ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR ENVIRONMENT AND DEVELOPMENT STUDIES

YEMESRACH YICHILAL FENTA

Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City

A Thesis Submitted to the Center for Environment and Development Studies of College of Development Studies in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development)

Addis Ababa, Ethiopia
October 2021

ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR ENVIRONMENT AND DEVELOPMENT STUDIES

YEMESRACH YICHILAL FENTA

Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City

Main Advisor: Tesfaye Zeleke (Ph.D.)
Advisor: Messay Mulugeta (Ph.D.)

A Thesis Submitted to the Center for Environment and Development Studies of College of Development Studies in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development)

Addis Ababa, Ethiopia
October 2021

Document : Yemisrach Thesis 9 Feb 2021.docx[D95102207]

About 2% of this document consists of text similar to text found in95sources. The largest marking is 77 words long and is 100% similar to its primary source.

PLEASE NOTE that the above figures do not automatically mean that there is plagiarism in the document. There may be good reasons as to why parts of a text also appear in other sources. For a reasonable suspicion of academic dishonesty to present itself, the analysis, possibly found sources and the original document need to be examined closely.

Click here to open the analysis:
https://secure.urkund.com/view/90819735-429546-285092

Click here to download the document:
https://secure.urkund.com/archive/download/95102207-616548-547447

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

This is to certify that this thesis was prepared by Yemesrach Yichilal Fenta, entitled: '*Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City*' and submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development) complies with the regulations of the University and meets the accepted standards concerning originality and quality.

Dr. Messay Mulugeta		9 Feb. 2021
(Advisor)	Signature	Date

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

This is to certify that this thesis was prepared by Yemesrach Yichilal Fenta, entitled: '*Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City*' and submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development) complies with the regulations of the University and meets the accepted standards concerning originality and quality.

Signed by the Examining Committee:

Examiner: _____ Signature: _____ Date: _____

Examiner: _____ Signature: _____ Date: _____

Main Advisor: _____Signature: _____ Date: _____

Advisor: _____ Signature: _____ Date: _____

Student: _____

Signature: _____

Date: _____

Acknowledgments

First, my deepest thanks go to God, as I could not have done any of this without Him and He is always with me. I would also like to thank my parents for their relentless support and my friends for their endless patience. I would also like to thank my brother for the many lessons he thought me.

I am deeply indebted and very glad to express my sincere gratitude and appreciation to my Advisor Dr. Tesfaye Zeleke and Dr. Messay Mulugeta for their important and constructive comments, criticisms, and professional advice. I would also like to thank them for dedicating so much time and effort to help me achieve my potential. My gratitude to the lecturers who taught me in the Center for Environment and Development from the College of Development Studies.

Finally, I would like to give my thanks to all the respondents and informants for providing me the primary and secondary data for my study. I would also like to thank the employees of the FDRMC, the Arada Police Department, the Central Statistics Agency, the Arada fire station, and the Ethiopian Insurance Corporation. I would also like to thank the *Idir* representatives of the Arada sub-city. I would also like to thank them for their candor and welcoming attitude to the data collection process.

Table of Contents

List of Figures

Figures Page

List of Tables

Tables Page

Acronyms

Abbreviation	Explanation
AAWSA	Addis Ababa Water and Sewage Authority
ARSDRR	Africa Regional Strategy for Disaster Risk Reduction
AU	Africa Union
CoBRA	Community-Based Resilience Analysis
COVID-19	Corona Virus Disease 2019
DM	Disaster Management
DRG	Disaster Risk Governance
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EEP	Ethiopian Electric Power
EMS	Emergency Medical Services
FDRE	Federal Democratic Republic of Ethiopia
FDRMC	Fire and Disaster Risk Management Commission
FDM	Fire Disaster Management
FFEPA	Federal Fire and Emergency Protection Agency
FRM	Fire Risk Management
HFA	Hyogo Framework for Action
ISDR	International Strategy for Disaster Reduction
UN-Habitat	United Nations Human Settlements Programme
UNISDR	United Nations International Strategy for Disaster Reduction

Abstract

The study examines the coping capacities and setbacks of urban households in Addis Ababa, specifically in Arada Sub-city. The research uses interviews, focus group discussions, and secondary data from the FDRMC, Arada Sub-city Administration, and Central Statistics Agency. It reveals that fire coping capacities and setbacks coexist, with administrative problems, lack of resources, public awareness, traffic jams, and a lack of a unified fire code hindering efforts. Some parts of Arada Sub-city are more vulnerable due to the frequency of fires in the last five years and the quality of house structures. Fire vulnerability varies at different times of the year, with windy and dry seasons being most fire-vulnerable, while Belg and Kiremt are more resilient due to wetter and more humid weather. The study concludes by identifying two aspects: coping capacities and setbacks to resiliency exhibited by urban households in the face of fire risks. Major pro-active urban fire vulnerabilities include a mismatch between current DRM policy and practice, high population density and overcrowding, unchecked urbanization, unsuitable urban planning, and sub-standard housing. Competing phase setbacks include misalignment of regulations and existing policy, high population density, overcrowding, lack of resources, and invading established Police parameters.

Keywords: Resilience, Revealed Coping Capacities, Revealed Setbacks, Latent Coping Capacities, Latent Setbacks

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Fire risk causes damages all over the world. Fire disasters can occur due to natural or manmade hazards. Common causes of natural fire disasters are attributed to volcanic eruptions, landslides, droughts, floods, epidemics, earthquakes, freeze, heat waves, and storms. Manmade fire disasters are attributed to fire accidents, riots, explosions, shipwrecks, structural collapse, vehicular accidents, and war (Abreha, 1997). Despite the works done on disaster resilience in both urban and rural communities, no consensus exists currently on how to measure resilience.

In the global arena, Fire Risk Management (FRM) is a component of the Sendai framework. Even though the framework does not mention that aspect of Disaster Risk Management (DRM) specifically, it has a marked shift in how DRM has evolved beyond just response and recovery, to more pro-active measures in dealing with both natural and anthropogenic hazards (Aitsi-Selmi, et al., 2015).

Fire hazards are also prevalent in Africa, both natural and manmade. However, most efforts to combat fire risks are aimed at natural fire disasters, primarily wildfires. While urban fire disasters are not ignored in the broad context, there are few studies dedicated to their occurrence. Even when the issue of an urban fire disaster is discussed, it is usually from the perspective of how natural hazards cause urban fire disasters.

One of the major man-made disaster risks that Ethiopia is exposed to is fire accidents in urban centers. Therefore, this study focuses on fire disaster risks in urban centers. Urban fire is a major issue in DRM everywhere. Addis Ababa's population is the fifth fastest-growing city in Africa. The main reason for this is rural to urban migration. The inflow of people moving to the city looking for a better life puts stress on the city to provide adequate housing and urban services to its residents. Because of this strain and urban poverty, people resort to living in poor-quality housing with unsafe electrical wiring and cooking practices, which has led to an increase in urban fires (Alemayehu & Sotomayor, 2016).

The focus of the study is urban fire resilience, specifically, on a community's ability to prepare for and adequately respond to a specific kind of disaster risk, fire risk due to man-made hazards. To measure a community's ability to survive a fire disaster or in other words be resilient, the researcher measured urban households' fire vulnerability, hazard, and coping capacities.

The study considers the different fire hazards in the sub-city of Arada, how people are exposed to them, how people respond to them when they occur, how the city administers prevention and responses, and how people cope after the disaster has passed. This topic was selected due to the identified gap in the review of studies in this field. The literature reviewed in this field showed that most studies, both in Ethiopia and Africa, were targeted at fire disasters that came about because of a natural disaster.

1.2. Statement of the Problem

Fire risks, vulnerabilities, and resilience are major concerns around the world specifically in third-world countries. This issue is more prominent in Ethiopia where coping capacity is minimal. The main gaps identified in this topic are those of Literature, Methodology, and Content. The Literature gap can be exemplified by the fact that many studies related to fire risks in Ethiopia, Africa, and even the world is related to, mainly fire disasters as a by-product of a natural hazard like wildfire, volcanoes, earthquakes, and hurricanes.

The few studies that link fire disasters with manmade hazards focus on how rural areas are impacted by the disaster as their livelihoods are much more linked with the environment than in urban centers. A study on how wildfires can be associated with manmade factors argued for capacity building and fire hazard preparedness (Tedim & Leone, 2017). The study was conducted through a series of case studies and the conclusions were too specific. As far as the researcher has examined, there have been no relevant studies done on fire resilience due to manmade causes in Ethiopia, let alone Addis Ababa.

The Methodology gap identified by this study relates to the fact that most of the disaster and resiliency studies in Africa and Ethiopia are conducted using a quantitative approach. The most common tool of study is a survey. It is mainly employed to study the impact that disasters have had on the environment, the economy, and the displacement of affected areas. Xin & Huang (2013) conducted a study on fire risk management of buildings by conducting a survey. This study improved FRM, but it was a purely quantitative study. While some studies do employ the qualitative approach, the data collected is used as supplementary information rather than being the center of analysis. The study uses qualitative approaches to find in-depth data about the research topic.

The Content gap is identified because aside from news reports, the researcher has not found any studies conducted on the urban centers of Ethiopia regarding fire vulnerabilities and resilience. Previous studies done in Ethiopia regarding vulnerability and resilience are geared towards natural hazards such as droughts and floods. Studies like those conducted by Venton (2018) and Ogato (2013) focus primarily on natural disaster resilience. Even the National Policy and Strategy on Disaster Risk Management (2013), barely acknowledges the problem. As such, there is a sizable gap in knowledge about the fire hazards, vulnerabilities, and resilience in urban centers due to direct manmade intervention and its impact on overall urban resilience.

The issue studied is fire resilience in urban centers due to manmade causes in Arada Sub-city. This problem relates to the lack of attention given to urban disasters due to manmade causes. A Doctoral thesis on the Qoshee Garbage Dumpster Disaster in 2017, showed how unprepared the city is for an urban disaster. The problems of fire disasters in Addis Ababa are unaddressed except for fleeting news reports or journal articles like Alemayehu & Sotomayor's (2016) study of the *Efoyta* Market neighborhood fire in 2012. The few articles that mention urban fires in Addis Ababa fit it in as a secondary issue or a case study to support bigger problems like rapid urbanization. This study has studied urban fire resilience as a concept of its own. It identifies the main fire hazards, the coping capacities and setbacks to resilience, and the practices of the FDRMC regarding fire risks and accidents in the city (Zenebe, 2020).

The research site is selected in Addis Ababa because it is the most urbanized city in the country. Arada sub-city is selected because it is centrally located, highly urbanized, overcrowded, and thus more likely to be exposed to anthropogenic disasters such as construction hazards, fire hazards, and explosions.

1.3. Research Questions

1. What are the frequent fire hazards in Arada Sub-city?
2. What is the resilience of Arada Sub-city against fire disasters?

1.4. Objectives of the Study

1.4.1. General Objective

The overriding objective of this research was to explore anthropogenic fire resilience in Addis Ababa with specific reference to the Arada Sub-city.

1.4.2. Specific Objectives

More specifically, the study aspires to:

1. Describe the spatial-temporal frequency of fire disasters in Arada Sub-city.
2. Describe the interventions provided by the Fire and Disaster Risk Management Commission (FDRMC) to aid urban fire resilience in Arada sub-city.

1.5. Significance of the Study

One of the issues addressed in the study focuses on analyzing the reoccurrence of fire accidents. This allows for pattern analysis of why some parts of the study area are more vulnerable, why one type of hazard is more common at certain times of the year, and why it is difficult to cope with.

The second objective of providing an evaluation of the existing governance strategies to adapt to the fire risks and governance challenges help broaden understanding of how administrative offices, in this case mainly the Fire and Disaster Risk Management Commission services of Addis Ababa and the government in general has previously handled such disasters, disaster risks and what is planned.

The study aims to fill, at least partially, the Literature, Methodological and Content gap identified in the Statement of the problem section of the study. The setbacks to resilience identified in the study could be mitigated by policymakers and city administrators while encouraging the coping capacities). The results of the study contribute to other urban disaster resilience studies in academia.

1.6. Scope of the Study

The scope of the study is limited spatially within the boundaries of the Arada sub-city in Addis Ababa. The stakeholders identified for KIIs were chosen due to their influence over the Arada Sub-city's urban resilience to fire. The thematic scope of the study is limited to an analysis of urban fire resilience due to direct manmade hazards. In this study, urban fire resilience has two characters: revealed and latent coping capacities. The development of these characters encourages resilience but the challenges to develop them are exemplified as setbacks. The study analyses these coping capacities through one disaster cycle (from preventive measures to responses, to recovery) but does not cover recurring disaster models.

In this study, resilience is measured on the elements of the well-being before and after a disaster, existing vulnerability, measuring resilience capacities to cope, adapt, and transform in case of a disaster, losses, stress, and measuring the reaction to and recovery from disasters.

