ADDIS ABABA UNIVERSITY

COLLAGE OF DEVELOPMENTAL STUDEIS

DEPARTEMENT OF ENVIROMENT AND SUSTAINABLE

DEVELOPMENT

Retailers' Knowledge, Attitude, and Practices towards Pesticide Waste Disposal and Their Implications on the Environment and Human Health: The Case of Addis Ababa, Ethiopia.

A Thesis Submitted to the Centre for Environment and Sustainable Development, College of Development Studies, Addis Ababa University in Partial Fulfillment for the Requirement of MA Degree in Development Studies (Environment and Sustainable Development)

By

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October,2022

Addis Ababa Ethiopia

DECLARATION

I semhar Berihun Registration Number GSR/0000/13, do hereby declare that this thesis is my original work and that it had not been submitted partially; or in full, by any other person for an award of degree in any other university.

Submitted by:

Full Name ..... Signature ……. Date ……

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This thesis has been submitted for examination with my approval as University supervisor.

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APPROVAL

I undersigned certify that they have read and hereby recommend to Addis Ababa University to accept the thesis submitted by Semhar Berihun and entitled ― Retailers' Knowledge, Attitude, and Practices towards Pesticide Waste Disposal and Their Implications on the Environment and Human Health: The Case of Addis Ababa, Ethiopia., in partial fulfillment of the requirements for the award of a Master of Arts Degree in Development Studies (Environment and Sustainable Development)

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ABSTRACT

In Ethiopia, pesticides are widely used for a variety of purposes. These pesticides have wastes which are considered as potentially dangerous chemicals to human health and the environment. The occurrence of contamination and poisoning among humans and the environment is highly reported due to unsafe handling practices and their usage. This is due to insufficient knowledge and unfavorable attitude towards the hazardous risk of pesticide wastes among retailers. Hence, the overall objective of the study is to assess the knowledge, attitude and disposal practices of pesticide retailers found in Addis Ababa city. The data were collected from 85 pesticide retailers which were selected through simple random sampling technique. The data were collected through questionnaires, interview and related literature review. The collected data were analyzed qualitatively and quantitatively. Descriptive statistics and inferential statistics tools such as t- test and Pearson chi-square were used. Among the respondents, 80% of them didn't use the proper methods of pesticide waste. 58.8% of pesticide retailers dispose pesticide wastes in a place which is not given or known by the government. 55.3% of them do not dispose their wastes in unsuitable place. 51.8% of the respondents replied that they don't dispose according to the instruction labeled on the container. In general we can conclude that there is improper pesticide waste disposal practices among retailers. From 85 retailers only 24 (28.24%) know the risk or hazard of pesticide wastes, but 61 (71.76%) of them, which are the majority, don't know the hazardous nature of pesticide wastes. 82.35%, 83.53%, 76.47%, and 65.9% of the respondents didn't know environmental Policies, strategies of pesticide waste management, proclamation of environmental pollution control on hazardous waste, and government regulation on pesticide waste management respectively. more than 50% of the respondents answered that impacts of pesticide waste on land, air and water bodies is weak, medium and no effect. This implies that most of the retailers have no knowledge on the impacts of pesticide wastes on the environment and human health. Only 11.77% of the retailers were not worried about the environment, while 31.76%, 29.41% and 27.06% of the retailers gave sometimes worried, worried and very worried responses respectively. 23.53% and 41.18% of the respondents strongly agree and agree respectively on the harmfulness of pesticide wastes but 9.41% and 14.12% of them strongly disagree and disagree with this issue. On the responsibility of retailers for pesticide management, 43.53% and 28.23% of the respondents strongly agree and agree respectively but, 1.18% and 17.65% of them strongly disagree and disagree respectively. 31.77% and 25.88% of the respondents strongly agree and agree respectively that they upset when they see other retailers disposing pesticide wastes irresponsibly while 8.24% and 22.35% of them strongly disagree and disagree respectively. This implies that significant number of the retailers have positive attitude to protect the environment. Generally, we can conclude that although they have no sufficient knowledge, most of the retailers have positive attitude towards the hazardous risks of pesticide wastes.

Key words: *Pesticides, knowledge, Attitude, Practice, Disposal, Environment, Human health*

ACKNOWLEDGEMENT

I would like to say thanks to God!! To express my profound appreciation to Dr. Ermiyas Teferi Demessie (PhD), my advisor, not only for all unreserved guidance, inspiration and enthusiasm he has provided for this research work and thesis to be on Retailers' knowledge, attitude, and practices towards pesticide waste disposal and their implications on the Environment and Human Health: the case of Addis Ababa, Ethiopia, and continual encouragement but also for his kindness and paternity throughout my term as a graduate student at Addis Ababa university. I would also like to thank Mr. Abaya Alemu from Ministry of Agriculture for his support, also to friends and my family.

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ACRONYMS AND ABBREVIATIONS

- **APP Advanced Practice Provider**
- **BMPs Best Management Practices**
- **DDE Dichlorobiphenyl Dichloroethylene**
- **DDT Dichloro Diphrnyl Trichloroethane**
- **EHH Environmental and Human Health**
- **EPA Environmental Protection Agency**
- **FAO Food and Agricultural Organization**
- **FIFRA Federal Insecticide Fungicide and Rodenticide Act**
- **IRS Indoor Residual Spraying**
- **MRL Maximum Residue Limit**
- **MOH Ministry of Health**
- **NGOs Non- Governmental Organization**
- **PAHs Polyaromatic Hydrocarbons**
- **PCBs Polychlorinated Biphenyls**
- **POPs Persistent Organic Pollutants**
- **UN United Nations**
- **WHO World Health Organization**

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Evidence exists of unnecessary and unacceptable occurrences of high level of contamination and poisoning of pesticide users, agricultural workers and bystanders across the world (FAO, 2010). In recent years these have been pressing public health and food safety concerns related to pesticide residues. Increased reporting of these problems may partially be related to growing consumer demand for safe food, not only in developed countries, but also increasingly in developing countries. Human exposure to pesticides occurs primarily through dietary residues, outdoor pesticide exposures, indoor pesticide exposures, occupational exposures, and through unsafe use of pesticides on domestic animals (Konradsen F).

Several reports have suggested that, farmers are more susceptible to neurological, digestive, retinal, respiratory and reproductive disorders than general population, due to their close contact with these chemicals (Fuhrimann et al., 2019). Globally, pesticides are an indispensable part of normal farming practices and exposure to them is an inevitable occupational hazard for crop producers (Nankongnab et al., 2020). Thus, it is important to take certain precautions to minimize the hazardous impact of these toxic substances on individuals involved in agriculture (Damalas & Koutroubas, 2016).

Pesticides in the agricultural sector were introduced in Ethiopia in the 1960s. Different types of pesticides were imported by both private and public companies for agricultural uses. Since then, the use of pesticide has increased rapidly for crop protection. Pesticides have many benefits, including controlling harmful pests, diseases and invasive plants that have impact on crops and the natural environment. But pesticides can potentially have harmful environmental impacts if they are used and disposed improperly and unsafely.

Proper pesticide waste disposal is an important part of responsible pesticide use. Improper disposal can lead to contamination of soil, groundwater, and surface water, causing serious liability problems for the pesticide user, as well as a poor public image. Improper disposal can result in fines for the pesticide applicator. Everyone who handles pesticides products especially pesticide retailer must know how to properly dispose pesticides products when they convert to waste. It is possible to dispose these wastes legally, responsibly, and economically. Therefore, pesticide wastes need to be disposed properly to prevent accidents on human lives and to protect

the environment. If there are unwanted pesticide products, store them safely and dispose them as soon as possible as directed by the MOH.

Furthermore, Pesticide manufacturing firms should lend support in the disposal of pesticides no longer in use and harmful for the environment. Any person in possession of pesticides, which is no longer in use, should immediately inform the concerned authority about the quantity and type of the product so that their disposal should take place according to legislation and norms of the country. Particularly in developing countries there are many difficulties associated with disposal due to lack of proper facilities. The Basel and Stockholm conventions had provided direction in this matter on how such hazardous waste must be dealt (FAO & WHO, 2015).

Retail firms are required to have, at minimum, a technical advisor with competence in the handling of pesticides and knowledge about their health hazards. Such persons are expected to supervise all technical operations on the premises to ensure that pesticides are distributed in a safe manner. In addition, sales personnel are required to have sufficient knowledge about pesticides to enable them to handle pesticides safely and to advise end-users appropriately, which may help to reduce APP incidence and support notification of the agents involved in APP (Lekei et al., 2014).

The main objective of this paper was to assess retailers' knowledge and attitude about the impact of pesticides on the environment and human health and practices of pesticide waste handling and disposal among retailers in the case of pesticide retailers in Addis Ababa, Ethiopia.

1.2. Statement of the problem

The use of chemicals on a large scale has not been started long ago however this approach has brought havoc in the biosphere, leading to a decline in the quality of life (Pimentel, 2005). A variety of chemical compounds are continuously being used these days to eradicate unwanted weeds and insects with the most common among them being pesticides. According to the World Health Organization (WHO) pesticides are considered as a special class of chemical compounds used to kill a wide range of pests that include insects, weeds and rodents. These chemicals are used to enhance the yield as well as quality of crops. Pesticides are considered as potentially dangerous chemicals to human health and their consumption needs to be carefully monitored. Further, pesticides should not only be carefully used and stored but also need to be disposed in a proper manner. In early 1986, Pimental and Lavitan found that only 0.1% of pesticides reach the

target whereas, larger parts of them cause contamination of the environment (Pimentel & Lavitan, 1995).

The levels of knowledge and awareness of the stakeholders, especially farmers and retailers, of the hazards of pesticides should be taken into account to enhance the integrated management of agricultural pollution and agrochemical supervision in rural regions. As end users and distributors, farmers and retailers of pesticides are directly exposed to pesticides, and their behaviors for the safe use of pesticides and proper disposal of their wastes play an important role in reducing point and non-point sources of pollution, hazards, and acute or chronic intoxication to pesticides in agricultural regions. The levels of knowledge and risk awareness and the practices of retailers are essential elements for increasing the efficiency of devising to avoid the risks of pesticides. Therefore, monitoring retailers' knowledge and attitude towards the risks of pesticides and their impact on the environment and human health and practices of proper disposal methods would be useful to assess the appropriateness of information for reducing or/and avoiding the risks from pesticide (Cui, 2009; Zhou et al., 2011).

In Ethiopia, pesticides are widely used for a variety of purposes. The occurrence of contamination and poisoning due to inadequate knowledge and flawed attitude of retailers for the danger of pesticide wastes on the environment and human health and improper disposal of pesticide wastes is highly reported (Haylamicheal & Dalvie, 2009).

But no detailed studies have been carried out to ascertain this issue. Therefore, this paperwork assessed the knowledge and attitude of retailers towards the hazardous risk of pesticide wastes, and their practices of pesticide waste disposal. It assessed also the determinant factors of retailers' knowledge and attitude towards the hazardous risk of pesticide wastes.

1.2.1. Research Questions-

- Are pesticide retailers aware of the adverse effects of pesticides on the environment human health?
- What factors determine the knowledge and attitude of pesticide retailers towards pesticides and their implications?
- Do pesticide retailers perform pesticide management practices?

1.3. Objectives of the study

1.3.2. General Objective

The general objective of the study is to assess retailers' knowledge and attitude towards the implications of pesticides on the environment and human health and practices of pesticide waste disposal among retailers in the case of pesticide retailers in Addis Ababa, Ethiopia.

1.3.2. Specific Objectives

The specific objectives of this research is to:

- ✓ assess retailers' knowledge and attitude towards the adverse effects of pesticides on the environment and human health.
- ✓ assess pesticide waste disposal practices of retailers.
- ✓ explore the factors associated with retailers' knowledge and attitude towards the adverse effects of pesticides on the environment and human health and disposal practices of pesticide retailers.

