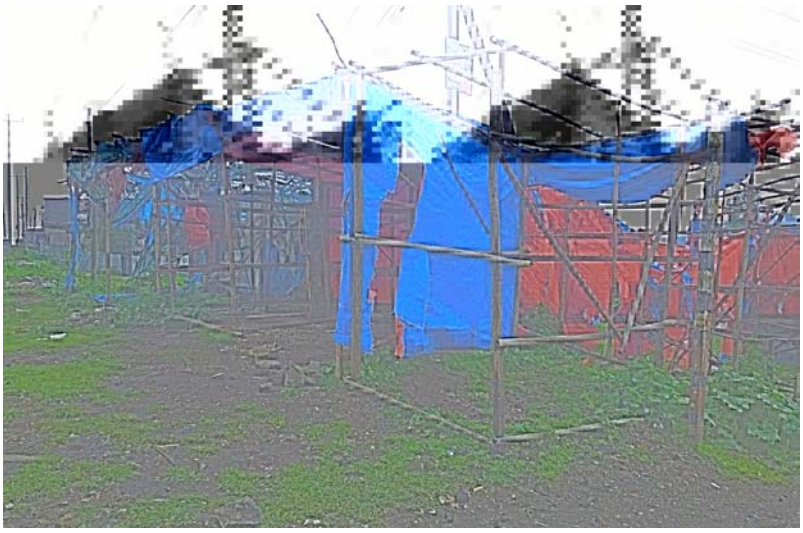


Figure 4.5 Previous sanitaria service providers

The key informant 32 years-old female who works as a manager of Kolfie sub city Wereda 2 administration explained the challenges as follows:

> *One of the most severe pollution occurs in our rivers and river side. Especially, rivers that pass through the dumping site are vulnerable to be polluted by the communities living near the river. Some of the waste products which are creating the problem are plastics and hazard materials that create toxic smell and damaging to the soil surrounding the river. This woreda has 9 working public sensational services. The cleaning service preformed at this sector is poor. This is because shortage of water. Our public sanitation services have water tanks but they are not enough. As a solution our sector is working on reporting the issue and working on it. Even if shortage of water occurs additional tankers must be provided. Improvement was noticeable at the begging of the Covid pandemic and should be continuing.*

Covid 19 pandemic started spreading in Addis Ababa on March 13, 2020. Since then the Federal Ministry of Health of the Ethiopia announced that everyone to wear a face mask, social distance and sanitize. The figures above displays that the place was sanitary services were provided for the residences of Koshe dumping site. Currently the area has been removed and stopped providing any kind of sanitaria services. This is due to the area health department and the environmental health centers of this kebele can only afford on emergency cases. For instance they can provide supplies during water pipe outbursts or toilet flooding happen. All of the participants in the FGD stated that there is no sanitary provider around Koshe dumping site..

In-depth interview 26 years-old Female works at small fast food business also elaborated in the following way:

> *When Covid 19 pandemic started spreading in Addis Ababa, health inspectors came regularly to check if I was using the Covid 19 protocols for my customers. But it is difficult to provide clean water for my customers because we only get pipe line water once in a week. At the beginning of the pandemic the kebel supported us and we had regular water supply but after few months they gave up providing all the support.*

Data gathered from the key informant and in depth interview revealed that The demand for drinking water in Addis Ababa is mostly fulfilled using bottled water and through sink. Those who have no access to water supply, usually obtain water from rivers, unprotected springs and hand-dug wells. To add to their woes, data generated from key informant interview with the head of sanitation administration office, fast population growth, uncontrolled urbanisation and industrialization and poor waste management practices are causing several rivers there are highly polluted which makes it unfit for drinking, hand washing and other household purpose.

Chapter Five

Discussion, Conclusion and Recommendation

This section presents discussion of the findings in relation with the literatures reviews discussed in chapter two. The different themes the researcher discussed in comparison with the existing literatures will be discussed. This chapter deals with the major finding discussion, conclusion and implications.