The unit of analysis is limited to households within the sub-city as they are more a direct measure of the resilience of a rapidly urbanized city center like Arada sub-city as its residents. Businesses are mainly rented property, which means any damage suffered by any accident falls on the proprietor. Renters -public or otherwise- are not included in this study because any exposure or hazard is the responsibility of their proprietor. Condominium recipients are also excluded from the study due to the fact their owners rent them out because the prime real-estate location makes it more profitable to rent out the property. The occupants are mostly composed of renters rather than the actual owners and thus not as invested while the owners are detached and see the property only as a source of money.

The Methodological scope of the study is within the qualitative research approach. It is limited to the techniques of Focus Group Discussions, Key Informant In-depth interviews, and Field observations.

The time scope for gathering primary data and data analysis for the study was from May to November of 2020. The time scope for the secondary data analysis for the study is 5 years' worth of data from September 2015 to May 2020 GC (Meskerem, 2007-Ginbot, 2012 EC).

1.7. Ethical Considerations

The ethical issues relevant to research participants range from collecting information, seeking consent, providing incentives, seeking sensitive information, the possibility of causing harm to participants, and maintaining confidentiality and anonymity (Ranjit, 2011). In the context of this research, information was gathered from participants who have been informed of the research's purpose, their role in it, and how their anonymity and confidentiality have been maintained. The researcher identified there to be little risk in participating in this study as it is neither politically controversial nor personally damaging. There were no incentives provided for the research participants, financial or otherwise, nor was sensitive information requested, thus reducing any bias or risk for the participants.

In the context of this study, the researcher has neither hidden nor exaggerated findings for personal or professional gain. The methods selected for the study were arrived at by careful consideration of the objectives and the skill set of the researcher rather than being selected to

exaggerate or diminish the findings, which would be unethical. The findings of this research are reported only to fulfill the objectives of the study with no consideration or accommodation of external stakeholders who may wish to alter the results for their purposes. The information found during this study should have no adverse impacts on the participants of the study.

In summary, any data recorded has been handled carefully and only viewed by the researcher. The Key Informant In-depth Interview guide and the Focus Group Discussion guide state the purpose of the research clearly and assure any participant of the study anonymity and confidentiality. Any data collected are used for purely academic purposes.

1.8. Limitations of the Study

This study has several limitations, which take the form of setbacks within the scope of the study. One of the limitations in this study is the lack of presidents. Most studies reviewed for this paper cover natural disasters and most of them are conducted using a quantitative approach. Another limitation is lack of relevant data specifically in the form of information regarding what happens to people who have suffered from fires. There was also a lack of interest on behalf of the population regarding the study topic during data gathering.

1.9. Challenges of the Study

Any study encounters difficulties at all stages of the research process. This section presents the challenges of this study. These limitations are to be understood as problems and setbacks that had occurred during the research process within the scope of the study that affected the results.

- The most significant limitation that occurred during this study is the outbreak of the pandemic known as Corona Virus Disease emerged in December 2019 (COVID-19). This outbreak has affected this study particularly during data collection.
- People were wary about engaging in giving the required information either due to a lack of appreciating the value of the research or for a topic that offers them no personal compensation, and as such, interviews with homeowners within the study area were not possible. The researcher has compensated for these shortcomings by incorporating secondary analysis of their previous reactions.
- The topic of the study had little to no predecessors. This made finding empirical examples and constructing a conceptual framework difficult.

- Secondary data collected was often fragmented or missing. The lack of inter-bureau communication made tracking down missing data or corroborating information difficult.
- One of the data sources (list of fires declared as arson) that was relevant to the study was off-limits as it is confined to the district attorney's office of Arada Sub-city. This limitation was amplified by the scattered nature of public office bureaucracy and data storage where there is no universal format for data collection from the public and weak communication between different public offices.

Despite these limits, the researcher has tried to compensate and produce a reliable study that meets its objectives and contributes to existing literature regarding the topic.

CHAPTER TWO: LITERATURE REVIEW

This section presents the context for the study regarding the conceptual context, empirical studies in the field, the theoretical literature, and the policy review of the study. It outlines where the contributions of the study fit into the known literature gap.

2.1. Conceptual Review

A disaster is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses that have exceeded the ability of the affected community or society to cope using its resources (Schneiderbauer & Ehrlich, 2004). In this context, a disaster occurs when an accident becomes so volatile that it causes widespread losses and is challenging to recover. A fire disaster is a fire accident that has gotten out of control and causes significant damage.

A hazard is a potentially damaging physical event, phenomenon, and/or human activity, which may cause loss of life, injury, property damage, social and economic disruption, or environmental degradation. Hazards can be single, sequential, or combined in their origin and effects. A fire hazard is any source of threat that could result in a fire accident or disaster (Schneiderbauer & Ehrlich, 2004).

Exposure is an inventory of elements that can be affected by the hazard (Cardona, 2012). The exposure factor, for this study, is identified as peoples' lives, health, livelihoods, and property. Vulnerability has been defined as the degree to which a system may react adversely during the occurrence of a hazardous event (Proag, 2014), and or vulnerability is the tendency of a society to be exposed to damage due to an external hazard (Twigg, 2015).

Risk is the probability of harmful consequences or expected losses resulting from a given hazard to a given element at danger or peril, over a specified period (Schneiderbauer & Ehrlich, 2004). Fire vulnerability is the degree to which a system may react adversely during a fire accident (Twigg, 2015). Disaster risk is a combination of hazard and vulnerability that is mitigated by coping capacity (Schneiderbauer & Ehrlich, 2004).

Disaster Management (DM) is a public policy and practice aimed at reducing or managing the impact of hazards before they become an accident or disaster through prevention; prepare rapid response on behalf of the government and communities should an accident or disaster occur; and facilitate recovery and growth after the disaster has passed. Developing countries that are

empowered, disaster-resilient, and informed community combined with adequate political leadership can prevent or at least mitigate the impact of disasters even if they have fewer resources than developed countries (Abebe, 2010).

DM consists of three phases of: Pro-Active Phase (pre-disaster measures/mitigation/ preparedness), Response Phase (post-disaster response), and Recovery Phase (post-disaster recovery). Each phase is important and has a direct impact on resilience. If the DM of a country or state is well planned and executed; then accidents are prevented, if not prevented then quickly brought under control before they turn into disasters, and if they do turn into a disaster then there is a well thought out plan to handle response and recovery (Abebe, 2010).

In the context of this study, Fire Disaster Management (FDM) is the planning and practice to prevent, respond to, and recover from a fire accident or disaster. The pro-active phase of FDM incorporates the policy/regulatory and physical measures to pre-empt fire disasters or, at least, mitigate them. This includes adequate policies and regulations on how to prevent and combat fires, land use planning, urbanization plans, population density accounting, emergency services availability and practice, and training the community as to how to prevent and respond to a fire accident or disaster (Abebe, 2010).

The response phase of FDM includes the plans for and actions during a fire disaster. This phase deals with the training of the community and services provided by the government in the midst of a fire disaster (Abebe, 2010). This incorporates the interventions provided by the FDRMC to reduce and contain fires as well as how people react to fire disasters such as evacuating in an orderly manner and contacting the authorities.

The recovery phase of FDM pertains to the actions taken by the government as well as individuals to recover from a fire disaster after the fire has been contained (Abebe, 2010). This includes short-term actions, such as carefully sorting through the debris to account for losses and investigate arson, establishing and maintaining the perimeter of the site providing medical assistance to any victims, and contacting an insurance agency, and long-term actions such as relocation and rebuilding.

Resilience can be seen in terms of latent coping capacity and revealed coping capacity. Coping capacity is the ability to utilize all the resources available to a person, household, or community to combat a disaster. This incorporates preparations made to prevent or reduce disaster risks, responses during a disaster, as well as recovery efforts in the aftermath both short term and long

term.Coping capacity in the case of fire accidents is manifested as an individual's or a community's ability to utilize its' resources to bounce back from a fire accident or fire disaster (Ikeda, & Nagasaka, 2011).

Revealed coping capacities in this study refers to formal and public countermeasures, which incorporate existing infrastructure and services such as fire brigades, monitoring/warning systems, and police forces to prevent, respond to, and recover from fire disasters. Revealed setbacks is a failure to utilize official resources to combat disasters (Ikeda, & Nagasaka, 2011).

Latent coping capacities in this study refers to informal and personal countermeasures taken by individuals and communities to prevent, respond to, and recover from fire disasters. They are often manifested in daily activities and cooperation in the face of a fire disaster. Latent setbacks are failures to practice personal countermeasures to combat fire risks, as well as failures to respond as a community to disasters (Ikeda, & Nagasaka, 2011).

This study identifies the latent and revealed coping capacities during the three phases of DM to urban fire resilience in Arada sub-city as well as their setbacks to show gaps for improvement and encourage further studies.

2.2. Empirical Review

Urban resilience has been measured by a variety of stakeholders, ranging from scholars, government officials, to private companies. From 2015 to 2016, resilience was featured as an important theme across six major global agendas: notably the Sendai Framework for Disaster Risk Reduction 2015-2030, the Sustainable Development Goals, the Paris Agreement on Climate Change, the World Humanitarian Summit Commitments to Action, the New Urban Agenda, and the Addis Ababa Action Agenda (UN-Habitat, 2017).

The world is going through a resilience renaissance. There is a growing emphasis on enhancing the resilience of cities in the face of unprecedented urbanization and climate change. Urban resilience is shaped by who defines the agenda, whose resilience is being prioritized, and who benefits or loses as a result. Building general adaptive capacity is now prioritized over adapting to specific threats. There are also priority areas, sectors, and hazards that probably differ from city to city (Meerow, Newell, & Stults, 2016).

The UNISDR conducted a study on how investment in disaster risk reduction pays off in Africa. The conclusions show how resilience can be encouraged by reducing both the short and longer-term impacts of disasters on individual households, communities, and cities. It also showed that

despite the documented evidence of the benefits of investment in resiliency, the level of public investment in disaster risk reduction in many countries remains insufficient. The paper concludes that national and local authorities should address the risk to natural hazards in a holistic manner, namely by working on food security, the environment, sustainable livelihoods, urban planning, water resource management, and disaster management, while education and health also remain key sectors for this topic (Note, 2011).

A study on assessing the progress in disaster risk governance (DRG) in Africa until the year 2012 found that African countries have made progress in implementing DRG. The main recommendation forwarded by this study was that multi-layered ownership and understanding of disaster risks and their cross-sectorial nature, with strong community engagement is required for true progress in disaster risk governance (Niekerk, 2015).

A study on disaster management (DM) in Ethiopia from 1975-2008 showed that up until 1989 the focus of DM efforts was geared towards a reactive stance after a disaster had occurred. During this period DM was rudimentary, un-integrated, and had ineffective administrative and policy responses that were mainly aimed at the response and recovery actions. From 1990 to 1994, the focus of disaster management shifted to a national prevention and preparedness strategy published in March 1990. In 1995, a new Policy/legal framework was put in place setting a stage for a transformed disaster management system. After that, in the period from 1995 to 2008 the DM shifted from being relief-oriented to prevention, mitigation, and preparedness. This work firmly outlined the progression of disaster management strategies in Ethiopia, but it goes no further than 2008 in its analysis (Abebe, 2010).

A study on the impact of early humanitarian response and resilience-building on humanitarian outcomes in the Tigray and Somali regions of Ethiopia identified that pro-active preparation is better than just responding to a crisis. The study found that the impacts of drought on households are complex and interrelated. Regardless, it concluded that early donations (before the disaster) could save losses on disaster relief aid measured in the billions (Venton, 2018).

A study on building a fire risk analysis model based on scenario clusters and its application in fire risk management of buildings in China tried to form a basis for fire risk management based on quantitative data. It sought to understand and characterize the fire hazards, the unwanted outcomes that may result from the fires, and the probabilities of fire and unwanted outcomes

occurring. The model created could be taken to improve the building fire safety grading and reduce fire risk levels and subsequent damage (Xin & Huang, 2013).

Disaster risk management and resilience studies that were done in Ethiopia are mainly geared towards natural disasters such as climate change, drought, and floods. A study that evaluated the disaster management system in Ethiopia from a sustainable DM system perspective found that disasters like droughts, floods, conflict, insect infestations, and earthquakes occur commonly in Ethiopia. The study concluded that due to the divergent and complicated nature of disasters and their adverse impacts in different parts of our world, handling disasters requires holistic approaches. This study supports the theory of evolutionary resilience whereby it encouraged resiliency at every phase (preventive, response, and recovery) as well as encouraging development through improving existing systems (Ogato, 2013).