1.4. Significance of the study

This research mainly focused on the knowledge and attitude of pesticide retailers towards pesticides and their implications on the environment human health. And also focused on pesticide waste disposal and handling practices of pesticide retailers. The output of this study is helpful for local retailers, other researchers, government policy makers and different stakeholders that are concerned in this specific issue. For retailers, this study is useful to create awareness of pesticides and their hazardous risks on the environment and human health. It can be also used to acquire knowledge about proper pesticide waste disposal method among retailers. For other researchers, this study is helpful as an additional input for further research. For government policy makers, this study proposes the safest possible waste disposal methods that might help in developing laws and regulations that decrease or halt the alarmingly increasing implications that negatively affect the environment and human health in general.

1.5. Scope and Limitation of the study

This study, like all studies, was subjected to many limiting factors. The first of these is the research area which is confined to Addis Ababa. This was due to financial and time constraints. Future research will hopefully be able to study this subject on a larger scale and provide a more wholesome picture of the problem.

Another limitation imposed on this research was the lack of diversity in the population size which includes only the pesticide retailers. Since the problem of pesticide waste disposal is a concern for everyone who wants to live a healthy life, it was the belief of the researcher that the general population of Addis should be concerned with the subject of this study. However, the research was conducted on the retailers.

Thus, the scope of this research was constrained with in the limitations mentioned above and attempted to explore the solutions for the research questions.

1.6. Organization of the study

The study had five chapters. The first chapter was the introduction part which included background, statement of the problem, research questions, and objectives of the study, significance of the study, and scope & limitation of the study. Chapter two described related literature review gathered from different sources. Chapter three explained methodology of the study which included description of study area, targeted population, research design, sampling technique, data collecting methods, and data analysis methods. Chapter four was about data analysis and interpretation in which data was analyzed and interpreted so that findings are made. The fifth and the last chapter were conclusion & recommendation. In this chapter conclusions and recommendations were made based on the findings made in analysis part.

1.7. Operational definition of concepts

Knowledge: facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject. It is an awareness or familiarity gained by experience of a fact or situation.

Attitude: It is a settled way of thinking or feeling about something.

Practice: is the actual application or use of an idea, belief, or method, as opposed to theories relating to it.

CHAPTER TWO

2. RELATED LITERATURE REVIEW

2.1. INTRODUCTION

This chapter discussed about review of related literatures taken from different sources. It explained conceptual definition, theoretical frame work, pesticide disposal globally, pesticide disposal in Ethiopia, awareness and knowledge of pesticides, practice and sources of pesticides, The determinant factors of the attitude and knowledge of retailers and their practices of pesticide disposal, Pesticide management practices of the retailers, Implications of pesticides on the environment and human health, empirical frame work and conceptual frame work.

2.2. Definition and concepts of pesticides

A pesticide is a substance or mixture of substances that is used to prevent, destroy, repel or mitigate any pest, ranging from insects (insecticides), rodents (rodenticides) and weeds (herbicides) to microorganisms (fungicides, algaecides, or bactericides) (FAO, 2014; EPA, 2009,2016).

The use of chemicals on a large scale has not been started long ago however this approach has brought havoc in the biosphere, leading to a decline in the quality of life (Pimentel, 2005). A variety of chemical compounds are continuously being used these days to eradicate unwanted weeds and insects with the most common among them being pesticides. According to the World Health Organization (WHO) pesticides are considered as a special class of chemical compounds used to kill a wide range of pests that include insects, weeds, and rodents. These chemicals are used to enhance the yield as well as quality of crops.

Pesticides are considered as potentially dangerous chemicals to human health and their consumption needs to be carefully monitored. Worldwide, the many fold increase in the demand of pesticides is mainly due to continuous attack of pests like insect larvae, which are responsible for destroying crops and huge monetary losses to the farmer communities (Cerda et al., 2017). Besides their role in getting rid of pests/ insects in crop fields, they are also used to prevent the spread of vector borne diseases in the environment. Pesticides like dichloro diphenyl trichloroethane (DDT) and its metabolic product dichlorobiphenyl dichloroethylene (DDE) are used for indoor residual spraying (IRS) to control vector-borne diseases like malaria, dengue leishmaniasis, Japanese encephalitis (JE) and schistosomiasis (WHO, 2012; King and Bertsch, 2015; Claborn, 2010;Dutta et al., 2011).

Although it is known that pesticides enhance crop production through improved control of pests, herewith contributing to the overall regional and global economy, there is a great deal of evidence for impacts of pesticides on humans and the environment, as well as unintended side effects on non-target organisms (Aktar, 2009).

Pesticides should not only be carefully used and stored but also need to be disposed in a proper manner. In early 1986, Pimental and Lavitan found that only 0.1% of pesticides reach the target whereas, larger parts of them cause contamination of the environment (Pimentel, 1995). These pesticides have been classified under persistent organic pollutants (POPs) and their usage is strictly regulated across the world by the Stockholm convention on persistent organic pollutants (WHO, 2011).

Developing countries are prone to risks from pesticides due to lack of knowledge, awareness and finances to support proper precaution measures to safely handle pesticides (WHO, 1990). Retail firms are required to have, at minimum, a technical advisor with competence in the handling of pesticides and knowledge of their health hazards. Such persons are expected to supervise all technical operations on the premises to ensure that pesticides are distributed in a safe manner. In addition, sales personnel are required to have sufficient knowledge about pesticides to enable them to handle pesticides safely and to advise end-users appropriately, which may help to reduce APP incidence and support notification of the agents involved in APP (Lekei et al., 2014)

2.3 Theoretical framework

Theory of reasoned action (TRA) and theory planned behavior (TPB) are used in this study on be on Knowledge, Attitude, and Practices towards Pesticide Waste Disposal of Pesticide Retailers and Their Impacts on the environment and human health and solid a framework in understanding, explaining and predicting behavior. These theories are also useful as a guide for designing intervention strategies to maintain or change a particular behavior. The theory is based on the assumptions that individual behavioral intentions are directly associated with their attitudes. The theory of reasoned action views an individual's intention to perform or not to perform as an immediate determinant of the action. This behavioral intention has two determinants: (a) attitude towards the behavior, and (b) the subjective norms. Ajzen and Fishbein (2008) argue that the beliefs related on attitude towards the behavior are called behavioral beliefs, while normative beliefs are for the subjective norms. The theory planned behavior further views an individual's determination is influenced by attitude, 10 social support and

perceived behavioral control. Thus, it is best to examine human behavior related to their awareness of, attitude towards be on Knowledge, Attitude, and Practices towards Pesticide Waste Disposal of Pesticide Retailers and Their Impacts on the environment and human health and are voluntary and under an individual control (Gamba and Oskamp, 2004). Therefore, this theory is suitable to predict the researcher's intent to be aware of, show positive attitude and engage in practicing the pesticide waste disposal in the study area.

2.4 Pesticide waste disposal globally

According to the FAOSTAT database global pesticide use (in tons of active ingredient) increased by 46% during the period 1996-2016. The growing human population has put increasing demand on agricultural productivity per hectare and on public health, which contribute to intensified pesticide use. There is widespread international consensus on the need to implement alternative strategies that reduce or even eliminate the reliance on chemical pesticides, notably integrated pest management (IPM) in agriculture and integrated vector management (IVM) in public health. However, forces which include persuasive pesticide marketing have kept pesticide use as the dominant practice for plant protection in most countries. In public health, available methods of vector control still depend largely on the action of insecticides.

Where pesticides continue to be used for food production and public health, it is imperative that their adverse effects on human health and the environment are minimized as much as possible by adopting best practices of regulation, proper use and management, while promoting IPM and IVM as use-reduction strategies. The International Code of Conduct on Pesticide Management ("Code of Conduct") provides a voluntary framework for governments and other stakeholders to manage agricultural and public health pesticides throughout their life cycle (2). Pesticide management covers all aspects of the pesticide life cycle, including production, registration, import, transport, storage, application and disposal of pesticides and their containers. Agricultural pesticides are defined as those used to control agricultural and forestry pests injurious to plants and plant products, whereas public health pesticides are those used for vector control household use and for professional pest control. The Code of Conduct, which complements the legally binding instruments of the Rotterdam Convention, the Stockholm Convention and the Basel Convention, promotes standards and best practices which ensure pesticide efficacy, and reduce risks to human health and the environment. In addition, the Code of Conduct promotes IPM and IVM as strategies to reduce pesticide use. Despite broad support for the Code of Conduct, there are signs that the adoption of standards and

practices of pesticide management has been slow, particularly in low- and middle-income countries. Agricultural and public health programs generally prioritize targets of food production and disease control, but they are often unable or reluctant to address the risks caused by the pesticides used. Programs in which pesticides are used should integrate the sound management of pesticides to reduce the adverse effects and waste.

The objective of this joint WHO–FAO survey is to describe the current global situation regarding the legislation, registration and management practices of agricultural and public health pesticides.

Previously, FAO published the results of surveys on the implementation of the Code of Conduct in 1993, 1996 and 2010 (3–5). WHO conducted global surveys on public health pesticide management in 2004 and 2010 (6, 7). The current survey is the first global survey combining both agricultural and public health pesticides; the survey was conducted jointly by WHO and FAO. The results are expected to inform future plans to optimize and prioritize global pesticide management practices

2.5. Pesticide waste disposal in Ethiopia

As yet there is no specific policy instrument that deals with the production, storage and distribution and use of pesticides in Ethiopia. However, there is a general provision in the Environmental policy of Ethiopia that highlight on the need for precaution measures with regard to hazardous chemicals, in which pesticides are also included. The most relevant provisions with regard to pesticides in to pesticides in the environment policy are; To provide adequate regulation of agriculture (crop and livestock) chemicals and micro-organisms;

To formulate and implement a country-wide strategy and guidelines on the management of wastes from the medical, agriculture and other sectors that may use potentially hazardous biological organisms, their fragments or chemicals, and to issue the necessary regulations to enforce them;

To establish a system for monitoring compliance with land, air and water pollution control standards and regulations, the handling and storage of hazardous and dangerous materials, mining operations, public and industrial hygiene, waste disposal, and water quality;

To maintain an up-to-date register of toxic, hazardous and radioactive substances, and to make the information available on request;

To create by law an effective system of control, distribution, utilization and disposal after use of expiry of chemicals, biological organisms or fragments of organisms that could be hazardous but are required for use; to hold as legally liable an employer who deploys employees in using or handling hazardous materials without adequately training them on how to deal with the hazard and without adequate equipment to protect each one of them from physical harm or disease that

Is caused by working condition whether the harm or disease starts in the place of work or away from it; and to foster better understanding of the dangerous effects of chemicals and organisms and their fragments through the provision of information in a form understandable to users, and provide or enforce the provision of information on the appropriate methods and technologies for the treatment and disposal of wastes.

Ethiopia has issued a Special Decree on pesticide registration and control (Special Decree no. 20/1990) in order to lay a scheme of control which would make it possible to minimize, to extent realizable, the adverse effect that utilization of pesticides might cause to humans, animals, plants and the environment.

This Special Decree requires not only for pesticide registration and control but also promotes safer pesticide handling and use. As per the Special Decree, pesticide importers should obtain, from the Ministry of Agricultural and Rural Development, a license up on fulfillment of certain requirements including trained personnel, proper storage facilities, and safety devices. The Regional Agricultural and Rural Development Bureaus issue licenses to pesticide dealers and Distributors with delegated authority from the ministry.

The Special Decree also requires that pesticide may not be allowed to enter the country unless it is packed and labeled as per the requirement. Furthermore, pesticide samples are taken and analyzed to confirm

2.6. Awareness and knowledge of Pesticide

According to previous studies, factors contributing to poor handling practice during pesticide application included poor knowledge, absence of pesticide-related training, and unfavorable attitude toward pesticide. The health risk of workers is also higher if there are poor practices during pesticides use. They are unaware of the exact requirements for safely storing, preparing, applying, and disposing of pesticides, which all employees should follow. Most Ethiopian workers lacked pesticide related training, were ignorant of new pesticide alternatives, lacked a full set of personal protection equipment, and did not shower after work. However, excellent pesticide management techniques and alternate pest management strategies may assist employees in reducing the dangers of pesticide poisoning (Karunamoorthi et al., 2012).