Discussion

The general physical compositions of the waste generated from Addis Ababa are disposed on the Koshe open landfill site. Koshe is located at the south west of Addis Ababa. It is under the Nifas Silk-Lafto and Kolfie sub cities administration According to Aklilu.A (2002) 70% organic recyclable and 30 % others; which results in a poor environmental conditions. Air, water, soil pollutions are the few problems that Koshe dumping site is facing currently. The residences of at the landfill have been living with toxic environment for decades. Projects have been established at Koshe area that can potentially minimize the pollution by reusing the landfill. One of the project includes the new Reppie incinerator located at the landfill. According to U.S. Energy Information Administration (2021*)* it is one of the first wastes to energy incinerator. Waste-to-energy plants burn municipal solid waste (MSW), often called garbage or trash, to produce steam in a boiler that is used to generate electricity. This study indicates that after they convert the waste to energy; they dispose the burned waste back to the landfill which causes troubling smell to the environment. Maschal (2018) harmful gases pose a risk to human health in nearby residences. Burning trash releases dioxin, lead, and mercury. The finding indicates that residence of Koshe dumping site especially around the Reppie incinerator plant were complaint about the toxic dust that comes down from the landfill.

As per Waste Management Theory, the informal sectors play a big role on the recycling and reusing system of the city. Wastes such as vegetable, bones, wood, combatable and non combatable and other wastes are collected and disposed by the government system. The recycling system uses these informally collected wastes that include metals, plastics, cloth and glass. The finding of this study shows that informal actors collect materials door to door or from the dumping site. After they collect and repair they sell their materials at Minaleshi Tera located at Merkato.

Waste picker and rag collectors are a victim to various infectious and chronical diseases (Maschal 2018). They are directly exposed to chemical wastes that are realized on to the environment causing diseases. Asthma, COPAD, cancer, birth defects and wealth loss are some of the challenges that are faced by the people who are living at Koshe dumping site. The finding showed that residents found at this site absorbed the contaminated air which can cause respiratory disease.

According to the CSA Welfare Monitoring Survey (2012) an estimate of 72.27% of Addis Ababa residents lacks access to adequate toilet facilities. Currently the Koshe landfill area has no working public sanitation service and stopped providing any kind of sanitaria services Due to the area health department and the environmental health centers of can only afford on emergency cases.

Conclusion

Developing countries tend to have a worse air pollution and shortage of sanitaria options. This study intended to investigate health and economical challenges that are faced by the Koshe residents. Koshe waste dumping site is a towering mountain of waste; it is a 50-year-old dumpsite for Addis Ababa, Koshe is an Amharic word meaning “dirty”.

In this city wastes are disposal in a crude open dumping: hauling the wastes by truck, spreading and leveling by bulldozer and compacting by compactor. In addition to that, some of the communities who live around Koshe landfills are advantageous economically. Some of them based their life on collecting materials from the area like: wood for firewood, metals, nails, clothes and shoes are the major ones. But plastics water bottles are the most ubiquitous material on the dumping site, after collecting the materials they sell them around Merkato the place called Minalesh Tera.

However, residents at the dumping site of Koshe and parts of Kore area are suffering from different reportorial diseases. The emission of toxic gas from the wastes causes many health problems: asthma, lung cancer, loss of appetite and many infectious diseases. Even though, the new Reppie Incinerator plant located at the dumping site provides energy for the city of Addis Ababa, however the residents of that area are vulnerable to harmful dusts and noises pollution and also finding clean and safe water is hard they only get clean water once in a week (Sunday), which makes it hard to keep their hygiene. Considering the place and the environment it is important to provide clean water to the residents unless they will be to different health problems which are resulted from poor hygiene.