Fire disasters are not simply natural phenomena that we must accept as a part of nature that was not caused by us. A study based on secondary analyses of historical data on the United of America argued that fire accidents, especially urban fires, are highly liked to development and urbanization. It is also argued that to dispute this or diminish our role in causing urban disaster could cause massive damages and loss of life. This work was well written but there were few follow-up studies conducted afterward (Simon, 2017).

A study on how wildfires can be manmade and argued for capacity building and fire hazard preparedness shows that preparing any system for disaster is better than coping with the aftermath. The study called for more holistic studies where vulnerability studies were conducted through surveys along with studies on the local community's coping capacity (Tedim & Leone, 2017). The study was conducted through a series of case studies and the conclusions were too specific.

A report for bettering the fire management in Ethiopia targeting international help focused on how the existing system was ill-equipped to prevent, cope, and recover from a forest fire in Ethiopia. It pointed out the deficiencies in the firefighting organization, fire reporting or even information gathering, policy, and the technical limits (studies done on the topic in the country). It also recommended possible improvements to the situation such as encouraging open communications with other countries, in both Africa and the rest of the world to learn from one another on how to cope with forest fires. Establishing a fire monitoring system and organizing an emergency response team at the national level, which is equipped, both materially and

financially to deal with forest fires would have helped as well (Million, 2001). It was aimed at only forest fires throughout the country. Its' scope did not reach urban centers, nor did it incorporate manmade fire hazards that were more direct than deforestation.

A study on forest fires showed that they are influenced by ecological, human, and climatic factors such as elevation, slope, aspect, vegetation type, proximity to settlements, and distance from roads. The main objective of the study was to identify the locations of fire-prone areas early on to effectively plan fire control measures in forest and wildlife management areas. They used these identified factors to mark the fire-prone areas in the Harenna forest in southwestern Ethiopia using remote sensing and GIS techniques. The results classified four forest fire-risk areas of Harenna forest as very high risk, high risk, moderate risk, and low risk (Suryabhagavan, Alemu & Balakrishnan, 2016). Using GIS methods as this study does is common and suited when analyzing rural fire risks; however, the human component -which is usually analyzed through qualitative methods-, is more prominent in urban cases.

A master's thesis on how to model and map forest fire risk zones of Bale Mountains National Park using remote sensing and GIS approach contributed to how forest fires are mapped and coordinated (Tafesse, 2016). While this work did focus on a smaller scale than national studies, urban fires and community responses were out of the study's preview.

A report was written about urban resilience in Ethiopia by studying the fire in the *Efoyta* Market neighborhood in Addis Ababa on 22 January 2012 showed that the fire had done considerable damage due to several factors such as poor construction and sub-standard cooking utensils. The paper focused on how urban fire is among the challenges of a rapidly urbanizing city characterized by unplanned growth. It also focused on urban flooding due to the lack of adequate road drainage systems as well as unemployment rates (Alemayehu & Sotomayor, 2016). The report they conducted is similar to this study but the report was composed of highlights as opposed to deep analysis. It was a purely secondary report with no focus on urban resilience.

A doctoral thesis showed how the Ethiopian Red Cross Societies have played a great role in the natural and manmade disaster risk reduction and rehabilitation process in Ethiopia, especially in the rural disaster area. The main purpose of the study was to assess the Qoshee Garbage Dumpster Disaster on March 11, 2017, Victims' Risk Reduction and Rehabilitation process of the Society. The study showed how the Ethiopian Red Cross Societies struggled to help the community recover due to a lack of readiness for mass urban catastrophe or disaster. This study

showed why urban resilience studies should be expanded in the urban centers of Ethiopia as the risks differ from those in rural areas. It showed how lack of preparation before a disaster, inability to respond quickly, and lack of direction in how to recover could cause devastation (Zenebe, 2020).

This study identifies the gap in the literature as a lack of studies conducted on urban fire resilience where the disaster is caused by direct interference from humankind. The scope is limited to the analysis of urban fire resilience in Arada sub-city but it gives a context for an analysis of other urban disasters that came about from anthropogenic reasons in both Addis Ababa and other urban centers in Ethiopia.

2.3. Theoretical Review

The concept of resilience originates from the natural sciences. The term resilience was coined as a concept to explain why some relationships in an ecosystem survive and absorb changes of state variables, driving variables, and parameters, and persist (Holling, 1973).

Lack of resilience meant the extinction of a relationship and involved species that could not adapt. This theory of resilience has been adapted to other fields including environmental studies. The major classification for resilience includes ecological, social-ecological, urban, disaster, and community resilience domains rural and urban resilience (Davidson, et al., 2016).

Many theories explain urban resiliency. The most relevant theories include static urban resilience and Socio-ecological Resilience. Static Urban Resilience is a theory that states that the ability of an urban system or city to withstand a wide array of shocks and stresses so that its subsystems (physical, social, economic, and natural) return to their previous (normal) form or condition. According to this theory, if a system returns to its previous condition after a disaster has passed, then it is resilient (Alberti and Marzluff, 2004).

Social-ecological Urban Resilience refers to the ability of an urban system or city to adapt/adjust to internal and external changes by reorganizing its subsystems to minimize disruption to them. According to this theory if a city or community can maintain stability and recover from a disaster through its efforts then it is resilient (Pickett, Cadenasso, &Grove, 2004).

The most recent perspective on Urban Resilience is evolutionary resilience. This term refers to the ability of an urban system or city to respond to the new requirements imposed by internal and external shocks or change processes by learning, adapting, reorganizing, and transforming its

subsystems to take advantage of new opportunities (Godschalk, 2003). Other scholars supported this theory because it sees resilience as more than just returning to the status quo.

Evolutionary Urban Resilience states that resilience is not just a response to an external shock but also takes advantage of the situation for development (Cartalis, 2014). The theory also states that the social-ecological systems can change over time with or without an external disturbance as it constantly tries to improve itself (Davoudi, Brooks, & Mehmood, 2013).

This perspective incorporates adaptation, innovation, and organization with the ability to persist. It is measured primarily by the magnitude of disturbances a system can absorb without breaking down, the degree of the self-organization for a response, and the ability to increase learning capacity and adaptation techniques. It views resilience as a process of constant evolution where challenges are transformed into opportunities and that even when there is no disruption, systems in society still change for better efficiency (UN-Habitat, 2017).

After the passing of the new DRM policy in 2013, the use of forecast, planning, and linking of resources among stakeholders has changed how the country responds to disasters. Currently, disaster sites are renovated to be better than the previous structure. All of these actions fall in line with the resilience theory of coping with fire disasters both on an individual level and as a community (FDRE, 2013). The theory of evolutionary resilience is used in this study to show how a system -in this case, fire prevention, response, and recovery- can be applied and improved upon to encourage resilience.

2.4. Policy Review

In the twenty-first century, our understanding of disasters that are caused by natural, technological, and/or human sources has improved and so has our practices of coping with disasters and yet disasters continue to harm millions of people each year worldwide. In 2004, the initiative of the International Strategy for Disaster Reduction (ISDR) brought more attention to the management of disaster risks. The initiative identified the Ten Essentials to empower local governments and other agencies to implement the Hyogo Framework for Action until 2015 (Nirupama, 2013).

Over recent decades, disaster risk management has become a hot topic. It is discussed on a global scale in documents such as the Hyogo Framework for Action (2005-2015), the UNISDR Strategic Framework (2016-2021), and the Sendai framework (2015-2030). In 2004, the African Union (AU) produced the document Africa Regional Strategy for Disaster Risk Reduction to

address DRR in Africa. In Ethiopia, the current national policy for DRM is in place National Policy and Strategy on Disaster Risk Management (2013).

BMZ & GIZ (2015) have outlined how DRM seeks to reduce a society's vulnerability to a hazard event and increase resilience. Not all hazards are predictable, be it natural or manmade. They are also difficult if not impossible to prevent, thus most policies and practices are geared towards mitigating their effects.

The Hyogo Framework for Action (HFA) 2005-2015 identifies how efforts to reduce disaster risks must be systematically integrated into policies, plans, and programs for sustainable development and poverty reduction. The framework identified the gaps from the previous framework in place, the Yokohama Strategy, and aimed to promote DRR as a national and a local priority with a strong institutional basis for implementation (Stanganelli, 2008). The concept of resilience as a framework and as a target was introduced officially in the HFA. It referred to resilience as a key approach to reducing risk vulnerability. This concept was then incorporated into subsequent policies.

The Sendai Framework for Disaster Risk Reduction 2015-2030 (2015), places more emphasis on DRM rather than Disaster Management (DM). The framework defined seven global targets as; reduction of disaster risk as an expected outcome, a goal focused on preventing new risk, reducing existing risk and strengthening resilience, setting a list of guiding principles that outline the primary responsibility of states to prevent and reduce disaster risk, and encourage an all-of-society and all-of-State institutions engagement in DRM. The framework broadened the scope of DRR to include both natural and manmade hazards and related (Aitsi-Selmi, et al., 2015).

The framework shows how African countries are more exposed to challenges related to disasters and increasing risks, especially concerning enhancing the resilience of infrastructure, health, and livelihoods. The Sendai framework assigns the responsibility of enhancing resilience to states. It encourages cross-Sectorial and multi-scale coordination between local, regional, national, and international stakeholders to promote resilience (Aitsi-Selmi, et al., 2015).

The Africa Regional Strategy for Disaster Risk Reduction (ARSDRR) aims to improve and support the effectiveness of DRR policies and institutional mechanisms in African countries. Its objectives included increasing political commitment to DRR, improving identification and assessment of disaster risks, enhancing knowledge management for DRR, increasing public awareness of DRR, improving governance of DRR institutions, and integrating DRR in

emergency response management (AU, 2004). This strategy is still in place even though some countries in Africa have moved beyond conducting DRR and have moved on to incorporating DRM.

DRM in Africa is exemplified by combating recurrent complex emergencies such as frequent food insecurity, cyclical drought, and sudden-onset disasters, such as earthquakes, floods, and storms. To adequately prepare for disasters, the DRR in the continent aims at instituting early warning systems for natural hazards, strengthening agricultural livelihoods to limit the effects of drought and food insecurity, and engaging vulnerable communities to understand and implement disaster preparedness and mitigation practices. The main targets for resilience in Africa are livelihood diversification, development of human capacity, water distribution, agricultural diversification practices, and markets in support of resilience (Cooke, 2015).

In Ethiopia, same as other countries, the capacity to cope with disaster had been given rising priority since the late 1980s. At the time, the actions undertaken concerning disaster were geared towards post-disaster recovery and rehabilitation. It was more of a reactive system than an anticipatory one. An official document was published entitled A Brief on The National Disaster Prevention and Preparedness Strategy for Ethiopia (PDRE, 1989). This document focused on relief services provided one at a time, most of which were geared for combating droughts. It did not distinguish between rural fires and urban fires rather it focused on how people should coordinate after a fire has broken out. People were not asked to be involved in the making or administration of the document. There was also little cooperation among the official bodies assigned to formulate and administer the document.

The Federal Democratic Republic of Ethiopia eventually published a new document for DRM entitled National Policy and Strategy on Disaster Risk Management (2013). This document had its priorities set in actual risk management rather than just reacting after a tragedy has occurred. This system is oriented by an early warning system that has proved its effectiveness repeatedly.

The main targets of resilience for urban centers in Addis Ababa are to strengthen risk management initiatives, address localized flooding, have a better understanding of vulnerable groups, identify new sources of water, and run a pilot urban densification program (FDRE, 2013). This policy still does not differentiate between rural and urban fires; however, it focuses on risk identification, preparedness, response, and recovery, unlike its predecessors.

The risk of drought has always been a relatively cyclical concern in Ethiopia, however, recently other disaster risks such as flooding, livestock disease outbreak, crop pests, and forest and bush fires due to climate change, not to mention urban disasters like fire and disease epidemics due to rapid urbanization have been given higher priorities than ever before.

This study focuses on how the current DRM policy applies to fire disasters in urban settings and whether or not its implementation has been effective in boosting urban fire resilience in Arada sub-city. The findings of the study help in providing an understanding of how community resilience can affect the overall resilience of the city. After an analysis of available literature on urban fire resilience, the study settled on exploring the specific objectives mentioned in the first chapter.

CHAPTER THREE: RESEARCH METHODOLOGY

This sub-section presents a systematic account of the research methods employed to generate answers to the research questions and objectives. The methods applied in this research uses qualitative methods as a tool of analysis.

3.1. Description of Study Area

It is estimated that more than 20 percent of the total population of Ethiopia currently lives in urban areas, which makes it among the least urbanized countries in Sub-Saharan Africa. However, the country has one of the higher rates of urbanization even by the standards of developing countries, which is estimated at 4.1 percent. To keep up with the rate of urbanization, Addis Ababa has expanded outwards with a high rate of horizontal expansion (Assefa, 2018).