The level of knowledge and awareness among pesticide retailers about the risks to the environment and human health posed by using pesticides needs to be ensured as they are the ones who handle and manage the chemical content of the pesticides, not the latest and most advanced machines. Most pesticide retailers who handle the pesticides do not understand the harmful effects that pesticides can have on the environment and the threats to their own and public health (Begum et al., 2005).

2.7. Practice and sources of pesticide

Practices of pesticide retailers are Transport, shop organization and disposal

2.7.1 Transport

Pesticides are in their most concentrated and dangerous form when being transported to or from the shop, warehouse, or farm. Accidents can result in broken containers, spills, environmental contamination, and poisoning to you or others. Care and attention to safety are thus needed.

When transporting pesticides:

- Pesticides should never be transported by passenger carrying vehicles such as a bus or taxi.
- Pesticides should never be transported with food, animal feed, or goods intended for consumption or human use (for example, clothing).
- The best type of vehicle is a flat-bed truck, such as a pick-up. There should be no nails or other projections on the load bed, which can damage containers.

- Passengers or animals should not ride with the pesticides in the load bed. Children should never be carried in a vehicle transporting pesticides.
- Pesticides should not be carried in the passenger compartment of the vehicle.
- The vehicle should carry the necessary safety equipment in case of an accident or spillage (protective clothing, shovel, soap and water, fire extinguisher, emergency telephone numbers).
- Pesticides should only be transported in intact, undamaged containers, with readable labels. The containers should be checked for leaks and loose bungs before loading.
- Load the pesticides carefully. Do not throw or slide the containers, as this may cause damage. Tie the load down, and cover the containers with a tarpaulin to protect the containers from the sun. Shelf life will be shortened if the pesticide becomes too hot.
- Unload the pesticides carefully. Do not throw, slide, or drop the containers off the vehicle. If the containers are heavy, roll them down inclined planks onto some old tires.

2.7.2 Shop organization and sales

Pesticides retailers are directly involved with the storage and sale of pesticides, and it is essential that they know and understand the principles and procedures involved. This is for their own safety and the safety of their staff and customers, to give the best service to their customers, and to operate a successful business.

Storage Hazards

The main hazards involved with pesticide storage, whether in a warehouse or shop, are those of fire and environmental contamination. Many pesticides can easily catch fire or the vapors can explode, particularly oil based formulations. If a fire does occur, pesticides will release toxic smoke and fumes, which present severe risks to firefighters and bystanders. Environmental contamination can occur in case of spills, or from the run-off of water used in firefighting.

Basic Principles for Storage and Display of Pesticides

Pesticides must be stored and displayed separately. They must never be kept in the same area as food, drink, or medicines (including veterinary medicines) for human or animal consumption. They must also not be kept in the same area as any material that might become contaminated, such as seed, fertilizer, or clothing.

- Pesticides must be kept out of direct sunlight, temperature extremes, water and moisture.
- If stored on shelves, dry pesticides should be placed above liquid pesticides.
- Herbicides should be on the lowest shelves.
- Containers should be inspected regularly to ensure that there are no leakages.
- Shelves should not be over-stocked, as this makes correct stock rotation and the detection of leaking containers more difficult, and increases the risk of shelves breaking due to the weight.
- Materials must be available for cleaning up spills – sawdust/sand, bucket, broom, shovel, drums/strong plastic bags for sweepings, overalls, gloves, boots, face mask.
- Firefighting equipment must be available – fire extinguisher (foam or dry powder), bucket of sand.
- Washing facilities must be available – water, soap, towel.
- There must be no smoking, eating or drinking in the pesticide area.
- No unauthorized access must be allowed into the pesticide area.
- Warning notices should be displayed – 'No smoking', and 'Danger – Pesticides'.

2.7.3 Disposal

Disposal is concerned with both empty pesticide containers, and of unused spray mix.

Empty pesticide containers:

- When paper containers are empty, cut them open and shake all the remaining pesticide formulation into the spray tank.

- When plastic or metal containers are empty, drain the container into the spray tank, fill one quarter full with water, replace the cap, shake for 30 seconds, and drain the water into the spray tank. Repeat this rinsing and adding to the spray tanker twice more. This procedure is known as triple rinsing.
- The containers can then be disposed.
- Paper and plastic containers can be burnt in a hot fire. Be careful not to burn the containers close to buildings, and ensure that there are no people or animals downwind of the fire who could breathe in the smoke.
- Metal containers should be punctured, crushed and buried in a hole at least one meter deep. Do not bury the containers close to water sources (canals etc), or close to buildings.
- The hole should be fenced off and a warning sign erected.

Empty pesticide containers must NEVER be used for another purpose, such as holding water or food. It is impossible to remove all the pesticide, even with triple rinsing.

Unused spray mix:

- The golden rule with spray mix is not to have any left over at the end of the spraying operation.
- Only the correct amount of spray mix should be prepared for the area to be sprayed. This requires knowledge of the actual area, the application rate of the pesticide, the amount of water required, and correctly calibrated sprayers.
- With practice, farmers should know the correct amount of spray mix to prepare for the area or crop to be sprayed.
- If there is spray mix left in the tank at the end of the spraying operation, it should be sprayed on the field, walking much faster than for the normal spray operation so that the amount of pesticide in the twice treated areas is not too high.

Unused spray mix should NEVER be poured into canals or onto the ground.

Spills

Spills of pesticide formulation can occur during transport, storage and mixing. There are three stages to dealing with spills – Control, Contain and Clean-Up.

Control

- Put on the necessary protective clothing.
- Stop the source of the spill if at all possible. If a container has fallen over, put it the right way up; if a small container is leaking, put it in a larger empty container. If a large drum is leaking or has fallen over, you may not be able to quickly stop the source.
- Keep other people away from the spill. Have someone stay at the site at all times to warn other people to keep away.

Contain

- Confine the spill to stop it spreading. Surround the spill with soil or sand as a dam to contain the spill.
- Absorb liquids by covering them with sand, soil, sawdust, newspaper.
- Stop dry pesticide from blowing away by covering with a plastic sheet, or spraying a light mist of water. Do not use too much water as this will make clean-up harder.

Clean-up

- For liquid spills, sweep up the absorbent material with the pesticide, and place it in a heavy duty drum or bag.For dry spill, sweep up and place in a heavy duty drum or bag.
- If the spill area is non-porous, such as concrete or tiles, wash down the affected area with soap or detergent and water. Do not use too much water, as this will spread the contamination. Soak up the water with absorbent material and place in the drum or bag.
- Wash all equipment and clothing used during the containment and clean up.
- Wash yourself thoroughly.

2.8. The determinant factors of the attitude and knowledge of retailers and their practices of pesticide disposal

Retailers' attitude can sometimes be influenced by the training they attended and also from life experiences. In the meantime, a fair practice level reflected the application of instruction and

knowledge that leads to real action. Thus, the combination of lack of awareness, incompetent training, low education background and blindly believed in hands-on experience may influence the respondents' knowledge, attitude and practice. Retailers with low education level may have difficulties to understand methods in using pesticide as being explained on the label. Training is expected to positively affect the knowledge, attitude and disposal practice of the retailers.

Age is another factor that is expected to negatively influence the waste disposal practice of retailers. Mostly observed that old aged people do not focus on the environment related issues and the impact of waste on their health; they also consider as this is the responsibility of the government in general. Sex can be also a factor for disposal practice. As traditional trend shows often the women are feeling as more responsible to dispose properly than men. Government enforcement can also affect the knowledge, attitude and disposal practice of the retailers.

2.9. Pesticide management practices of the retailers

Best management practices (BMPs) are practices that are capable of protecting the environment while considering economic factors, availability, technical feasibility, ability to implement, and effectiveness.

The MDA is responsible for the development, promotion and evaluation of BMPs. The BMPs include mandatory label requirements and a series of optional voluntary practices. Together, these practices reduce contamination of water resources, reduce the severity of off-target impacts and guide chemical use while considering the specific needs of farming operations.

Herbicide BMPs

These voluntary BMPs should be adopted when applying all agricultural herbicides in Minnesota.

- General Water Quality BMPs for all Agricultural Herbicides
- Specific Water Quality BMPs for acetochlor, atrazine, metolachlor and metribuzin

Insecticide BMPs

The following core voluntary BMPs should be adopted when applying agricultural insecticides in Minnesota. The BMPs may also refer to mandatory label use requirements. Always read and follow product labels. Sources of additional information are listed in these BMPs.

- General Water Quality BMPs for all Agricultural Insecticides
- Water Quality Best Management Practices for Chlopyrifos
- Chlorpyrifos Label Setbacks in Minnesota
- Neonicotinoids BMPs

Fungicide BMPs

These BMPs are designed to prevent fungicide drift and minimize volatilization, and to protect bystanders and off-target areas.

- Potato Fungicide BMPs to Prevent Drift and Minimize Volatilization (PDF)

Pesticide Management and Handling BMPs

These BMPs are designed to protect personal safety and the environment, and provide guidelines to apply, manage and dispose of waste properly.

- Handling Pesticides Safely
- Managing Pesticides, Waste Pesticides and Empty Pesticide Containers
- Mixing and Loading Pesticides
- Pesticide Application How-To's

Pesticide BMPs for Turfgrass (lawns and golf courses)

The MDA and the University of Minnesota developed a set of core voluntary BMPs related to turfgrass pesticides. The purpose of these BMPs is to protect water resources, humans, and non-target organisms including pollinators. The BMPs were finalized based on comments received during a public comment period.

- BMPs for Turfgrass Pesticides (PDF)
- Turfgrass Pesticide use BMPs for Homeowners & Commercial Lawn Care

Pesticide Cue Cards

Cue cards are developed to provide guidance on the setback or buffer requirements of certain pesticides to protect water resources. The information in these cue cards is not a substitute of the product label. Always carefully read, understand and follow the product label.

- Herbicide Drift Management
- Label Setback or Buffer Requirements for Certain Herbicides
- Label Setback or Buffer Requirements for Chlorpyrifos and Synthetic Pyrethroids
- Atrazine Use - Setback Requirements and Restrictions for Standpipes

  (British Columbia Ministry of agriculture, Environmental protection and pesticides, 2017)

2.10. Implications of pesticides on the environment and human health

Due to high efficacy and affordability of synthetic pesticides, they are considered as the most prevalent pesticides across the world (Aktar et al., 2009). They are routinely used in agricultural sectors but also have implications on humans and environment. Initial exposure can cause headache, nausea, convulsions, diarrhoea, irritation in eyes and breathing discomfort (Costa, 2018; Hoppin et al., 2017; Jaga & Dharmani, 2006; Kamel & Hoppin, 2004). It has been observed that pesticides exposure can lead to neurological disorders, respiratory distress, retinopathy, gastrointestinal dysfunction an cancer under certain conditions (Mamane et al., 2015; Abolhassani et al., 2019; AbreuVillaca & Levin, 2017; Jaga & Dharmani, 2006).

Studies have shown that persistent exposure of pesticides can lead to their accumulation in the tissues and induce harmful effects on growth, development as well as the metabolism of the body (La Merrill et al., 2013). The pesticides have been linked to several disorders, which are associated with cardiovascular (Obukhov et al., 2015), central nervous (Keifer and Firestone, 2007) and pulmonary system (Ye et al., 2013). These compounds have also been observed to be carcinogenic, mutagenic and teratogenic in nature (Baird et al., 2005; Parker et al., 2017).

Exposure to pesticides may either be acute or chronic: acute exposure to pesticides is considered when individuals are exposed with high amounts for a short duration. This type of exposure causes burning of skin, blisters or rashes, blindness, abdominal pain, diarrhoea and vomiting (Thundiyil et al., 2008) whereas chronic exposure has effects that appear months or

years after pesticide exposure and include cancer, birth defects, reproductive abnormalities, toxicities and even death (Alavanja et al., 2004).