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Recommendations

- Waste is generated by everybody and the impacts will also affect every one, to minimize or avoid the problem, people in management position should work hard by collaborating with the community who live around koshe.
- The residence of Koshe dumping site especially around the Reppie incinerator plant have been suffering from toxic dust that comes down from the plant. These harmful gases pose a risk to the residences health; this should be resolved by Reppie incinerator plant by providing save place to the residents to live.
- The residence of Koshe dumping site have not get basic services like electricity and water as long as Reppie incinerator plant objective is solving the problem of electricity it has to even solve residents electricity problem.
- In addition to that residence of Koshe dumping site suffering from the loud sound that the plant realizes every morning which they could not get enough sleep, the whole neighbor is disturbed by the noise which is come from the plant, Reppie incinerator plant should consider the working time of the residents.
- Koshe dumping site can be good source of generating income for young people around the place, if the concerned body collaborate with young people and make it formal collecting material from the area.

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Appendix:1 Instruments

I. QUESTIONS FOR INTERVIEW SECTION

Questionnaire Letter of introduction

Dear Respondent, I am a student at Addis Ababa University pursuing a master's degree in Sociology. As a partial fulfillment of the Masters course, I am conducting a study on the impact of air pollution on the economic and health of residence including public sanitary usage in Koshe dumping site. Please take a few moments to answer the attached questionnaire. Your contributions and answers will be treated with utmost confidentiality and no names of participants will be published in the final research document. Your assistance and cooperation will be highly appreciated.

Code_____

1. Age?
2. Are you a resident in Koshe dumping site?
3. What is your activity at Koshe dumping site?
4. Do you agree that Koshe dumping site is the most polluted area in Addis Ababa? Why?
5. What are the benefits got from the New Reppie Incinerator plant?
6. Mention some of the causes for this pollution?
7. Any challenges you faced during your stay at Koshe dumping site?
8. Air pollution is one of the major problems in this city; what are the changes you would do to improve the air quality?
9. What comes to your mind when you think of using public sanitation options?

II. KEY INFORMANT INTERVIEW GUIDE

Greeting!!

My name is Mahlet Fassil; I am a student at Addis Ababa University pursuing a master's degree in Sociology. As a partial fulfillment of the Masters course, I am conducting a study on the impact of air pollution on the economic and health of residence including public sanitary usage in Koshe sub city. Please take a few moments to answer the attached questionnaire. Your contributions and answers will be treated with utmost confidentiality and no names of will be published in the final research document.

Thank you for your time!

1. As we know Koshe area is a dumping site for Addis Ababa; what are some of the environmental changes that occur due to this reason?
2. Which parts of the community are mostly affected by air pollution?
3. What are the main causes of air pollution?
4. Who are the most vulnerable by the pollution?
5. What are the most frequently health problems occurred because of the area?
6. How can we prevent air pollution from causing more problems?
7. What are the preventions done by health officers?
8. Shortage of sanitation facilities are one of the problems causing pollution; what are the public sanitary options provided for the residence in Koshe sub-city?
9. What are the current hygienic states of these sanitation facilities?
10. What must be done in the future?

III. OBSERVATION GUIDELINES

Hours of observation: 10:30 pm-12:00 pm and also 3:00 am Monday, Wednesday, Friday.

Location: Latitude and longitude coordinates: 38.5325105, 8.0151289. It is 13 km away from the center of the city;

Transportation:

- From Jemo on the road to Ayer Tena.
- From Mekanisa to Kore

While you observe please DO:

- Take photos of the dumping site.
- Record short videos.
- Take photo of any market areas.
- Take photos of public sanitation stations
- Assign someone to take photo during focus group discussions.
- Ask the willingness of garbage collectors; observe them as they engage in daily routines.
- While at times you may be disturbed by the smell so wear mask at all time.
- Follow all the Covide 19 precautions.

Not to do:

- Do not eat, drink during the observation.
- Don't take photos or videos of unimportant scenes.
- Don't point, wave or call out at children's or people

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