Addis Ababa is home to 25% of the urban population in Ethiopia and is one of the fastest-growing cities in Africa. It is the growth engine for Ethiopia and a major pillar in the country's vision to become a middle-income, carbon-neutral, and resilient economy by 2025. Addis Ababa's economy is growing annually by 14%. The city alone currently contributes approximately 50% towards the national GDP, highlighting its strategic role within the overall economic development of the country (World Bank, 2015).

Most parts of the city are exposed to fires caused by, among others, unsafe cooking practices (use of kerosene and open fires) and unsafe electrical wiring. The fire hazards in the city are exacerbated by the population density of neighborhoods (mostly informal settlements or slum areas such as Merkato), poor housing quality, and lack of road access, and traffic congestion which prevents mobility of people including emergency responders (Abreha, 1997).

Addis Ababa Fire emergency management was established in 1926 E.C as an agency and was restructured into Addis Ababa Fire emergency management Authority and again into Fire and Disaster Risk Management Commission. The FDRMC currently has 1393 workers (administrative, paramedics, firefighters, search and rescue workers, prevention awareness workers, and relief workers) and 9 fire stations (in 9 sub-cities). The head office is located in Arada Sub-city.

Arada sub-city is the oldest residential and business center in Addis Ababa located at 38°42´ and 38°44´east (Mebrate, 2008**).** Arada sub-city is located in the center of the city and contains several notable landmarks such as The National Museum of Ethiopia and The Trinity Cathedral Museum. According to Addis Ababa City Government (2017), its area is approximately 9.9 sq. km (949.85 hectares) and has a total of ten *Woredas.*

The number of people identified as the average population density for urban centers is 399 people per square meter. The population of the Arada sub-city is approximately 225,999 people with a population density of 22,805.1 people per square meter, which classifies as highly dense. Besides residential areas it also has many schools, universities, hotels, hospitals, also has big market areas like Ataklt tera, Piassa (Cohen, 2015). Its features are depicted in the figure below.

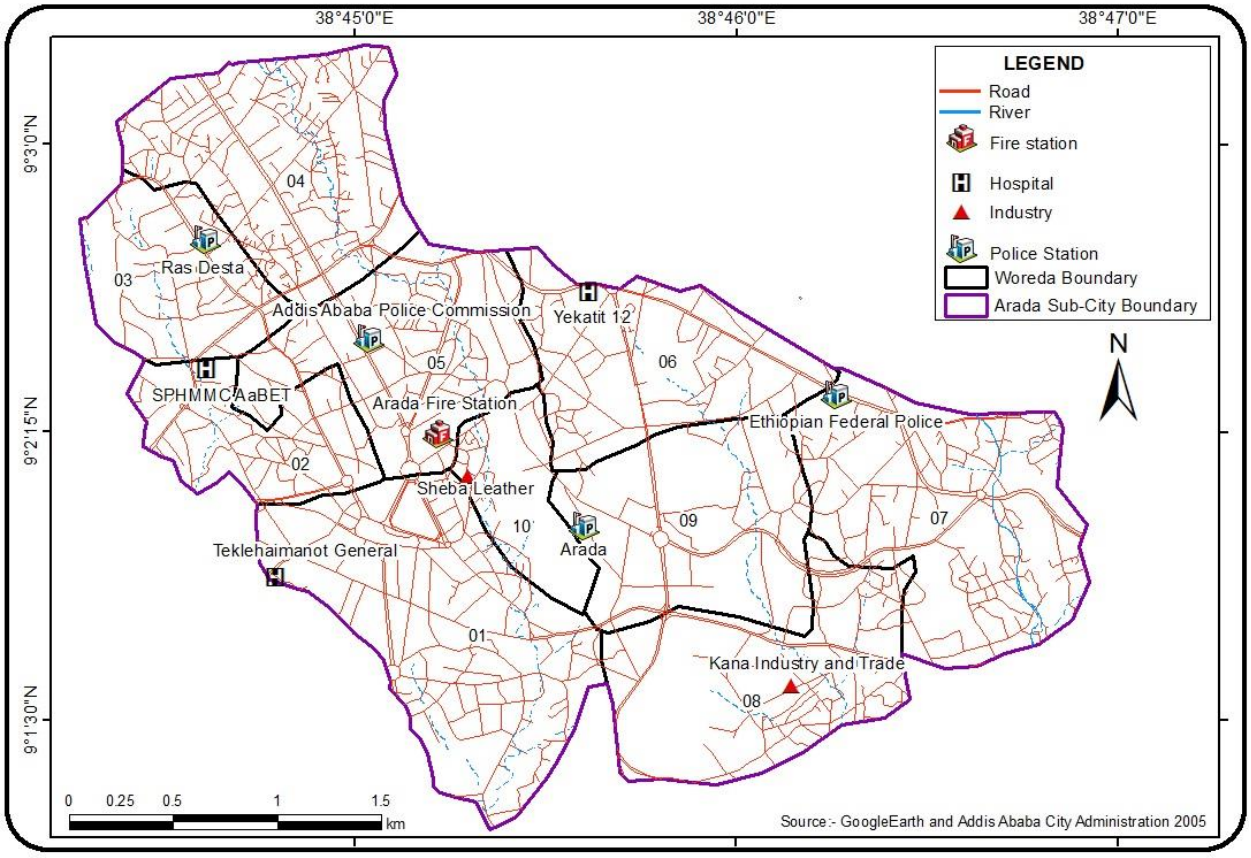


Figure 1: Map of Arada Sub-city with its' major Landmarks (Source: Author)

The Arada Fire Station, Addis Ababa Police Commission, Tekilehaimanot hospital, SPHMMC kidney transplantation hospital, and Yekatit 12 hospital represent the major services provided by the FDRMC and the Arada sub-city administration to boost FDM.

Ras Desta Hotel, Sheba Leather, and Kana Industry and Trade are highly populated areas, for commerce. The road lanes show the accessibility of the sub-city by car. The double lane roads can accommodate fire trucks easily while the single lane roads are difficult to access, which makes these areas more vulnerable to fire disasters.

Arada sub-city is characterized by modern buildings and old residential settlements. As one of the business districts of the city, it is undergoing rapid urbanization. The area was selected as a research site as it is an accurate representation of an urban center exposed to anthropogenic fires.

The total population of Ethiopia by 2012 GC is projected to be 84,040,000 with 42,291,000 males and 41,749,000 females. The total urban population of Ethiopia by 2012 is projected to be 14,887,000 with 7,417,000males and 7,470,000 females. The urban population in Addis Ababa by 2012 EC (2020) is projected to be 3,046,333 (CSA, 2013). While this data may seem to be too general to be relevant, it helps draws a picture of how much of the total population of Ethiopia and Addis Ababa has become urbanized.

The public sector provides 12% of the total employment in Addis Ababa, while the private sector employs 64% of Addis Ababa's workforce. The remaining 24% is registered as unemployed as it is difficult to account for illegal enterprises. The study applies the summary of this data to the Arada Sub-city. A majority of the working population is engaged in the private sector be it working for a company or self-employed (CSA, 2018).

The population of Arada sub-city as well as the Arada sub-city administration actively contribute to the FDM of the study area. The remaining sections of this study refer to these figures while explaining the themes and findings of the study.

3.2. Research Methods

This section presents a systematic account of the research methods employed to generate the answers to the research questions and fulfill the specific objectives. The methods used in this research are qualitative.

3.2.1. Research Design

A research design is constituted of the where, when, how much, by what means concerning an inquiry or a research study. It is required in a study because it acts as a guide for how data is to be gathered and eventually converted into information. It facilitates the smooth transition between different research operations making the study efficient and yield relevant information.

The main factors taken into consideration in a research design include; means of obtaining information, availability, and skills of the researcher, objectives of the study to be studied, nature of the problem to be studied, and availability of time and money for the research work (Bordens & Abbott, 2011).

The study employs a qualitative approach. This approach is selected because qualitative studies on resilience are rare in general and those on urban resilience are even fewer. The researcher employed qualitative methods to gather primary data and secondary data as well as quantitative secondary data to support the findings of the qualitative analysis. Data collection and analysis were conducted according to the type of data gathered and the technique employed for acquiring it. Descriptive quantitative data was gathered and analyzed from secondary sources. Qualitative data was acquired through qualitative techniques such as Key-informant In-depth Interview (KII), Focus Group Discussion (FGD), and Field Observation.

3.2.2. Sampling Technique and Sample Size Determination

Purposive sampling method was selected for the qualitative analysis. Interviews and discussions were conducted until data saturation was achieved. Braun & Clarke (2019) defined data saturation as a point in the data collection process whereby information redundancy occurred, that is there was no more new data to collect within the scope of the study. Thus, the sample size was determined based on how much relevant data could be gathered from stakeholders.

The sample for the Key-informant In-depth Interviews (KII) was limited to informants and stakeholders relevant to the topic of urban fire within the Arada Sub-city. There were 19 Key-informant In-depth Interviews conducted. These stakeholders include:

- The Arada Police Station (the Head of Investigations and 2 police officers),
- The Arada Fire Department (the General Director, the Emergency Dispatcher, and the Medical Dispatcher),
- The Arada sub-city administration (the Head of Communications, and the Head of Land Administration),
- The Fire and Disaster Risk Management Commission (FDRMC) (Director of Fire Prevention Research and implementation, the Assistant Director of Fire Prevention Research and implementation and the Fire Chief),

- *Idir* group representatives (10 *Idir* group leaders in consistent contact with the Arada Fire Department), and
- National Insurance providers (the Headquarters Branch Manager of Ethiopian Insurance Corporations).

These representatives had relevant and valid knowledge regarding urban fire resilience in Arada Sub-City, Addis Ababa.

The Focus Group Discussion (FGD) participants were from the Fire Fighters of Arada Fire Station voluntarily. Due to the COVID-19 pandemic and the measures taken to combat it, the FGD had four high-ranking firefighters with at least 10 years of experience as participants.

3.2.3. Techniques and Tools of Data Collection

The techniques employed for qualitative data include Key-informant In-depth Interview (KII), Focus Group Discussion (FGD), and Field observation. The supplementary quantitative data was collected via a review of previous studies, surveys, and government records.

3.2.3.1. Key-informant in-depth interview guide (KII Guide)

In-depth interviewing is a type of interview that is used to gather information to achieve a holistic understanding of a participant's point of view. This type of interview involves asking informants open-ended questions and using follow-up questions to dig deeper. Such interviews are guided by a checklist of basic questions to ensure that the interview covers the relevant issue and does not spiral into an unrelated topic (Berry, 1999).

The KII for the study was conducted with the various stakeholders and representatives until data saturation occurred. These KII geared for the FDRMC was conducted to establish the chain of command, the policy implementation, the major challenges faced by The Fire and Disaster Risk Management Commission, and any recommendations for improvement and expansion. It was also used with representatives from Arada sub-city Police Department and with the Arada Sub-City Administration until data saturation occurred. A different KII was used for *Idir* representatives and a third one for the National Insurance Corporation.

The KIIs were implemented using a KII guide as a tool for gathering data. The questions in the KII guide were used for gathering data regarding urban fire risks due to manmade/technological hazards. In case of Indistinct issues, follow-up questions or explanations not mentioned in the guide were asked.

All of the participants chose to go through the interview in English, the results of which were transcribed, translated, and edited for analysis by the researcher. An individual interview lasted approximately from one hour to one hour and thirty minutes. A sample of each KII Guide is provided in the Appendix.

3.2.3.2. Focus group discussion guide (FGD Guide)

The FGD was implemented for gathering data from the firefighters of Arada Fire Station regarding their routines on the job. This included their interactions with their superiors, their major concerns for themselves as well as the well-being of those they are trying to protect, the main challenges they face due to the job both personally and professionally speaking, as well as any recommendations they could suggest for improvement.

The FGD had an FGD guide to serve as a tool for data collection. The ideal number for an FGD is eight participants, however, due to COVID-19; the researcher had to limit the participants to four high-ranking firefighters within Arada Fire Station.

The list of questions used for gathering data from the informants incorporated questions regarding urban fire risks due to manmade/technological hazards. In case of indistinct issues, follow-up questions or explanations not mentioned in the guide were asked. The informants chose to engage in Amharic, thus the discussion was recorded, transcribed, translated, and edited for data analysis by the researcher. The discussion lasted over two hours. A sample of the FGD Guide is presented in the Appendix.

3.2.3.3. Checklist for field observation

The technique of field observation was employed to collect supplementary data for all three objectives. Personal observations throughout the data collection period were also gathered via field observation checklist. The items on the checklist vary from the number of fire trucks to the number of operators working at a fire stations' emergency hotline, to the number of Fire hydrants available within the Sub-city of Arada. The field observation was implemented using a Checklist as a tool for gathering data. A list of questions was used for gathering data from the personal observations of the researcher regarding urban fire risks due to manmade/technological hazards.