Due to their persistent nature, they have become a major threat to the ecosystems as natural resources like water and soil are constantly being affected by them (Kole et al., 2001). Keeping in view the ability of pesticides to affect human health through variegated sources, their permissible limits need to be carefully reviewed before application (Damalas and Eleftherohorinos, 2011).

POPs are the pesticides or chemical compounds exhibiting high degrees of stability and are resistant to environmental degradation. Due to their ability to accumulate in the living systems, they pose a serious threat to mankind and other inhabitants of our planet. These Persistent Organic Pollutants include some key chemical compounds- Aldrin, Chlordane, Dichlorodiphenyltrichloroethane (DDT), Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Polychlorinated biphenyls (PCBs) and Polychlorinated dibenzofurans, Toxaphene, Polyaromatic hydrocarbons (PAHs) (Ashraf, 2017; Jones and de Voogt, 1999).

Natural habitats are being converted to agricultural lands to meet the demands (Dudley and Alexander, 2017) and pesticides are being used on a large scale to increase the yield from crops to cater to the growing needs of the ever-increasing population. These consequences are causing loss of biodiversity as after being applied to the crops, pesticides ultimately find their way to soil and groundwater reserves, air and water which are important resources for living beings (Akhtar et al., 2009; Schafer et al., 2012). Several factors that play a key role in determining the effects pesticides have on water resources include-half lives, solubility, rate of application of the pesticide and disposal (Agrawal et al., 2010).

Research has demonstrated that approximately ninety per cent of chemical pesticides applied in agriculture end up having consequences which can be deleterious to the ecological system. This leads to detrimental impact on the environment and living organisms which are not the primary targets of these chemicals. So far it has been discovered that adversity caused by pesticides is exacerbated by their non-biodegradability and toxicity. Till date few microbial communities have tried to reverse the effects of the pesticides to some extent by means of remediation but nothing concrete has been revealed (Castelo-Grande et al., 2010; Murillo and Villa Verde, 2017).

Many studies suggest that water bodies near agricultural fields are contaminated by pesticides via simple drifting, percolation through soil, run-off or even spillage. Not only this,

but the aquatic ecosystems have also been found to be seriously disturbed (Moss, 2008). Further, these consequences make water unfit for human and animal consumption. On the other hand, spray-based pesticides and volatile compounds can spread across distances, which can further make environment vulnerable. Further, aerial spraying through aircrafts can cause severe damage to living organisms. It has also been observed that volatile organic compounds are released from pesticides meant to fumigate soil; they can act as major air pollutants when they reach the troposphere (Squillace et al., 2002).

It has been reported that excessive application of pesticides causes reduction in organic matter of soil which also lowers its water retention ability. This leads to a decline in soil fertility as the microbial load and diversity of the soil reduces. Consequently, the total organic matter present in the ground lowers considerably. Therefore, it makes the area more prone to droughts. Thus, serious measures should be taken on a global scale to tackle the problem of environmental pollution due to pesticides. The Rotterdam Convention has most of the UN member nations committed to ensure fair trade in hazardous chemicals whereas the Stockholm Convention, signed in 2001 by 90 countries, aims to restrict the usage and production of POPs.

2.11 Empirical frame work

In Ethiopia, pesticides are mainly imported for agricultural purposes, and lesser amounts of pesticides are imported for health care (vector control) and industrial purposes. Chemical pesticide use in Ethiopia has been historically low, but due to recent developments in intensification and expansion of modern agricultural activities including commercial horticultural farms such as small-scale irrigated farms, large-scale open farms and cut-flower greenhouses, there has been almost a threefold increase within a decade (1440 to 4586 tons from 2001 to 2013)

Surveys conducted before 2011 on pesticide-related knowledge and practices in Ethiopia have indicated that farm workers had limited knowledge on proper pesticide use and handling, have inadequate awareness of safe pesticide management, and exercise poor hygienic and sanitation practices. Furthermore, other relatively recent studies have indicated similar results to previously conducted surveys which indicate ongoing improper pesticide use (misuse, incompatible pesticide mixing, over spraying of crops), pesticide handling (inadequate use of personal protective equipment (PPE)) and pesticide management such as empty pesticide burial/burning and disposing in nearby farm fields. In addition, studies in Ethiopia have indicated the continued use of a POPs such as dichlorodiphenyltrichloroethane (DDT) directly on food crops.

In addition to absence of knowledge in pesticide users (i.e. farmers and farm workers) leading to improper pesticide use and management, there have been reports of private actors such as retailers and state actors recommending inappropriate management of pesticides, including burning or burying of empty packages. Similarly, a study on governmental agricultural extension workers in Ethiopia indicated the surveyed workers have inadequate knowledge of pesticide-related hazards and may recommend improper handling of pesticides to farmers.

Health risks

As previously explained, there has been intensification in pesticide use accompanied by unsafe handling and management of pesticides in Ethiopia. This situation has resulted in pesticide exposure episodes leading both to acute and chronic health effects in Ethiopian farmers and farm workers. Regarding acute pesticide poisoning in Ethiopia, a standardized survey using a WHO case definition of severe forms of acute pesticide poisoning indicated a 16% overall prevalence of severe acute pesticide poisoning (including discontinuing work and/or fainting while applying pesticides). In addition, the highest prevalence (32%) was recorded among applicators in cut-flower greenhouses, and the same study also showed a "healthy worker selection effect", i.e. a decrease of acute pesticide poisoning risk with years of service that might indicate that poisoned farm workers leave their employment after severe acute poisoning incidents.

Respiratory health is the most frequently studied occupational health effect of pesticide exposure in Ethiopia; different studies have indicated higher prevalence of respiratory symptoms and reductions in respiratory function in individuals occupationally exposed to pesticides. With the exception of Hanssen *et al.*, all the other studies were done primarily among male applicators and in former state farms (i.e., large-scale open farms).However, another relatively larger study that focused both on male pesticide applicators as well as female re-entry workers in commercial farming systems in Ethiopia (i.e., small-scale irrigated farms, large-scale open farms and cut-flower greenhouses) indicated significant exposure-response associations of occupational pesticide exposure with respiratory symptoms and reductions in lung function. Negatu *et al.* compared the magnitude of the reduction in lung function due to pesticide exposure with a standardized estimate of lung function loss due to cigarette smoking per year and the observed effect due to pesticide exposure was 3- and 5-fold greater per year than cigarette smoking in males and females, respectively.

Other than some of the aforementioned studies on the health effects of pesticides that include cut-flower greenhouses farms some studies specifically on workers from cut-flower greenhouses

farms in Ethiopia have indicated diverse health problems including swelling of the feet and kidney problems. A high prevalence of abnormal serum cholinesterase levels, respiratory and dermal symptoms have been reported. In addition, there have been many reports of the negative health and environmental impacts of cut-flower greenhouses farms such as floriculture farms in Ethiopia. In cut-flower greenhouses farms, in comparison to large-scale open farms or small-scale irrigated farms, there are reports of relatively higher (8–13-fold) intensity of pesticide use, use of unregistered pesticides, use of WHO highly hazardous pesticide list pesticides, and higher occupational pesticide exposures compared with open field farming that might lead to higher frequency of health symptoms.

The other health-related pesticide risks in Ethiopia include self-poisoning and residential pesticides exposure risks. There are many hospital-based studies that indicate pesticides as the main means of intentional self-poisoning. The high frequency of suicide using pesticides may be due to easy availability of highly toxic but cheap pesticides such as organophosphates in illegal (open) markets. To our knowledge there is only one study in Ethiopia that has investigated the association of acute pesticide intoxication (API) with residential proximity to green houses. It indicated that 42% of those residing close to flower farms (<5 km) are reported to have experienced API, compared to 11% of those living farther away (5–12 km) with a significant prevalence ratio (PR) of (PR=3.7, 95% CI: 2.6–5.4).

Surface water risks

Pesticide contamination of water bodies can be hazardous both directly and indirectly to humans and other organisms that live near water. A study conducted in surface water samples around western Ethiopia and Addis Ababa (the capitol) showed mean concentrations of 2, 4-D, malathion, diazinon and fenpropimorph ranging from 1.59–13.90 μg/l and 0.11–138 μg/l for Jimma and Addis Ababa water samples, respectively. The same study indicated the residue levels of some of the pesticides were above the European drinking water guideline values. The study also indicated a clear chronic risk to public health, particularly from exposure of diazinon and fenpropimorph due to higher estimated daily intake (EDI) than the acceptable daily intake (ADI) of these pesticides.

Environmental monitoring studies in the Ethiopian Lake Zeway area showed a higher chronic risk posed by the insecticide spiroxamine (using the European standardized cut-off value of pesticide residues of 0.1 μg/L) if surface water is used for drinking purposes and higher acute exposure toxicity ratio values for pesticides clofentezine, sulfur, spiroxamine and methomyl that

can pose an acute toxic risk to aquatic organisms. Additional surface water pesticide risk assessment studies in the Debre Zeit area of central Ethiopia indicated that lambda-cyhalothrin, endosulfan, profenofos, and diazinon pesticides may pose high risks to the aquatic ecosystem and a decrease of macro invertebrate biodiversity and disappearance of sensitive taxa may be due to chemical pesticide loads. Similar to the negative health risk posed by cut-flower greenhouses farms as discussed in the health risk section above, there are many studies on the negative impacts of cut-flower greenhouses farms on surface water, as risk assessment studies include surface water samples of nearby effluents of floriculture farms, indicating a risk to public health and aquatic systems.

Risks to fish

There are few pesticide-related risk assessment studies on fish in Ethiopia. A study on tissue samples of fish collected from Lake Hawassa in southern Ethiopia showed contamination with organochloride pesticides (OCPs) including DDT and endosulfan. In addition to the risk posed by OCPs to fish, the study also indicated a risk to consumers' health, in particular for children between the ages of 0–1 year. Another study on samples of muscle and liver of three fish species from Lake Hawassa indicated residues of DDTs that could have biomagnified in the lake's food web. Similar studies in lakes of the Central Rift Valley, Ethiopia indicated OCP contamination in muscle samples of five fish species from Lake Zeway and residues of DDT, endosulfans and chlorpyrifos from Lake Koka. In addition, the study on Lake Koka indicated bio magnification of DDTs in the food web, similar to the results of the Lake Hawassa study.

Risk to bee colonies

Many studies have been conducted on the effects of pesticide use in bee colonies across Ethiopia, for example a study in the Ethiopian Central Rift Valley where pesticides are used intensively for small-scale horticultural production indicated that 48.3% of beekeepers abandoned beekeeping as a result of colony losses due to pesticide applications. Similarly, studies in other parts of Ethiopia, including the Enebse and Bure districts, the Dangila, Guangua and Mecha districts, the Gojjam zone of northwest Ethiopia, the Ejere District of western Ethiopia, and others reported a decreasing trend of honeybee populations and their products due indiscriminate pesticide application.

Risks to soil and wildlife

A study in Ethiopia around Upper Awash agriculture industry enterprises detected substantial amount of OCPs (i.e., sigma endosulfans up to 56000 and sigma DDTs up to 230 ng g (-1) dry weight) which could be a threat to the surrounding and downstream ecosystems. In addition, the only study on wild birds in the Ethiopian Rift Valley region indicated the main DDT metabolite, p,p'-DDE, was most abundant and significantly greater concentrations in the investigated bird species (up to 138.5 μg/g lipid), that could have deleterious effects on survival and/or reproduction of birds.

Pesticide residues in food

There have been many risk assessment studies of pesticide residues in plant products in Ethiopia. All of the assessments in Ethiopia detected pesticide residues in samples and some were above the allowed maximum residue limits (MRLs). For example, diazinon residues were detected in wheat samples. All food items scrutinized for residues contained one or more pesticide residues. Analyses for 2, 4-D, aldrin, endosulfan and DDT pesticides in commercially available wheat samples showed detectable residues and all maize samples showed contamination by DDT. However, all of the above studies indicated a detectable residue lower than MRL except Mekonen *et al.* in which more than 33% of the food samples were above MRLs and Mekonen *et al.* where mean concentrations of DDT in maize samples were far above the MRLs. Additionally, an investigation of pesticide residues in khat, a common stimulant used in Ethiopia, indicated that 80% of the khat samples contained DDT and some of the residues were above MRLs.

In addition to the risk of pesticide residues in plant products, other studies have shown contamination and risk of pesticide residues in animal food products. A study in southern Ethiopia indicated 60% of the dairy farm owners offer or sell products to the public from animals treated with a variety of drugs, including pesticides, without a withdrawal period for the drug, which poses a risk to consumers' health. Similar studies detected varying levels of persistent organochlorine pesticides residues from cow and goat milk. In addition, a 3-fold higher DDT residue concentration above the acceptable daily intake set by the WHO was detected in human mothers' and cows' milk samples. On top of the risk of pesticide residues in dairy products, other studies in Ethiopia also showed residues of organochloride pesticides in cattle carcasses and honey samples.

2.12. Conceptual frame work

Retail firms are required to have, at minimum, a technical advisor with competence in the handling of pesticides and knowledge of their health hazards. Such persons are expected to supervise all technical operations on the premises to ensure that pesticides are distributed in a safe manner. In addition, sales personnel are required to have sufficient knowledge about pesticides to enable them to handle pesticides safely and to advise end-users appropriately, which may help to reduce APP incidence and support notification of the agents involved in APP (Lekei et al., 2014).

Proper pesticide waste disposal is an important part of responsible pesticide use. Improper disposal can lead to contamination of soil, groundwater, and surface water, causing serious liability problems for the pesticide user, as well as a poor public image. Several federal and state laws, including the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Florida Pesticide Law (Ch. 487 F.S.), regulate the disposal of pesticide waste. Improper disposal can result in fines for the pesticide applicator. Everyone who handles pesticides must know how to dispose of pesticides properly. It is possible to dispose of these wastes legally, responsibly, and economically (Norman and Frederick, 2020). Generally, the knowledge and attitude of retailers towards the hazardous risk of pesticides and their proper disposal method determines their actual practices of disposal of pesticides. And the knowledge, attitude and practices of disposal are determined by different factors. These factors are grouped into two groups: Demographic factors (Education level, age, and sex) and institutional factors (Government enforcement and training).

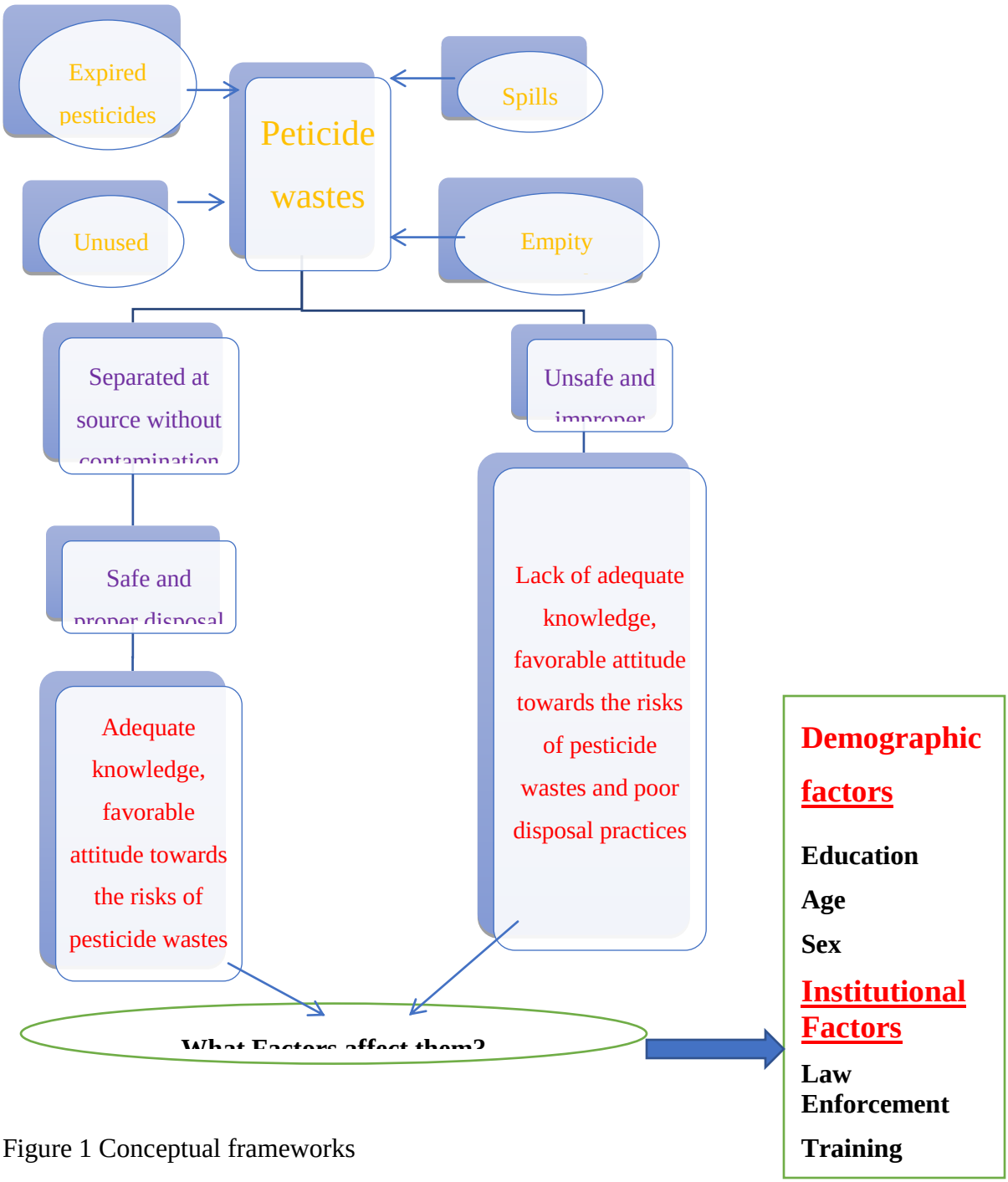

Figure 1 Conceptual frameworks

CHAPTER THREE

3. METHODOLOGY OF THE STUDY

In this chapter, the methods which were applied in the study were discussed. That were description of the study area, research design, sampling method, data collecting methods, and data analysis methods were explained.

3.1. Description of the Study Area

Addis Abeba is the capital city of Ethiopia and the African Union and is often called the "African Capital" due to its historical, diplomatic and political significance for the continent. The city is an important administrative center not only for Ethiopia but also for the whole of Africa. The headquarters of the African Union and the United Nations Economic Commission for Africa can both be found in the city. This historically significant city in its enchanting mountain setting is recognized as one of the world's most problematic, yet fascinating and beautiful cities. Its country's border war with Eritrea and unsteady relationship with Somalia have put a heavy burden on Addis Abeba as it has become a center for refugees whom it cannot support.

Addis Abeba has a population of 3,627,934 as of 2007; and is the world's largest city that is in a landlocked country. When the city was at risk due to a shortage of firewood in the early 1900s, an ambitious campaign to plant Eucalyptus trees imported from Australia in and around the city essentially secured its lasting location. Today, a greenbelt of forests and semi-subsistence cultivated land surrounds the city. Addis Abeba is Located in the foothills of the Entoto Mountains and standing 7,726 feet (2,355 meters) above sea level, it is the third highest capital in the world. It is located in the geographic center of the country.

In Addis Abeba, the climate is warm and temperate. The summers are much rainier than the winters in Addis Abeba. This location is classified as Cwb by Köppen and Geiger. The average annual temperature in Addis Abeba is 15.6 °C | 60.0 °F. Precipitation here is about 1874 mm | 73.8 inch per year. The driest month is December. There is 7 mm | 0.3 inch of precipitation in December. The greatest amount of precipitation occurs in August, with an average of 419 mm | 16.5 inch. With an average of 17.2 °C | 63.0 °F, April is the warmest month. The lowest average temperatures in the year occur in December, when it is around 14.4 °C | 58.0 °F. The

precipitation varies 412 mm | 16 inches between the driest month and the wettest month. The variation in temperatures throughout the year is 2.8 °C | 5.1 °F. The month with the highest relative humidity is August (87.04 %).

The month with the lowest relative humidity is February (44.35 %).The month with the highest number of rainy days is July (29.00 days). The month with the lowest number of rainy days is December (1.67 days).

In Addis Ababa, the month with the most daily hours of sunshine is February with an average of 9.62 hours of sunshine. In total there are 298.29 hours of sunshine throughout February. The month with the fewest daily hours of sunshine in Addis Abeba is January with an average of 9.3 hours of sunshine a day. In total there are 288.44 hours of sunshine in January. Around 3114.25 hours of sunshine are counted in Addis Abeba throughout the year. On average there are 102.5 hours of sunshine per month (Addismayer.gov.et).

Figure 2 Geographical location of the study area **Source: (Addismayer.gov.et)**

3.2 The Study/target Population

The study area of the research was Addis Ababa city. The reason for selecting Addis Ababa was due to the availability of more pesticide retailers than the rest of the country and the working center of the researcher, there are 145 pesticide retailers in Adiss ababa.

3.3 Research Design and methods

This section discusses the selection and justification of the paradigm used in this research. Paradigms are essential to scientific inquiry because 'no natural history can be interpreted in the absence of at least some implicit body of intertwined theoretical and methodological belief that permits selection, evaluation, and criticism.

The positivistic paradigm seeks facts or causes of social phenomena without considering the subjective state of the individual, where precision and objectivity is preferred over intuition and experience. Social reality also depends on the mind. Therefore, what is being researched cannot be unaffected by the mind. The positivism paradigm focuses on a single reality that is understood through careful study applying appropriate methodologies. It involves collecting and analyzing data to enable the testing of theories and proving hypotheses. Quantitative methods are thus applied, including sample surveys. In this case, the researcher is completely separated from the research and has no influence over the matter being researched. The researcher who employs positivist paradigm emphasizes discovery of causal laws through careful empirical observations and value-free research. Post positivism (also referred to as realism) asserts that human knowledge is based on human conjecture, rather than the unchangeable foundations of positivism. The reality is assumed to exist but is only imperfectly apprehensible due to the limitations of human intellect. Claims about reality are subjected to critical examination to facilitate apprehending reality as near as possible to perfection. The researcher remains separate from the research, but may apply quantitative and/or qualitative methods (Creswell, 2014).

For the quantitative aspect of the study, sample survey of quantitative research method was used to gather different types of data on socio-demographic and economic characteristics of the sample.

As to the qualitative aspect of the study, the researcher employed questionnaire, semi-structured interviews with key informants, observations of relevant aspects of the settings of the study areas, and documentary analysis of different published and unpublished materials were also identified and used for this purpose.

3.4 Sampling Method and Sampling Procedure

The study area of the research was Addis Ababa city. The reason for selecting Addis Ababa was due to the availability of more pesticide retailers than the rest of the country and the working center of the researcher. The target population of the study was all pesticide retailers found in Addis Ababa city which had a size of 145. From 145 retailers the researcher selected 85 retailers by simple random sampling. The reason for choosing this sampling technique was to minimize time and cost required to do this study. Then the original required sample size was calculated by using Kothari (2014) formula at 93% confidence level as follows.

$\boldsymbol{n_r = 4pq/d^2}$…… Formula (1)

Where:

n_r =the original required sample size

p=0.5 (proportion of the population having the characteristics)

q=1-p=1-0.5=0.5

d=0.07(marginal error or degree of accuracy desired)

Therefore, the original required sample size (n_r) was calculated as follows.

$$\boldsymbol{n_r = 4 * 0.5 * 0.5/0.07^2}$$

$$\boldsymbol{n_r} \textbf{ =204}$$

From this result the adjusted minimum sample size ($\boldsymbol{n_a}$) was calculated by the following formula.