Photos, as well as descriptions of sites relevant to the study topic within the study area, were taken during field observation. These photos are dispersed and explained throughout the paper to depict existing conditions. In case of indistinct issues, follow-up questions or explanations not

mentioned on the Checklist were personally asked. The Checklist was filled out progressively throughout the data collection stage of the research. The results of the checklist were incorporated into the thematic analysis of the qualitative data. A sample of the checklist is provided in the Appendix.

3.2.3.4. Secondary analysis

Secondary analysis is a research method that completely relies on the data gathered by others. In this day and age, technological advances have led to vast amounts of data that has been collected, compiled, and archived, and that is now easily accessible for research. This means utilizing data gathered by others has become common practice (Johnston, 2017). In this study, the researcher used secondary data gathered by the Arada Fire Station, the Fire and Disaster Risk Management Commission (FDRMC), and The Arada Sub-City Administration. Secondary analysis is applied to all the objectives but its' highest significance is on the objective of tracing the spatial-temporal frequency of fire hazards in Arada Sub-city.

The temporal limits placed on the quantitative secondary data analyzed is that; the data acquired has to be limited to the last five years (2016-2021). Since 2021 is the current year, its' statistical data is fragmented and incomplete but still included. The spatial limit placed on this study is data collected from the 10 *Woredas* of Arada sub-city only. The fire risks and fire disaster occurrences identified in previous quantitative studies were filtered and have been limited to households.

For this study, the unit of analysis in the whole community of Arada sub-city residents. The study is a descriptive analysis of the general coping capacities and setbacks of the general population as well as the administration.

3.2.4. Techniques of Data Analysis

The technique of data analysis employed in the study is thematic analysis. Thematic analysis is a method of identifying, analyzing, organizing, describing, and reporting themes found within a data set established through data collection (Nowell, et al., 2017). This method of analysis is suitable as it allows for the simultaneous analysis of primary and secondary data. This technique makes it easier to identify patterns following the research questions and objectives.

The Data Analysis sub-section outlines how the researcher adapted and sorted the data gathered throughout the study into three themes in line with the specific objectives. The Results and

Discussion sub-section incorporates the results of the study with existing literature to answer the research questions, and realize the general objective of the study.

Secondary analysis is the re-analysis of either qualitative or quantitative data already collected in a previous study, by a different researcher to address a new research question. The secondary data for the study has been collected and incorporated into the study. The secondary data collected on households is too fragmented for analysis through a Statistical Software like SPSS without risking data tampering, so the researcher analyzed the data through EXCEL and dispersed the results according to the identified themes. The analysis presents which part of the study area's population (demography) is most susceptible to fire hazards in urban centers and why. It also indicates where (what parts of the Sub-city) and when (what time of year) fire disasters are frequent.

The data collected by qualitative techniques were transcribed, organized, and analyzed for thematic analysis and discussion. The data collected through the KIIs, FGD, and Field Observation were analyzed parallel to the data collection. Measuring resilience has been a topic of debate for many years now, with varying scales, dimensions, and levels for analysis. The participants' data from the KII was used to identify the implementation of the DRM (2013) (FDRE, 2013), the rules and regulations of the FDRMC, the response methods towards fire hazards and accidents, and any contributions they make towards helping victims of fire accidents recover. The data gathered from the FGD and Field Observation were analyzed to describe how the community views resilience, how they aim to achieve it, what factors make some more resilient to fire accidents than others, what coping strategies are employed to deal with fire disasters as they occur, how to recover afterwards, and which methods work better than others.

CHAPTER FOUR: RESULTS AND DISCUSSION

This sub-section of the study deals with the data acquired throughout the study edited, organized, and analyzed thematically in line with the specific objectives. The analysis presented below is a combination of primary and secondary data acquired through the methods listed in the previous chapter. The primary data was collected, transcribed, translated, organized, and analyzed as follows. The secondary data analyzed was collected from all of the stakeholders as either raw data or having gone through one round of analysis.

4.1. Spatial-temporal frequency of fire disasters in Arada sub-city

The spatial-temporal frequency of fire disasters in Arada Sub-city emerged as a theme because the data collection tools employed in the study were based on questions derived from the specific objectives. This theme is divided into two sub-themes that show where fire disasters frequently break out and when (the time of year). The goal of describing when and where fire disasters frequently break out is to identify what parts of the study area have significant revealed and latent setbacks, which show a higher fire vulnerability.

4.1.1. Spatial frequency of fire disasters in Arada sub-city

Parts of the city that were built as far back as the Imperial Regime (prior to 1974) still stand in Arada. These areas are vulnerable because they were not built with an urban plan in mind. The ones that followed were a part of the Master Plans during the Provisional Military Administrative Council (Derg) administration (1974-1987) and the early days of the Ethiopian People's Revolutionary Democratic Front administration (1988-2019), and as such were based on outdated plans that are inadequate for the current city structure they find themselves in. Some of these structures are residential houses while some are commercial establishments but the construction materials -mainly wood, mud- used in their construction has become hard and dry. This makes it very susceptible to catch fire since hard and dry wood catches fire very easily. Neighborhoods where these structures are found are at high risk of fire outbreaks compared to others.

These areas also contribute to the creation of slum areas and marginal settlements that are even more vulnerable to fire hazards. A slum area is any place where half or more of all households lack clean water, sanitation, sufficient living space, durable housing, and secure tenure (UN-Habitat 2016).

The following figure shows the fire disasters that occurred in the Arada sub-city from 2015 to 2020. This chart was constructed by the researcher based on data provided by FDRMC. The relevant table for this chart is shown in Annex I. It is limited to fire accidents that grew into disasters and required the help of firefighters to be contained within the study area. It is common practice for urban residents to experience small fires, handle it themselves and pretend as if it is a minor setback and not the symptom of a major problem. Fire accidents are not covered in this figure, as they are not feasible to track.

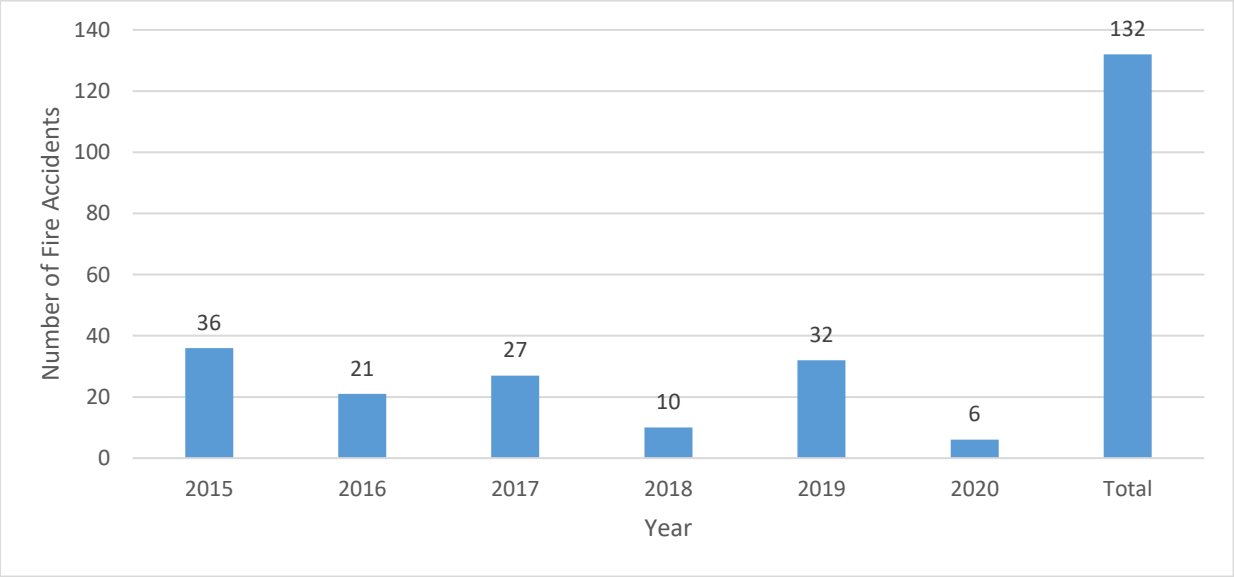


Figure 2: Fire disasters in Arada sub-city (2015-2020) (Source: Author)

The 132 fire disasters recorded from 2015 to 2020 shown in the figure above were all caused by anthropogenic factors. When a fire breaks out at businesses and commercial centers like offices, shops, and restaurants; big or small, it is reported to the police, fire station, and internally documented. This is because it is deemed relevant by the owners who track their productivity as well as the respective City Administrations that license these centers for public occupancy. This makes tracking fire disasters in centers of commerce, high-rise buildings, and apartments easier to track.

However, a residential fire is different regardless of its size. When a fire occurs in the home people often panic and run away or try to put it out themselves. Those that fail to contain a fire by themselves usually call out to neighbors and surrounding bystanders for help long before calling for emergency services.

By the time the appropriate authorities are contacted significant damage is done to the property and residents. Fires reported within five minutes of the outbreak have a much higher likelihood of being contained than those reported much later. This is why the FDRMC encourages citizens to report a fire that lasts longer than five minutes. However, people still prefer to handle things on their own, which ends up doing more harm than good until they have to admit that they need help.

Those that succeed in containing the fire count their blessings try to repair the damage and move on with their lives vowing to be more careful in the future.

The few people in the Arada Sub-city that have home insurance may contact their providers and the police for compensation but beyond that, the incident is forgotten. This is a problem because without these incidents being reported the fire risks in the area are underestimated and often repeatedly set off. Without accurate reports, it is difficult to track and report the prevalent fire risks in an area, which makes combating them in the future all the more difficult. A contained fire should still be reported even if additional help is not required.

The FDRMC has commissioned various continuous studies regarding various risks, including fire hazards in Addis Ababa. The studies from 2015 to 2019 (the study conducted in 2020 is not yet public) have been analyzed regarding identified fire risks in Arada Sub-city. The table below is an analysis based on the studies conducted by the FDRMC including the region of the Arada sub-city and extending beyond to be bordered by *Kidane mihiret* from the east, *Entoto* road from the west, Gulele *Woreda* 01 youth center from the north, and a river from the south. Along with statistical data, studies regarding levels of vulnerability were also conducted.

The studies identified that all ten of the *Woredas* in the Sub-city were exposed to manmade fire hazards. The sites below are identified as being fire vulnerable because they are regularly affected by fire risks. A table and a GIS depiction of the identified sites are shown below.

The sites identified in the table and depicted in the GIS figure are areas that have repeatedly caught fire in the last five years due to manmade hazards. They were mapped based on statistical data of fire disasters of all kinds (both natural and manmade). The studies showed that these sites have experienced reoccurring fire disasters due to the following characteristic flaws in their infrastructure. These include sub-standard materials used for construction, lack of public awareness about fire hazards, the publics' inability to handle fires of any degree, little to no

spacing between houses, poor electric grid infrastructure and design, and roads being too narrow for fire trucks.

A table and a GIS depiction of the identified sites are shown below.