$\boldsymbol{n_a = \frac{n_r}{1+(\frac{n_r-1}{N})}}$ ……..Formula (2)

Where:

n_a=adjusted sample size

N=population size=145

Therefore, the adjusted minimum sample size (n_a) was calculated as follows.

$$\boldsymbol{n_a = \frac{204}{1 + (\frac{204 - 1}{145})}}$$

$$\boldsymbol{n_a} \textbf{ =85}$$

3.5 DATA COLLECTING METHOD

In this study both qualitative and quantitative types of data was employed. And both primary and secondary data sources were used. Primary data was collected through questionnaires, interview, and observation. The secondary data was collected through related literature review, magazines, and internet websites.

3.5.1 Questionnaire

A questionnaire was the crucial instrument to obtain the necessary data from a sample. To conduct the study, the researcher employed structured questionnaires to obtain the required data from pesticide retailers found in Addis Ababa city. The questionnaires had open-ended and closed- ended questions. The questionnaire was prepared in English language and to ensure clarity and understandability it was translated into Amharic language.

3.5.2 Interviews

Interview was conducted on the retailers. The purpose of interview was to get relevant information from the retailers. There were ten retailers for the interview. The interview consisted of both structural and semi structural to get relevant information.

3.5.3 Observation/field survey

The researcher observed ten shops and stores of pesticide. In the actual observation important photographs was taken.

3.5.4 Related literature review

Information about some concepts and facts was obtained from different related literatures.

3.6 Data Analysis Method

Logit mode!

l Following the concept of the model from Green (2003) and Gujarati (1995), the Logit model for pesticide awareness, attitude and disposal practice retailers can be specified as below: to fulfill the Objectives of the study.

(1) $$\left(P(Y_i = 1)\right) = \frac{1}{e^{-(B_i X_i)}}$$

(2) $$\left(P(Y_i = 1)\right) = \frac{1}{1+e^{-2i}}$$

Where: P (Yi=1) is the probability that a retailer had awareness, favorable attitude and dispose their waste legally, Zi= the function of a vector of explanatory variables), e- represents the base of natural logarithms and equation is the cumulative distribution function. If P (Yi=1) is the probability of choosing to dispose legally, then 1- P (Yi=1) represents the probability that the household lack awareness or unfavorable attitude and/or choose to dispose illegally and is expressed as

(3) $$\big(1 - P(Y = 1)\big) = 1 - \frac{1}{1+e^{-Zi}} = \frac{1}{1+e^{Zi}}$$

(4) $$\frac{P(Y=1)}{1-P(Y_i=1)} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{Z_i}$$

Equation (4) simply is the odds ratio, the ratio of the probability that a retailer will be disposed legally to the probability that it will be disposed illegally. Taking the natural log of equation (4), we obtain

(5) $$L_i = In\frac{P(Y=1)}{1-P(Y_i=1)}\Big\} = Z_i$$

Where: Li is the log of the odd ratio which is not only linear in the explanatory variables but in the parameters also. Thus, introducing the stochastic error term (+) the logit model can be written as

(6) $$Z_i = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + u_i$$

Where X's = are explanatory variables that determines the retailer level of waste disposal system, the general model has a form of

$$Z_i = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + u_i$$

……formula (3)

- Y is the awareness, attitude and practice of the retailer
- X1is sex of the retailer
- X2 is age of the retailer
- X3 is educational status of the retailer
- X4 is government enforcement

- X5 is dummy variable taking the value of 1 if the respondents who get training and 0 otherwise

  ,,,, ,0, ,1,,2, ,3 4,.. are slopes or regression coefficients that represent the contribution of each independent variable to the prediction of the dependent variable. , is the constant or intercept

3.7 Working Hypothesis and Variable Specification

Dependent variables

1. **Knowledge:** knowledge of retailers about pesticides and their hazardous risk on the environment and human health. It also refers to knowledge of retailers how to dispose pesticide waste. Retailers should have the required knowledge about pesticides and their hazardous risk on the environment and human health and the knowledge to handle pesticides properly.
2. **Attitude:** refers to feeling of pesticide retailers about the negative impacts of pesticide wastes on the environment and human health. It is also the outlook of retailers about proper pesticide waste disposal. Retailers should have favorable attitude towards the impacts of pesticide wastes.
3. **Practice:** refers to pesticide waste disposal practices which can be either proper or improper. Pesticide retailers should dispose their wastes properly to proper disposal sites without contaminating the environment and health in general.

Independent variables

1) **Education**: it was measured as the number of year staying in school. It is expected to have a positive impact on the disposal practice without contamination of the environment and human being.
2) **Age:** is a continuous variable expected to negatively influence the waste disposal practice of retailers. Mostly observed that old aged people do not focus on the environment related issues and the impact of waste on their health; they also consider as this is the responsibility of the government in general.

3) **Sex:** As traditional trend shows often the women are feeling as more responsible to dispose properly than men. 1if the retailer sex female, 0 if male.
4) **Training:** It is a dummy variable expected to positively affect the knowledge, attitude and disposal practice of the retailers. If the respondent receipt training or information from the concerned body about how they are going to dispose their waste in particular and the consequence of inappropriate management of wastes on the environment and their health in general.1 if they have training, 0 otherwise.
5) **Government enforcement:** It is a dummy variable expected to affect the knowledge, attitude and disposal practice of the retailers. 1 if enforcement by government 0 otherwise.

Table 1 Independent variables on disposal wastage implications on EHH

Variables	Specification	Category of variables	Expected effect on EHH
Education	number of year staying in school	categorical	+
Age	Years	Continuous	-
Sex	1if the retailer sex female, 0 if male	Categorical	+
Training	1 if they have training, 0 otherwise	Categorical	+
Government enforcement	. 1 if enforcement by government 0 otherwise	Categorical	+

CHAPTER FOUR

4 RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the main body of the paper. To achieve each specific objectives of the study, the data obtained from survey are analyzed using different methods of analysis.

Descriptive statistics is used mainly to the first objectives. In addition to inferential statistics like t-test (for continuous variables) and chi-square (for discrete variables),

4.2 Personal Data (Demographic Characteristics)

Table 2 shows that 60% of the respondents are males and the 40% of them are females. Most of the respondents are males. The table also shows the average age of the respondents. 28.67% of the respondents have an average age of 34.63 years and 71.33% of them have an average age of 41.43 years. Most the respondents have an average age of 41.43 years. When we see the educational status of the respondents, 10.59% of them are illiterate, 28.24% of them completed primary school, 24.7% of them completed secondary school, and 36.47% of them graduated from college or university. This implies that most of the respondents are educated.

Table 2 Personal Data of pesticide retailers

		frequency	Percentage (%)
Sex	Male	51	60
	Female	34	40
	Total	85	100
Age	From 20-45 years	30	35.29
	From 46-75 years	55	64.71
	Total	85	100
Educational level	Illiterate	9	10.59
	Primary school	24	28.24
	Secondary school	21	24.70
	College/university	31	36.47
	Total	85	100

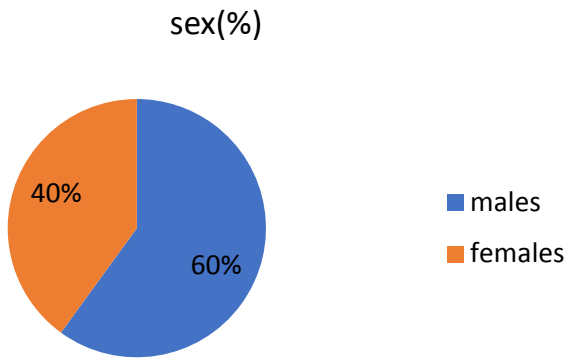

Figure 3 Sex of respondents in percent.

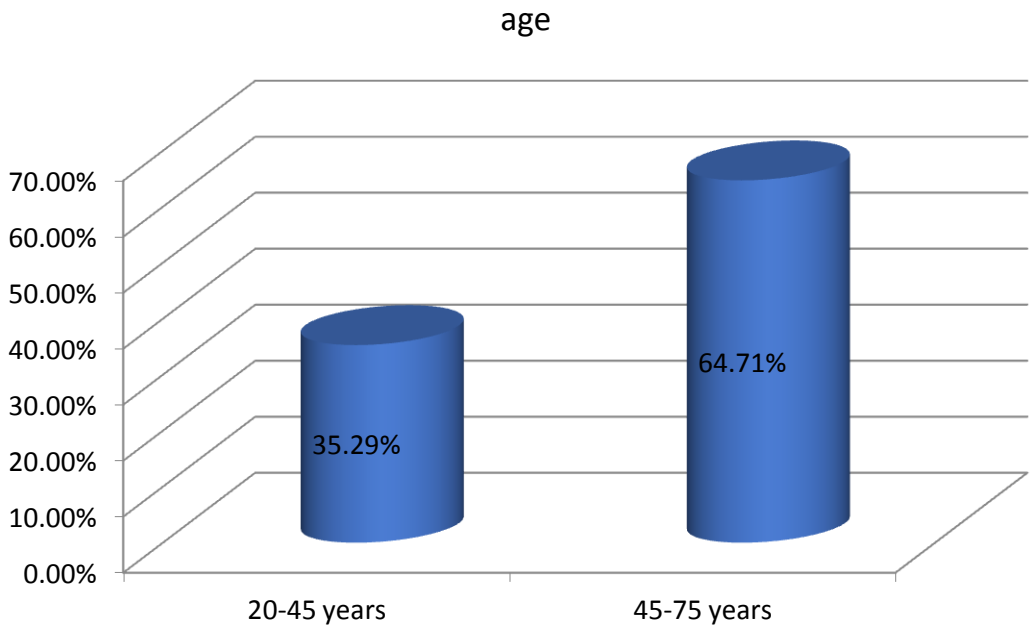

Figure 4 Age of respondent

Figure 5 Educational levels of respondents Practices of Pesticide waste disposal

Table 3 shows that 76.47% of the respondents generated pesticide waste due to spills, 5.88% of them had expired pesticides as a waste and 17.65% of them had both spills and expired pesticides as a waste. This shows that most of pesticide retailers generated pesticide waste due to spills of pesticides.

Table 3 Types of pesticide waste that retailers generate

No.	Types of pesticide wastes	Frequency	Percentage

1	Empty pesticide container	0	0
2	Unused spray mix	0	0
3	Spills	65	76.47
4	Expired pesticide	5	5.88
5	Both Spills and Expired pesticide	15	17.65
	Total	85	100

Table 4 shows that 20% of the respondents disposed spills using the three spills disposal procedures which are control, contain and clean up, but 80% of them apply only the first two procedures, that is control and contain. The table also shows that 40% of the respondents disposed expired pesticides reporting to the concerned body while 60% of them disposed expired pesticides without reporting the concerned body. From this we can conclude that most of the retailers didn't use the proper methods of pesticide waste. Hence their pesticide waste disposal practice is improper.

Table 4 Types of pesticide waste that retailers generate

No.	Pesticide wastes	Pesticide wastes Disposal methods	Frequency	Percentage
1	Spills	Control, contain and clean up	17	20
		Control and contain but no clean up	68	80
2	Expired pesticide	Report to the concerned body and	34	40

		dispose it properly and legally		
		dispose without reporting to the concerned body	51	60

Table 5 shows that 58.8% of pesticide retailers dispose pesticide wastes in a place which is not given or known by the government, while 41.2% of them dispose in a place which is given or known by the government. This implies that most retailers dispose improperly.

Table 5 Place of pesticide waste disposal

Place of disposal	frequency	Percentage
In a place not given by the government	50	58.8
In a place given by the government	35	41.2
Total	85	100

According to table 6 the means of getting training for those retailers, who got training, is through pesticide waste management experts.