Woreda	Area covered by the studies	Year of study	Identified fire hazards
1	From *America gibi* to *Somali tera*	Dec 2006	▪ Materials used for construction ▪ Lack of awareness about fire hazards. ▪ The publics' inability to handle fires of any degree. ▪ Houses are built too close to each other. ▪ Poor electric grid infrastructure and design. ▪ Roads are too narrow for fire trucks.
2	From *Italian sefer* to third twin road	Sep 2006	
	From *Bis meberat* to *Gojamberenda*	Feb 2009	
	From *Bis meberat* to *Gojamberenda* to *Sheadutekakinenaanestegna*	Mar 2009	
	From the back of St. Joseph church to *Tibebe* hospital *Bis meberat*	Mar 2009	
	From *Bis meberat* to *Gojamberenda* to Sheadutekakinenaanestegna	2011	
	From the back of St. Joseph church to Tibebe hospital Bis light	2011	
3	From *Abebech Gobena* orphanage to three twin road	Oct 2007	
	Around Islam mekabir (endeweyn)	Apr 2008	
	Behind Islam mekabir	Mar 2009	
4	From *zebegnasefer* to *Gutomeda* to the back of *Shewa dabo*	Mar 2009	
5	From St. George church to *Gedamsefer* to *Datsun sefer*	Mar 2009	
	Around *Gedamsefer*	Sep 2009	
	From St. George church to *Gedamsefer* to Datsun *seferto Birehanu* hotel	2011	
6	Around Woreda 6 administration office (Blind peoples association)	Nov 2008	
7	From behind 5-kilo to 6-kilo blind people association	Mar 2009	
	From behind 5-kilo to 6-kilo blind people association	2011	
	From *Kebeda* in front of Russian embassy to *Bezawit Mariam gedam*	2011	
8	Around *Aware gulit* market	Oct 2007	
	From In front of *Gebi* Gabriel church to *Menaharia* hotel	2011	
9	From 5-kilo Shewa dabo to along *Ginfela* river	Mar 2009	
	From 5-kilo Shewa dabo to along *Ginfela* river	May 2010	
10	From Ras Mekonnen bridge to *Mushrit* shop	Feb 2008	
	From *Doro mankeya* to Ampere cinema	Mar 2009	
	From Ras Mekonnen sefer to Doro *mankeya* to Mushrit shop	2011	

Table 1: Identified Fire vulnerable sites in Arada sub-city (Source: Author)

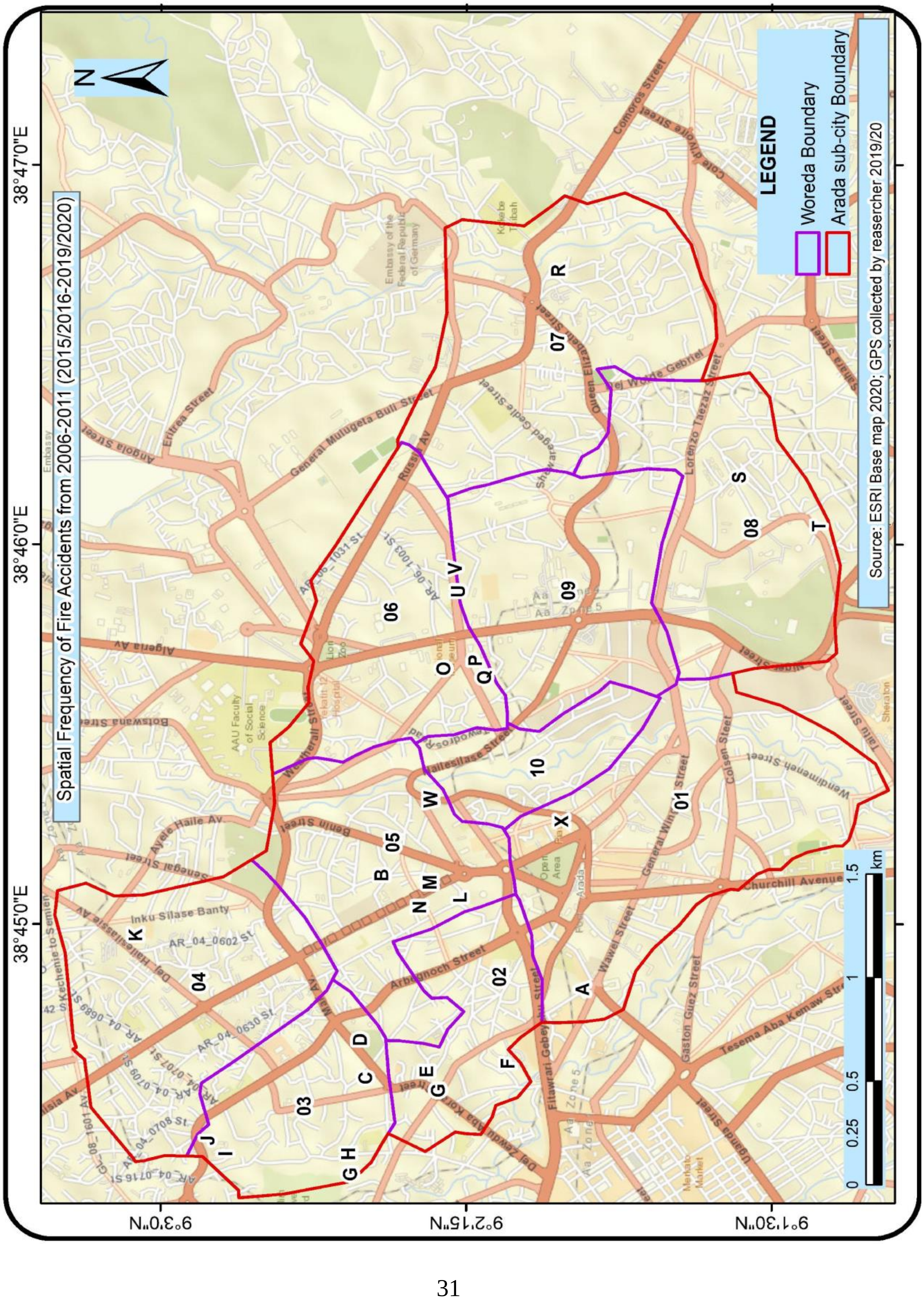

Spatial Frequency of Fire Accidents from 2006-2011 (2015/2016-2019/2020)
LEGEND
Woreda Boundary
Arada sub-city Boundary
Source: ESRI Base map 2020; GPS collected by reasercher 2019/20
38°45'0"E
38°46'0"E
38°47'0"E
9°3'0"N
9°2'15"N
9°1'30"N
0 0.25 0.5 1 1.5 km

Figure 3: GIS depiction of Fire Vulnerable Sites in Arada Sub-city (Source: Author)

An analysis of these characteristics revealed the following revealed and latent coping capacities and setbacks:

- **Population Density**

High population density in urban centers is mainly because of high rural to urban migration. The reasons people move to urban centers vary from trying to find better jobs and provide for their families, escape conflicts within their hometowns, seeking modern lifestyles, or advancing their education (Melesse & Nachimuthu, 2017). The immigration to Addis Ababa from all over the country in the past few decades has been steadily increasing and in most parts of the city, these immigrants settle in areas already overcrowded. Rural-urban migration affects both the place of

origin as well as the urban destination. Over half of the population growth in Addis Ababa is attributed to rural-urban migration.

In this case, the city is expected to absorb all the newcomers, which has led to overcrowding, a shortage of public amenities, high unemployment rates, an increase in poverty, and the spreading of disease (Yasin, 2018). On top of that, it is very common to have multiple people living under the same roof to split the rent. This steadily increasing demand puts tension on an already strained infrastructure accelerating the likelihood of urban fires especially electrically related fires. The current population density of the Arada sub-city stands at 399 people per square meter (Cohen, 2015).

The current population density of Addis Ababa is 5,165 people per square km while the population density of Ethiopia stands at 115 people per square km (World Urbanization Prospects, 2021) all of which are high. The high population density that characterizes most urban cities is also found in our study area. This has led to overcrowding in city centers, which contributes to increased demands on existing infrastructure such as the electrical grid, water lines, and emergency services.

The most reoccurring cause of fire in densely populated areas due to poor urban planning is electrical shock. The electrical grid within these neighborhoods was constructed a long time ago and was intended to provide for fewer people than it is currently providing.

This overstrained and very poorly maintained structure regularly breaks down with transformers catching fire and household cable wires breaking or damaging appliances that more often lead to fire within these residential areas. Overcrowding also makes an area vulnerable to fire accidents simply by the fact that there are more and more people using things like hot plates and stoves in confined areas.

Another problem is that the jurisdiction of the Arada fire station is not limited to the boundaries of the Arada sub-city; in fact, there are 25 Woredas under its' jurisdiction extending into neighboring sub-cities. These Woredas are not covered in this study as they fall out of its scope, but it bears mentioning that the Arada sub-city fire station is overextended. This jurisdiction was decided early in the FDRMC history and the reason it extended so far out was that decades ago the area was not as crowded as it is today due to high population density and 25 Woredas was deemed appropriate for its’ capacities. Currently, the resources of the Arada sub-city fire station are stretched thin trying to accommodate these demands.

The fact that people choose to live in such conditions either because they cannot afford better housing, prefer the location over the safety of their residence, or because of emotional ties to the community rather than moving elsewhere makes overcrowding a latent setback.

High population density in the Arada sub-city, which causes overcrowding, has created higher exposure during fire accidents because fires in the study area are much more difficult to access and contain. This is a revealed setback manifested in sub-standard housing being more flammable, road access being inconvenient at best and impossible to get through at worst, traffic gridlock hindering fire trucks, and lack of fire hydrants. Even if fire trucks are not stuck in traffic jams, if the accident site is in an unreachable area - lack of road access - it leads to extensive damage to personal property when a fire breaks out.

> *"When fires break out in neighborhoods with houses leaning on one another or densely populated areas, the site catches fire and spreads very quickly like a chain reaction. Fires jumping from one house to another is common in dense slum areas."* Menelik Adam, firefighter; Arada fire station

Arada city administration acknowledges that some sections of the city are more vulnerable to common urban risks (fire, flood, and collapse) than those who live elsewhere. To help improve the situation outdated buildings are being condemned and people are being relocated. Those who rent the property that has been condemned are given the option of buying into government condominium complexes. Those who own their residences and can provide a title deed are assigned land as well as the bare minimum estimated price of the residence being demolished.

Those who neither rent nor own a residence but still live in condemned properties (squatters) are automatically evicted with no compensation. This process decreases population density in urban centers however, it causes new problems such as; inadequate compensation for the property lost, long commutes to work, and broken social communities. The process of displacing people from an overcrowded area may be painful but, in the end, it is necessary.

Sub-standard Reconstruction - After surviving a fire people often rebuild or relocate; often, in both cases, it is too similar or worse residences and rarely better ones. Those who have insurance fight to have their policies upheld and use their compensation to rebuild their homes or relocate. Since they already reported the fire to the city administration -as required by insurance policies- reconstruction efforts are handled by professionals and are upgraded to prevent other fire hazards.

Regardless of the paperwork involved, having insurance is useful in rebuilding. Disasters have been more frequent in the last decade that having insurance for the most relevant hazard is common sense (Pinsker, 2019).

However, those who only have *Idir* as a safety net try to reconstruct their damaged property as cheaply as possible, which usually includes taking shortcuts in reconstruction. This involves using subpar construction equipment and leaning the renovation on a neighboring house or building which leads to an unstable structure that is not only vulnerable to all risk but also exposes the house or building it is leaning on. Even worse, those with no safety net, those who live in slums, as well as squatters often try to rebuild themselves personally or simply walk away without selling the property. This leads to even worse residences replacing those that were damaged, abandoned properties, and unsafe construction properties.

Sustainable Urbanization -

Sub-standard construction materials - the type of houses that are most susceptible to catching fire are those constructed using wood, hay, and mud. Unfortunately, the majority of the houses built using these materials are most likely to be found in a dense cluster with one house leaning on another. This exacerbates fire accidents because fire can easily jump from one house to another. These types of houses were constructed primarily before 1995 G.C. before the Addis Ababa City Administration Charter No. 361/1995 that outlines construction recommendations (Addis Ababa City Government, 2017). Such houses are also common in slum areas and marginal areas either because they are cheaper to construct or because they are illegal squatting homes near rivers or roads. Areas of the Arada sub-city where fire exposure is high due to sub-standard construction are seen in the GIS depiction of Fire Vulnerable Sites in the Arada Sub-city depicted earlier in this chapter.

Unsuitable Urban Planning and Sub-Standard Housing - New master plans are drawn up every ten years (the current one is being implemented from 2015-2025) and while their enforcement is delayed and hindered by previous plans; they seek to divide the business and residential districts, enforce up to code construction, improve road access, and encourage vertical development (high-rise buildings). These plans address how to reduce fire hazards. It also plans to decrease population density through relocation and allowing fire hydrants to be planted with construction as opposed to afterward. These plans encourage revealed coping capacities against fire hazards (Endeshaw, 2016). However, previous rigid urban planning causes fire risks to be

exacerbated in the pro-active phase. This setback is also manifested in the recovery phase as the current urban layout makes reconstruction a source of hazard on its' own.

Moving the required construction materials is a challenge due to narrow roads. The unreliability of the water and power supply in the city causes difficulty and delay in construction.

Arada is one of the oldest if not the oldest part of Addis Ababa and because of this most of the houses were built tightly packed and without any real room to grow or allow for road construction or further development of any kind. Containment in these areas is particularly difficult because it is very common for houses, businesses, and small shops to be leaning on one another or sharing a wall. There is also barely room to walk between the houses let alone drive a fire truck through to put out fires. In such areas, the firefighters have to extend the fire hose up to five hundred meters so that the water or foam can reach the affected site.

Figure 4: Doro Mankeya (Source: Author)

The two upper photos depict streets around *Doro Mankeya* and the bottom photo depicts the streets around *Serateah Sefer.* All that show poor urban planning. These areas show how houses and businesses are built leaning on each other and are encroaching on the road. The photos also show how narrow the roads are. The roads in Arada sub-city are composed of Asphalt, Cobble, Gravel, Paved, and Unpaved roads with varying widths.