Table 6 Means of getting training/lesson

Means	frequency	Percentage
woreda meeting	0	0
pesticide waste management experts	24	100
health institution	0	0

Table 7 presents the responses of retailers for different questions related to waste disposal practices. It is described as follows.

Among 85 retailers, 44.7% of the retailers dispose their wastes in a suitable place while 55.3% of them do not. This shows that significant number of the retailers disposes in unsuitable place this may be due to lack of knowledge and unfavorable attitude towards the risks of pesticide wastes. 58.8% of the retailers said that there is no specific disposal place provided by the government but 41.2% said there is a disposal place given by the government. 51.8% of the respondents replied that they don't dispose according to the instruction labeled on the container but 48.2% of them said that they dispose according to the instruction labeled on the container. The majority don't dispose according to instruction this may be also due to lack of knowledge and unfavorable attitude towards the risks of pesticide wastes. The majority of retailers (71.8%) said that they haven't come across any form of lesson associated with pesticide waste management but 28.2% of them said that they have come across some form of lesson associated with pesticide waste management. And the majority of retailers (65.9%) replied that they don' receive any advice from experts while the minority (34.1%) said that they receive advice from experts. This may negatively affect their disposal practices.

Table 7 Other Questions on practices of Pesticide waste disposal

Questions	Frequency		Total	Percentage		Total
	Yes	No		Yes	No	
Do you dispose in a suitable place?	38	47	85	44.7	55.3	100
Is there specific disposal place given by the Government?	35	50	85	41.2	58.8	100
Do you dispose according to the instruction labeled on the container?	41	44	85	48.2	51.8	100

Have you ever come across any form of lesson associated with pesticide waste management?	24	61	85	28.2	71.8	100
Do you receive some advice from experts about pesticide waste disposal?	29	56	85	34.1	65.9	100

In general from the above analysis we can conclude that there is improper pesticide waste disposal practices among retailers.

As presented in table 8 , among 85 respondents, 45.88% and 27.05% strongly agree and agree respectively that lack of knowledge and awareness is the cause of improper disposal, 31.76% and again 31.76% strongly agree and agree respectively that poor responsibility is the cause of improper disposal, 32.94% and 27.06% strongly agree and agree respectively that carelessness is the cause of improper disposal, 34.11% and 30.59% strongly agree and agree respectively that weak regulation is the cause of improper disposal. Therefore, according to the survey, the main causes of improper pesticide waste disposal are Lack of Knowledge and Awareness, Poor responsibility, Carelessness and Weak regulation.

Table 8 Cause of Improper Pesticide waste disposal

Questions	Strongly disagree		Disagree		Neither		Agree		Strongly agree		Total	
	F	%	f	%	f	%	F	%	F	%	f	%
Lack of Knowledge and Awareness	9	10.59	7	8.24	7	8.24	23	27.05	39	45.88	85	100
Poor responsibility	8	9.41	9	10.58	14	16.47	27	31.76	27	31.76	85	100
Carelessness	6	7.06	13	15.29	15	17.65	23	27.06	28	32.94	85	100
Weak regulation	8	9.41	7	8.24	15	17.65	26	30.59	29	34.11	85	100

4.3 Pesticide retailers' knowledge and attitude towards the Impacts of pesticide wastes on the environment and human health

4.3.1 Pesticide retailers' knowledge

Pesticide waste risks

Table 9 presents the responses of retailers for those questions related to knowledge of retailers about the risks of pesticide wastes. As illustrated in the table from 85 retailers only 24 (28.24%) know the risk or hazard of pesticide wastes, but 61 (71.76%) of them, which are the majority, don't know the hazardous nature of pesticide wastes. This may be due to different factors like educational status, age, lack of information, etc. The table also shows that 82.35%, 83.53%, 76.47%, and 65.9% of the respondents didn't know environmental Policies, strategies of pesticide waste management, proclamation of environmental pollution control on hazardous waste, and government regulation on pesticide waste management respectively.

Table 9 Questions on knowledge of retailers about the implications of pesticide wastes on the environment and human health

Questions	Frequency		Total	Percentage (%)		Total
	Yes	No		Yes	No	
Do you know pesticide wastes are hazardous substances?	24	61	85	28.24	71.76	100
Do you know Environmental Policies?	15	70	85	17.65	82.35	100
Do you know strategies of pesticide waste management?	14	71	85	16.47	83.53	100

Do you know proclamation of Environmental pollution control on hazardous waste?	20	65	85	23.53	76.47	100
Do you know any government regulation on pesticide waste management?	29	56	85	34.1	65.9	100

Impacts of pesticide waste

As we can see in table 10 more than 50% of the respondents answered that impacts of pesticide waste on land, air and water bodies is weak, medium and no effect. This implies that most of the retailers have no knowledge on the impacts of pesticide wastes on the environment and human health. But less than 50% of the respondents replied that the impact is strong and very strong which means, retailers who have knowledge on the impacts of pesticide wastes are less than 50%.

Table 10 impacts of pesticide waste

Impacts	No effect		Weak		Medium		Strong		Very strong		Total	
	F	%	F	%	F	%	F	%	F	%	f	**%**
Impact on land	6	7.06	19	22.35	25	29.41	20	23.53	15	17.65	85	
Impact on air	5	5.88	25	29.41	35	41.18	14	16.47	6	7.06	85	
Impact on water bodies	9	10.59	26	30.59	30	35.29	15	17.65	5	5.88	85	

4.3.2 Pesticide retailers' attitude

In most case attitude of the people towards the impacts of pesticide waste affect the waste management as well as the environment, table :4.10 shows that only 11.77% of the retailers were not worried about the environment, while 31.76%, 29.41% and 27.06% of the retailers gave sometimes worried, worried and very worried responses respectively. This implies that significant number of the retailers have positive attitude to protect the environment.

Table 11 the respondents who concerned about the environment

Respondent who concerned about environment	Frequency	Percent	Cumulative Percent
Not worried	**10**	**11.77**	**11.77**
Sometimes worried	**27**	**31.76**	**43.53**
Worried	**25**	**29.41**	**72.94**
Very worried	**23**	**27.06**	**100**
Total	**85**	**100**	

The study result in table 12 shows that 23.53% and 41.18% of the respondents strongly agree and agree respectively on the harmfulness of pesticide wastes but 9.41% and 14.12% of them strongly disagree and disagree with this issue. On the importance of pesticide waste management 35.29% and 41.18% of the respondents strongly agree and agree respectively but 1.18% and 10.59% of them strongly disagree and disagree respectively. 32.94% and 21.18% of the respondents strongly agree and agree respectively with the threat of improper waste disposal while 7.06% and 25.88% of them strongly disagree and disagree respectively. On the responsibility of retailers for pesticide management, 43.53% and 28.23% of the respondents strongly agree and agree respectively but, 1.18% and 17.65% of them strongly disagree and disagree respectively. 31.77% and 25.88% of the respondents strongly agree and agree respectively that they upset when they see other retailers disposing pesticide wastes irresponsibly while 8.24% and 22.35% of them strongly disagree and disagree respectively.

From the above discussion we can conclude that although they have no sufficient knowledge, most of the retailers have positive attitude towards the hazardous risks of pesticide wastes.

Table 12 Questions on attitude of retailers towards the Impacts of pesticide wastes on the environment and human health

Questions	Strongly disagree		Disagree		Neither		Agree		Strongly agree		Total	
	F	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**
Pesticide wastes are harmful.	8	9.41	12	14.12	10	11.76	35	41.18	20	23.53	85	100
Pesticide waste management is important	1	1.18	9	10.59	10	11.76	35	41.18	30	35.29	85	100
Improper waste disposal is a threat to environment.	6	7.06	22	25.88	11	12.94	18	21.18	28	32.94	85	100
Retailers should be responsible for pesticide waste management	1	1.18	15	17.65	8	9.41	24	28.23	37	43.53	85	100
Upset if you see other retailers that dispose pesticide waste irresponsibly	7	8.24	19	22.35	10	11.76	22	25.88	27	31.77	85	100

4.4 Factors that affect knowledge, attitude and practices of retailers

In this section, the researcher used various statistical tools in order to test the relationship between independent variables and dependent variable.

4.4.1 Demographic factors

Demographic factor is one of the factors that affect the knowledge, attitude, and practices of retailers. Demographic factors include sex, age, and educational status.

Sex of Retailers- Retailers' sex is indicated as one of demographic factor that influence the status of retailers' knowledge, attitude and practices of pesticide waste management system. Retailers' sex affects their knowledge, attitude and practice of pesticide waste management. From 85 respondents 51 of them are males and 34 respondents are female. Table 13 indicates that there is relationship between retailers' sex and knowledge, attitude and practice of pesticide waste management. Majority of the respondents (60%) are male. A comparison has made between retailers, who have and have no knowledge about the risks of pesticide wastes, have positive attitude and negative attitude, have good practice and poor practice with regard to sex. For instance, there are 25 retailers who have knowledge, among them 20 out of 51(60%) male retailers are males and 5 out of 34(40%) female retailers are females. That is 31 male retailers and 29 female retailers have no knowledge about the risks of pesticide wastes. Similarly, among those retailers who have favorable attitude which are 56in number, 37of them are male and 19 of them are females. And 14 and 15 male and female retailers respectively have unfavorable attitude. When we see their practices, 16 male and 8 female retailers have good practice and 35 male and 26 female retailers have poor practice.

A result of chi-square statistics also verifies the existence of significant relationship between retailers' sex and knowledge and attitude at 1% significance level for knowledge and at 5% significance level for attitude and practice. In general the result shows that the sex of averagely large number of retailers who have knowledge, favorable attitude and poor practice is male and no knowledge, unfavorable attitude and good practice is female retailers.

Table 13 Sex of retailers

Knowledge	**Knowledge**	**No knowledge**	**Total (frequency & %)**	**Chi-square**	**p-value**
Male	20 (39.22%)	31 (60.78%)	51 (60%)		
Female	5(14.71%)	29(85.29%)	34(40%)	5.9	0.99

Total	25(29.41%)	60(70.59%)	85(100%)		
Attitude	**Favorable**	**Unfavorable**	**Total (frequency & %)**	**Chi-square**	**p-value**
Male	37(72.55%)	14(27.45%)	51(60%)		
Female	19(55.88%)	15(44.12%)	34(40%)		
Total	56(65.88%)	29(34.12%)	85(100%)	2.52	0.3
Practice	**Good**	**Poor**	**Total (frequency & %)**	**Chi-square**	**p-value**
Male	16(31.37%)	35(68.63%)	51(60%)		
Female	8(23.53%)	26(76.47%)	34(40%)		
Total	24(28.24%)	61(71.76)%	85(100%)	0.62	0.002

Educational level of retailers- The educational level of sample respondents range from illiterate to college or university level. Table 14 indicates that from the total of 85 retailer respondents 10.59% are illiterate, 28.24% are primary school, 24.7% secondary school, 36.47% college or university. Moreover, the researcher made a comparison between the retailers' education level and his/her knowledge, attitude and practice**.** The result shows that from the total samples, knowledge, attitude and practice are improved from illiterate to higher education. From the total sample of knowledge, 11.11% of illiterate, 8.33% of primary education, 28.57% of secondary education, and 54.84% of college or university level of retailers have the knowledge about the impacts of pesticide wastes on the environment and human health. Whereas, 88.89% of illiterate, 91.67% of primary education, 71.43% of secondary education and 45.16% of college or

university levels of retailers have no knowledge. From the total sample of attitude 33.33% of illiterate, 54.17% of primary education, 57.14% of secondary education and 90.32% of college or university level retailers have favorable attitude. Whereas, 66.67% of illiterate, 45.83% of primary education, 42.86% of secondary education and 9.68% of college or university level retailers have unfavorable attitude. And, from the total sample of practice, 11.11% of illiterate, 20.83% of primary education, 28.57% of secondary education and 38.71% of college or university level respondents have good practice. Whereas, 88.89% of illiterate, 79.17% of primary education, 71.43% of secondary education and 61.29% of college or university level respondents have poor practice. The finding from retailers survey is further strengthened by Pearson chi-square test demonstrating a significant relation at 1% level between educational level and knowledge and attitude and at 5% level between education level and practice. In general, when the retailers' educational level improves, the knowledge, attitude and practice level of the retailers also improves. Furthermore, when the educational status of the retailers is compared with retailers' sex, males are better educated than females.