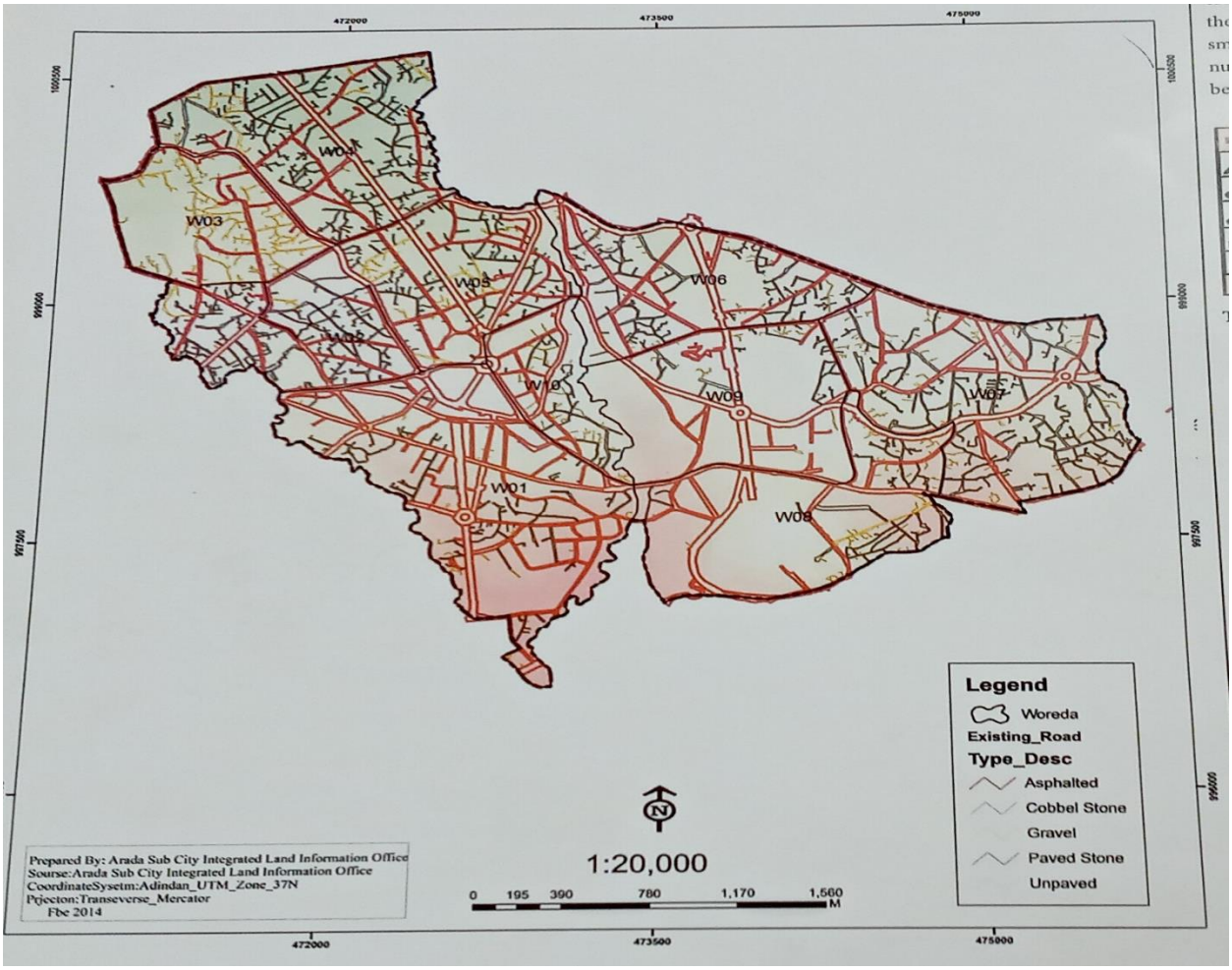


Figure 5: Road Map of Arada Sub-city (Source: Arada Sub-city Integrated land information office, 2014)

The road lanes are barely suited for foot traffic and cannot accommodate a fire truck. There is also high foot traffic in these areas during the day, as well as delayed vehicular traffic that is often jammed on one-way roads. Currently, the Arada Sub-City Administration office has granted over 149 building permits for personal residencies in the last four years (2009-2012).

These permits have several requirements that need to be met before they are granted including the standard of the planned structure.

The elements of the standard of the structure include zoning permits, road access, distance from other structures, construction equipment and regulations, building material quality, plumbing, and waste disposal structures, electrical wiring, ventilation access, and available exits proportional to the residence.

These requirements significantly improve a residence's resilience to disaster from prevention to recovery. However, these standards apply to new homes and renovations, which means that existing structures are exempt from these standards. These standards are also difficult to enforce in slum and marginal areas as they rarely have legal permits or title deeds.

The current road design and infrastructure of the entire city are overwhelmed by the number of vehicles. Gridlocks have become more and more common and severe. Even with the co-operation of traffic police officers, it has been impossible to prevent the fire trucks from being delayed. New roads (four-six-lane roads) are being constructed and while they are better than the previous road designs (one-lane roads), the lack of a dedicated lane for emergency services has led fire trucks and ambulances to be delayed with shocking consequences.

Houses built as far back as the Imperial Regime still stand in Arada, and even those built after have been based on poor or no urban planning. Their failings include; construction with highly flammable materials such as hard dry wood or metals that would become steel cage ovens in the case of a fire outbreak, being built without proper zoning that separates housing from business districts or factories, and lack of road access for fire trucks should there be a fire outbreak. While these challenges are mainly associated with outdated city plans, and new city plans are being formed and implemented, they still affect the study area, and the progress to alleviate them is slow.

> *"One of the biggest problems we face in city administration is trying to define an up-to-code house without marking thousands as unfit. However, peoples' willingness to be in an unsafe home puts them at constant risk. They build or move into a substandard home, it is damaged in some way (collapse, fire, burglary…), they make minor adjustments or none at all, and in a few months the house is once again damaged by either a new hazard or the same one."* The Head of Land Administration: Arada Sub-city Administration

While unchecked urbanization is a revealed setback, it contributes to sub-standard housing, which is a latent setback. Individuals choosing to live in sub-standard housing significantly increase their exposure to all hazards including fire because houses constructed using wood, hay, mud, or metal are flammable than those constructed of brick and cement. Houses built leaning on one another are also a problem as fires can jump from one house to the next. People who live in such houses are either unaware of the risks or are willing to take them due to lack of funds or negligence.

The drastic changes the city has gone through in the past few years due to urbanization has brought new problems along with it that the current resources of the FDRMC are not equipped to handle should an accident occur in certain conditions.

The main indicators of urbanization include (Larsen, et al., 2019):

- Urban Expansion: pushing outwards into other cities,
- Land Use Changes: from agriculture use, sparse vegetation, bare land, extensive horizontal residential, towards more densely packed use such as businesses, administrative buildings, and vertical residential centers like condominiums, and finally
- Changes in Population Density: a high increase in population density both in business centers and residential.

The current speed of urbanization is much faster than the development of the infrastructure of the city, which exposes the city to urban disaster.

One example of this is how currently firefighters are only capable of fighting fires on levels of 20 up to 24 stories while there are a few buildings that are more than 50 stories. Such buildings require assistance from helicopters should a fire breakout at those heights, which the Arada Fire Station does not have. The increasing population and size of the city have made it impossible for firefighters to respond to fires within a timeframe they can get it under control before it spreads. To address this issue there must be more fire stations opened up in different parts of the city to make access to every point in the city easier.

There also need to be more fire hydrants available from which to draw water. Ideally, there should be a fire hydrant every five hundred feet because it is the extension capacity of a standard fire hose.

Currently, there are 26 functional fire hydrants in Arada Sub-city, 15 of which are below ground and 11 of which are above ground, and one under maintenance. These fire hydrants have been

placed strategically throughout the sub-city near identified vulnerable areas, to not only fire but other disasters as well. They are placed near highly dense areas-population wise-so as to make drawing water easier for fire trucks both during a fire accident and to refill afterward. Most areas around fire hydrants are identified as being crowded in both vehicular as well as foot traffic.

As new additions are made to the infrastructure, the study area's limits are being tested. Road constructions are spiraling out from the centers of the city to its outermost limits and beyond. This is problematic for firefighters as there is no dedicated lane for emergency services, which leads to delays due to gridlock. Road construction plans also do not consider hydrants in their plans as they build; which leads to the destruction of existing hydrants, as well as a lost opportunity where hydrants could be planted along new road lanes. Instead, FDRMC is expected to plant hydrants at its discretion which leads to repeated construction at the same site, waste of resources, and conflicting city plans.

Rapid urbanization is also characterized by an influx of immigrants from rural sides of the country. This has led to many problems for urban centers from increased homelessness to ever-increasing demands on its' infrastructure. It has also led to people willingly living in marginal areas and slums just for a chance to live a city life. The increasing population and size of the city have made it impossible for firefighters to respond to fires within a period they can get it under control before it spreads.

Social Ignorance- People have the misconception and superstition that if they ignore it and never talk about it that fires will not break out and for this reason, they are very stubborn and reluctant to hear any information concerning preventive measures they should take to prevent fire accidents. Some people view learning about the causes of fire accidents will somehow jinx them into being exposed to fire accidents.

This lack of awareness is common around elderly citizens as well as children. Although in the case of children, it is due to a lack of understanding or being afraid. Despite the numerous and relentless efforts made to build awareness about the different numbers by which to reach the fire department people never seem to retain the information. These efforts include seminars and tutorials provided by the FDRMC for *Idir* groups and youth centers every three to six months on how to prevent, cope and recover from fire accidents. There are also pamphlets passed out and broadcasts around the city especially during the holidays as they are more vulnerable.

While some people seek to educate themselves about fire hazards, others choose to remain oblivious. This is a latent setback. Very few people would actively buy a fire extinguisher for their home or business. Most of the time people buy it for their businesses as required and even that is rare. Installed equipment like water sprinklers and smoke detectors are usually installed in high-rise buildings and upper-class homes with high incomes which means it is not widely used. Even fire extinguishers are considered frivolous and pointless as the common response to a fire in the home is a bucket of water.

Advertisement contributes to public perception, but in some cases despite how well services and warnings are advertised, some people chose to remain in the dark. In this case, they do so because of the belief that disaster and tragedy are things that only happen to others, not thinking of them as a priority, or simply choosing not to think about it because it is unpleasant. This is a problem because accidents and disasters that are unpredictable or unknowable to the public are dangerous enough, but to ignore the ones that can be prevented is a latent setback. Another aspect of this setback is not having a safety net should an accident occur.

> *"Most people come in to buy car insurance and the few that ask for home insurance only do so because their home is being used in a mortgage plan and the bank they are trying to secure a loan from required them to do so. Those with businesses buy insurance either because the city required them to do so or because they have invested a lot of money in their business often a combination of both. We advertise our services online, on television, and on the radio but we have yet to see any interest in home insurance because of it. We have also tried to advertise the home, life, and work insurance when people come in to buy car insurance but our customers seem to be offended that we even suggested it."*
>
> Branch Manager: Ethiopian Insurance Corporations

Most prefer to put their faith in *Idir* alone and leave it at that despite its' record for being inadequate to fully restore damaged property. Few seek out insurance, but a majority of insurance policies taken out are for cars, and that is mainly because it is required by law or for factories and businesses. The majority of people who look to take out an insurance policy for private residences are upper class or high middle-class as it is too expensive for low-income households. However, even some of those who can afford it choose not to take it out because they do not think a home fire could or would happen to them.

Common Negligence- Another latent setback is negligence, which goes beyond ignorance because it entails acknowledging a fire hazard and not even trying to prevent it. It can be linked to unsafe cooking practices such as using open fire pits, turning on gas stoves without a lit match ready to use, having a buildup of grease around the kitchen, or overtaxing electrical stoves.
Electrical fires can also be linked to overtaxed water heaters, an iron left on, exposed wiring, and cracked light fixtures. Chemical fires are rare but can occur if toxic liquids like paint, potent detergents, and hair dye are left near or mishandled around open flames. Forgotten candles and lit cigarettes are also a hazard of their own, especially around holidays and celebrations. It is also common for people to leave burning coal in their houses to heat their homes, which is not only a fire hazard but can also cause carbon monoxide poisoning. All of these hazards can be handled or at least minimized by people being more aware of their daily activities.

> "*Fire accidents can be prevented so easily sometimes but people forget basic steps like blowing out candles before going to sleep or making sure a cigarette is fully put out before walking away."* Menelik Adam, firefighter; Arada fire station

Along with statistical data, studies regarding levels of vulnerability were also conducted. They analyzed how different people responded to fire accidents by classifying them based on their age and disability. They classified different segments of the population's vulnerability as low, medium, and high. The levels are distinguished based on information from KIIs, fire response reports, FGDs, and secondary analysis conducted by the FDRMC. While the studies of the FDRMC identifies that everyone in the study is vulnerable, they are vulnerable in different ways. The following table shows how people of different ages and disabilities react to fire outbreaks as they happen according to the FDRMC.