Table 14 Educational level of retailers

Knowledge	**Knowledge**	**No knowledge**	**Total (frequency & %)**	**Chi-square**	**p-value**
Illiterate	1(11.11%)	8(88.89%)	9(10.59%)	15.84	0
Primary education	2(8.33%)	22(91.67%)	24(28.24%)		
Secondary education	6(28.57%)	15(71.43%)	21(24.70%)		
College/University	17(54.84%)	14(45.16%)	31(36.47%)		
Total	26(30.59%)	59(69.41%)	85(100%)		
Attitude	**Favorable**	**Unfavorable**	**Total (frequency**	**Chi-square**	**p-value**

			& %)		
Illiterate	3(33.33%)	6(66.67%)	9(10.59%)	14.66	0
Primary education	13(54.17%)	11(45.83%)	24(28.24%)		
Secondary education	12(57.14%)	9(42.86%)	21(24.70%)		
College/University	28(90.32%)	3(9.68%)	31(36.47%)		
Total	56(65.88%)	29(34.12%)	85(100%)		
Practice	**Good**	**Poor**	**Total (frequency & %)**	**Chi-square**	**p-value**
Illiterate	1(11.11%)	8(88.89%)	9(10.59%)	3.63	0
Primary education	5(20.83%)	19(79.17%)	24(28.24%)		
Secondary education	6(28.57%)	15(71.43%)	21(24.70%)		
College/University	12(38.71%)	19(61.29%)	31(36.47%)		
Total	24(28.24%)	61(71.76%)	85(100%)		

Age of retailers- The selected retailers constitutes various age groups from the minimum of 20 to the maximum of 75. The mean age of retailers who had knowledge and lack of knowledge is found to be 34.63 and 41.43 years respectively. The mean age of retailers who had favorable attitude and unfavorable attitude is found to be 38.56 and 41.21 years respectively.

And, the mean age of retailers who had good and poor practice is found to be 39.24 and 39.57 years respectively.

Furthermore, the t-test also shows that there is significant relationship between retailers' knowledge, attitude and practice and their age. 15 as per the data obtained from statistical tests, retailers' age and knowledge, attitude and practice have a significant negative relationship at 1% significant level. It implies that when the retailers' age increases their knowledge, attitude and practice would be decreased.

Table 15 Age of retailers

Knowledge	**N**	**Mean**	**St. Deviation**	**t-test**	**p-value**
Yes	24	34.63	9.764	-2.88	0.00456
No	61	41.43	9.923		
Attitude	**N**	**Mean**	**St. Deviation**	**t-test**	**p-value**
Yes	56	38.56	10.66	-1.17	0.243869
No	29	41.21	9.485		
Practice	**N**	**Mean**	**St. Deviation**	**t-test**	**p-value**
Yes	23	39.24	11.124	-0.125	0.90069
No	62	39.57	10.039		

4.4.2 Institutional Factors

In this section, the researcher investigated the influence of institutional factors on knowledge, attitude and practice of pesticide waste management; particularly, it includes law and law of enforcement, and training or information for different stakeholder.

The controlling body for pesticide usage (the Ethiopian Ministry of Agriculture) usually does not coordinate with other concerned institutions such as the Ministry of Health and the Ethiopian environmental protection authority and do not perform post-registration follow-up of pesticide usage.

This step is important to identifying unacceptable health and environmental risks of pesticides in actual field use. Therefore, there is no way of insuring that registered products are properly handled and managed in accordance with Ethiopian proclamation 765/2010.

In addition, coordinated work on the safe use of pesticides among all relevant governmental stakeholders (federal ministries, institutions, and regional states) as well as with non-governmental organizations working on similar activities is another gap highlighted in the studies in the present review. There is an absence of a pesticide monitoring system for both the environment and public health which would be an important to tool to detect early environmental and health risks due pesticide or usage so that appropriate regulatory measures could be taken (e.g., use restriction or banning of a hazardous pesticide). The last issue highlighted is the poor institutional capacity for implementation of both national and international regulations such as the Stockholm Convention on POPs in Ethiopia.

Government enforcement- According to table 16 13(15.3%) of the respondents said that they know government rules and laws and also said that there is government enforcement as a result they have knowledge, favorable attitude and good practice. On the other hand 72(84.7%) of the respondents don’t know any government regulation and laws and said that there is no government enforcement as a result they have no knowledge, favorable attitude and good practice.

The chi-square also indicates that there is a relationship between knowledge and practice and enforcement of regulation at 5% and 1% significant level respectively. From this one can understand that laws and regulation on hazardous wastes and its enforceability is very poor, it is one of a serious cause or constraint for acquiring knowledge and having good practice.

Table 16 Government enforcement

Variable	Yes	No	Knowledge		Attitude		Practice	
			Chi square	P value	Chi square	P value	Chi square	P value
Government enforcement	**13(15.3%)**	**72(84.7%)**	**4.877**	**0.027**	**0.931**	**0.335**	**10.962**	**0.001**

Training/Lesson- On the case of training/lesson associated with knowledge, attitude and practice, table: 17 indicates that the significant number of the respondents didn't take any training/lesson associated with knowledge, attitude and practice. From the total respondents 61(71.76%) of them didn't take any lesson or training related to knowledge, attitude and practice but 24(28.24%) of the respondents took training/lesson related to knowledge, attitude and practice. And hence, majority of the respondents have no knowledge, have unfavorable attitude and poor practice. The finding from retailer survey is further strengthened by Pearson chi-square test demonstrating a significant positive relation at 1% on lesson/training with knowledge, attitude and practice on pesticide waste management.

Table 17 Training/Lesson

Knowledge	**Knowledge**	**No knowledge**	**Total (frequency & %)**	**Chi-square**	**p-value**
Taking training	15(62.5%)	9(37.5%)	24(28.24%)		
Not taking training	22(36.07%)	39(63.93%)	61(71.76%)		
Total	37(43.53%)	48(56.47%)	85(100%)	4.899	0
Attitude	**Favorable**	**Unfavorable**	**Total (frequency & %)**	**Chi-square**	**p-value**
Taking training	18(75%)	6(25%)	24(28.24%)		
Not taking training	40(65.57%)	21(34.43%)	61(71.76%)	0.702	0.592

Total	58(68.24%)	27(31.76%)	85(100%)		
Practice	**Good**	**Poor**	**Total (frequency & %)**	**Chi-square**	**p-value**
Taking training	13	11	24(28.24%)		
Not taking training	16	45	61(71.76%)		
Total	29	56	85(100%)	5.978	0.042

Practice

The finding from retailer survey on the practice of taking training is significantly poor, from the total respondents 61(71.76%) of them didn't take any lesson or training related to knowledge, attitude and practice but 24(28.24%) of the respondents took training/lesson related to knowledge, attitude and practice. Even if the respondents have positive attitude towards training but, the finding shows that there is poor practice of training. According to studies, factors contributing to poor handling practice during pesticide application included poor knowledge, absence of pesticide-related training, and unfavorable attitude toward pesticide. The health risk of workers is also higher if there are poor practices during pesticides use. They are unaware of the exact requirements for safely storing, preparing, applying, and disposing of pesticides, which all employees should follow. Most Ethiopian workers lacked pesticide related training, were ignorant of new pesticide alternatives, lacked a full set of personal protection equipment, and did not shower after work. However, excellent pesticide management techniques and alternate pest management strategies may assist employees in reducing the dangers of pesticide poisoning (Karunamoorthi et al., 2012).


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Figure 6 Inspection and data collection in pesticide retailers firm (pesticides shops)

CHAPTER FIVE

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. CONCLUSIONS

Generally, as per the results of the study and based on its specific objectives, the following conclusions are made. Pesticide waste must be generated because of the need of increasing agricultural production which the main source of food. However, it is hazardous waste if it is treated and disposed improperly. Hence, safe and proper disposal is crucial from the health and environment point of view. The current trend of pesticide waste management is environmentally unsound. And it will result in negative effects on the environment and human health. Therefore, pesticide waste management is being a serious agenda in the world since it is a major cause of environmental pollution and human health risks. To have good pesticide management practice, retailers should have sufficient knowledge and favorable attitude towards the impacts of pesticide wastes on the environment and human health and they should have also good disposal practice.

According to the survey of the study, most of the retailers didn't use the proper methods of pesticide waste. About 80% and 60% of the respondents disposed spills and expired pesticides using improper method of disposal. Hence they have poor pesticide waste disposal practice. The chi-square result also shows that, waste disposal practice of the retailers is influenced by their educational level. It implies that retailers who disposed of wastes in unauthorized site improperly have less educational level than the one who disposed wastes properly. This is because the retailers did not get relevant information that can improve their understanding and motivation. In other words, the pesticide waste management expert staff did not provide information to the

retailers, particularly about the values of pesticide waste management and the negative consequences of improper disposal of pesticide wastes on the environment and human health. In general, according to the survey, the main causes of improper pesticide waste disposal are lack of knowledge and awareness, poor responsibility, carelessness and weak regulation

According to the survey of the study, most of the retailers don't know the hazardous nature of pesticide wastes and have no knowledge on the impacts of pesticide wastes on the environment and human health and also don't know environmental policies, strategies of pesticide waste management, proclamation of environmental pollution control on hazardous waste, and government regulation on pesticide waste management. This may be due to different factors like educational status, age, lack of information, etc.

Although most of the retailers have no sufficient knowledge, most of them have positive attitude to protect the environment.

From the variables, retailer's educational level shows significant relationship with their knowledge, attitude and practice with positively. It implies that retailers, who educated more, have sufficient knowledge, favorable attitude and better disposal practice than the uneducated ones. This is because when retailers improve his/her existing educational level that would be a grant to raise level of understanding and mind maturity. The sex of averagely large number of retailers who have knowledge, favorable attitude and good practice is male and no knowledge, unfavorable attitude and poor practice is female retailers. There is also a significant relationship between age and knowledge, attitude and practice. When the retailers' age increases their knowledge, attitude and practice would be decreased. The chi-square also indicates that there is a relationship between knowledge and practice and enforcement of regulation. From this one can understand that laws and regulation on hazardous wastes and its enforceability is very poor, it is one of a serious cause or constraint for acquiring knowledge and having good practice. On the case of training/lesson associated with knowledge, attitude and practice, the study shows that the significant number of the respondents didn't take any training/lesson associated with knowledge, attitude and practice. And hence, majority of the respondents have no knowledge, have unfavorable attitude and poor practice. The Pearson chi-square test also demonstrates a significant positive relation between lesson/training and knowledge, attitude and practice.

4.2. RECOMMENDATIONS

- According to the result of the study, the level of knowledge, and disposal practice of retailers is insignificant. The main factors of having insufficient knowledge and poor waste disposal practice are education level, training/lesson and government enforcement. Therefore, all stakeholder like Ministry of Environment, Forest and climate change, Addis Ababa Environmental protection Authority, Addis Ababa hazardous waste management organization, NGO and Development organization should develop and focus on retailers' knowledge acquiring program about the risks of pesticide wastes and its proper disposal method by improving their educational level and giving training/lesson.
- The Ministry of Environment, Forest and Climate Change should strengthen the rule and regulation of pesticide waste management. The Addis Ababa EPA and other stakeholder also should develop a law, specific regulations and also the guideline on pesticide waste management.
- Ministry of Environment, Forest and Climate Change and Addis Ababa Environmental protection Authority integrated with, Organization of Standardization and Customs Authority should set enforcements, standards and controlling mechanisms of environmental quality.

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