Low Level of Vulnerability: this classification applied to those who were,

- Physically fit and able to escape a fire,
- Careful of their surroundings in a fire to avoid injury as best as possible,
- Respond appropriately to fire accidents (do not panic, and call for emergency services)

Medium Level of Vulnerability: this classification applied to those who were,

- Moderately fit and could escape a fire,
- Confused by their surroundings in a fire and cause additional injury to themselves,
- Respond inappropriately to fire accidents (give in to panic, try to run away, and try to put out the fire themselves rather than call for emergency services)

High Level of Vulnerability: this classification applied to those who were,

- Physically unable or unfit to escape a fire,
- Unaware of their surroundings in a fire or even unable to identify a fire breaking out and cause injury to themselves and others,
- Unaware of the need to respond or panic, unaware of available emergency services

Element at Risk	Level of Vulnerability	Reasons for their Vulnerability
Infants and children (0-14 years old)	High	❖ They cannot run away from the fire fast enough. ❖ They usually panic and make unwise decisions or try to hide within the burning building.
Young Adults and Adults (15-54 years old)	Medium to low	❖ Unless they are completely unaware or find themselves in a particularly special case, they can usually escape to safety.
Elderly (55 and older).	High	❖ They usually have hard time seeing or hearing and therefore have a late response. ❖ Lack stamina and strength.
Disabled individuals	High	❖ Unless they have someone to assist him or her, they have a hard time navigating or moving from one place to another. ❖ Lack of stamina and strength.

Table 2: Levels of Vulnerability during fire outbreak in Arada sub-city (Source: Author)

4.1.2. Temporal frequency of fire disasters in Arada sub-city

The temporal frequency of fire disasters in the Arada sub-city differs depending on the time of year as well as national holidays. The following figure shows reported manmade fires in Arada sub-city by month from 2015-2020.

The figure below shows that windy and dry seasons (*Bega* and *Tseday*) are the most fire vulnerable seasons while windless and wet seasons (*Belg* and *Kiremt)* are relatively safer seasons when it comes to fire hazards. *Miyaziya* (April) as the hottest month of the Ethiopian calendar is the most vulnerable to fire hazards when compared to other months of the year.

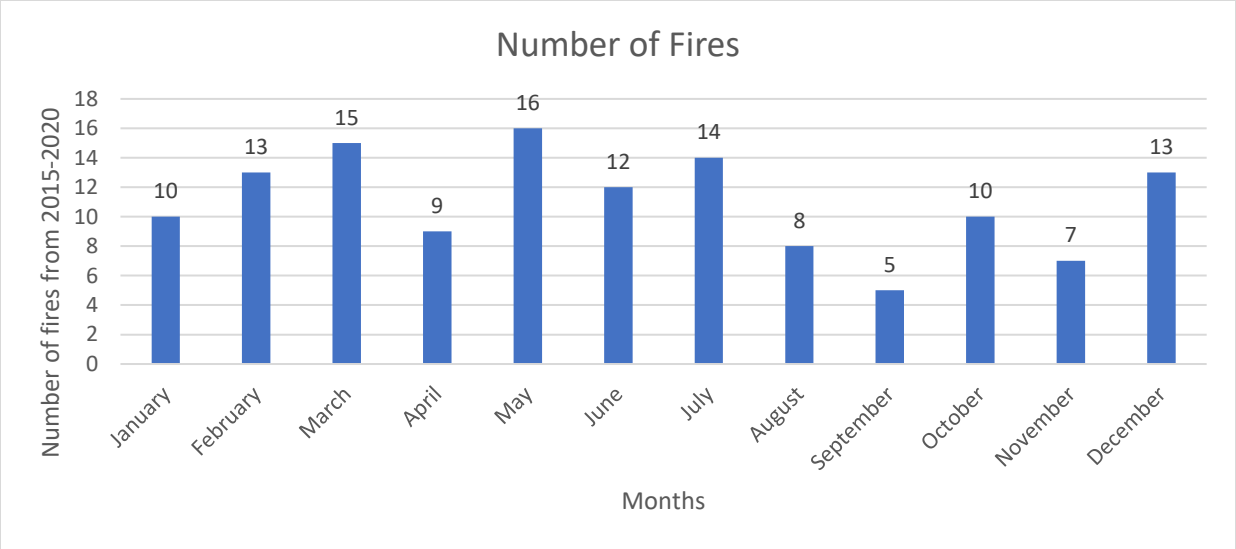


Figure 6: Temporal Frequency of Fire Hazards in Arada Sub-city (2015-2020) (Source: Author)

The frequency of this type of fire disaster (due to manmade hazards) spikes around holidays and festive times of the year with candles left burning or overcooking in an underequipped kitchen. Public spaces experience overcrowding, overuse of the electrical grid, and unsafe festivities during festive holidays, which increases their fire vulnerability during those days.

There are thirteen National holidays in the Ethiopian Calendar for both religious and patriotic holidays. Regardless of whether these days are festive, commemorative, or simply a remembrance, society feels compelled to gather and share their joy or grief; both of which lead to amplified cooking and a notable increase in demand on the city's electric grid, which are common causes for fire outbreaks.

Common negligence is seen in lax safety measures, which allows fires breakout. The two days leading to a holiday, the holiday itself, and the two days after a holiday are considered high fire vulnerable days due to consistent fire disasters both reported and self-contained.

4.2. Interventions by Fire and Disaster Risk Management Commission in Arada sub-city to aid in urban fire resilience

This theme identifies the interventions of the FDRMC to boost fire resilience in the study area. The strengths of the interventions taken by the FDRMC to combat fire disasters are manifested as revealed and latent coping capacities while the challenges that the interventions are met with are manifested as revealed and latent setbacks.

The FDRMC intervenes in all three phases of the FDM process. The pro-active phase interventions include conducting risk assessments to identify prevalent fire hazards, educating the public on how to reduce fire risks and how to combat fire disasters, and preparing resources to aid in short-term and long-term recovery. The response phase interventions include responding to and containing reported fires and rescuing those being victimized by the fires. The recovery phase interventions include investigating the cause of the fires and shifting through the debris to account for damage, employing short-term and long-term recovery programs to help victims, and log incident reports for pattern analysis in the future.

4.2.1. Pro-active phase interventions

The interventions in this phase consists of raising public awareness of fire hazards and preparing the required resources to combat fire disasters. The revealed coping capacities of these interventions are seen in how thoroughly they succeed to educate the public and how well prepared the fire stations are to respond to a fire disaster when it occurs. The revealed setbacks are challenges faced by the FDRMC as they try to educate the public regarding fire hazards as well as the challenges they face to prepare the fire stations and the community to respond to a fire disaster when it occurs.

- **Educating the public on fire hazards**

The Prevention Research Team (Kidme Adega) within the fire department conducts studies every six months to assess disaster risks in Addis Ababa. These studies present a profile of the city's infrastructure, population composition, business distribution, and residential areas, comparing these factors to available resources to combat and contain disasters. The Arada branch identifies areas that are vulnerable to fire outbreaks and other disasters, such as densely populated areas with poor infrastructure or structures.

Vulnerable areas are informed of the risk they are in and willing volunteers receive training on how to handle small fires before they spread. Multimedia broadcasting services are also used to build awareness. Brochures are sent out during festive holidays to advise caution and invite volunteers to participate in public awareness-building campaigns.

National broadcasts may not convey accurate information about who to contact, but fire risks and preventions are advertised to raise awareness on how to combat fire hazards. Programs are given at youth centers, Idir and Equib meetings, and company conventions about fire prevention and fighting.

The Arada fire station provides volunteer training on fire safety, with brochures distributed during holidays to raise awareness about increased risk. Idir provides public access to various topics, and FDRMC hosts training programs for volunteers to teach basic fire and emergency prevention. They also educate people on how to react to fires in their homes or neighborhoods. However, there is a lack of awareness about the breadth of services provided by the Arada Fire Station and the FDRMC. The main issue is the advertisement of the emergency hotline, which was intended to be a free, direct line for emergencies in Addis Ababa. The advertisement is too focused on the hotline and widespread, making it seem like the only option for everyone in the country.

> *"We get calls from all over the country. Sometimes we contact the relevant fire station counterpart in their region and sometimes we do not understand the language at all. We try to help as best we can. From time to time we get a prank call and pass the information through only to have frustrated regional police officers and firefighters report that there was no emergency at all."* Almaz Kara, Dispatcher; Arada Fire Station

The FDRMC in Addis Ababa is not solely focused on fire accidents, but also handles all hazards within the city, from prevention to recovery. However, many people do not use emergency hotlines or fire stations, preferring to call the police. Learning about fire hazards is seen as a latent coping mechanism, but some individuals seek information and training to protect themselves from all hazards. They volunteer to learn how to prevent, fight, and recover from fire accidents, as well as provide first aid. These individuals increase their resilience by practicing vigilance, knowing how to behave during a fire, and preparing a safety net in case of need.

> *"Some volunteers from youth groups, churches, or at random come to our seminars to learn from us not because their groups are doing it, but because they are truly interested. They do not treat it as a chore. They are often people that have survived a fire or any other disaster or at least witnessed it. It is very satisfying that our message is reaching some people even if it is not as many as we would like."* The Fire Chief: FDRMC headquarters

❖ **Preparations of the Arada Fire Station to respond to a fire disaster**

Preparations for combating fire disasters include providing resources to combat fires such as adequate policy, firefighters, equipment, training, and preparations. The fact that these resources are available contributes to revealed coping capacities.

There are currently three fire trucks, an assortment of fire retardant uniforms, and a water truck available to fight fires. It may not be enough to combat all fires but these resources are being used to combat fires throughout the study area and beyond. The most valuable resource that the Arada Fire Station currently has at its disposal is the employees.

> *"We do the best we can with the equipment we have. The job of a firefighter, actually the job of any emergency respondent, is special. Being able to help people in immediate danger creates a sense of purpose in life."* Assefa Desta, firefighter; Arada fire station

Resources are allocated based on the current DRM policy. However, there is a mismatch between urban fire disasters and the current DRM policy. The main mismatch is that urban fires are not given a separate classification; rather they are lumped in together with rural fires and addressed with the same measures (FDRE, 2013). While this may have worked in the past, it is no longer effective. Acknowledging this fact, the FDRMC is implementing its guidelines and has been trying to incorporate a unified Fire Code for the city since 2014.

This mismatch between policy and regulation has led to problems in inter-bureau communication, funding, and chain of command between the FDRMC and the Federal Fire and Emergency Protection Agency (FFEPA).

> *"As our jurisdiction is limited to Addis Ababa, the reports we file to our superiors are contradictory to the reports of the FFEPA. Their requirements target wildfires or factory fires, where concerns like lack of cooperation, traffic jams, and jammed phone lines are not such a high priority. The national policy is aligned with their requests more than ours because they cover the rest of the country. However, their measures do give much importance for purely urban centers."* Director of Fire Prevention Research and implementation: FDRMC

The most vivid break in the chain of command is between the FDRMC and Federal Fire and Emergency Protection Agency (FFEPA). The FFEPA is responsible for fire and emergency protections for all regions of Ethiopia except Addis Ababa, which is under the jurisdiction of the

FDRMC. Both their regulations are supervised by the Ministry but there is little to no communication between the two branches of emergency services. The FDRMC is responsible for Addis Ababa, which is a completely urbanized city, and thus requires its regulations to be different from other parts of the country while the FFEPA draws its regulations from The National Policy and Strategy on Disaster Risk Management (2013). This lack of communication is a hazard on its own, as it makes a collaborative effort for national emergencies difficult to coordinate.

Inter-bureau communication and cooperation with other public offices is another issue. Their response is often either delayed or incompetent. This happens regularly and is one of the main causes that fires get out of control, even if the firefighters get to the site within a few minutes, they are mandated to remain standing there waiting for the power to be cut or for the police to control the crowd so that they can do their jobs properly.

> *"It goes against our nature as firefighters to stand and watch as a building burns down, but we have no choice but to wait for the power to be cut. Sometimes we cannot stop ourselves and go in anyway despite the danger of electrocution. It also causes panic in the crowd, when we arrive and then do nothing. Explaining that even though we are standing right there but cannot help is very painful."*
> Menelik Adam, firefighter; Arada fire station

The main reason for this lack of co-operation is that, much like the Arada Fire Station, the other public offices such as the Arada Police Department and EEP are also overstretched and underfunded. Many among the firefighters, as well as the FDRMC, believe that there should be a signed agreement with other public institutions. It should be mandated that a response be given within a specific timeframe and competency to ensure accidents are dealt with on time instead of how it's done now where firefighters have to wait for the other institutions to respond however and whenever they see fit.

There is also an administrative issue because the officials in charge of policy scripting and budget allocation have no training or experience with firefighting and because of this most of the policy and strategy in place is disharmonious with the reality on the ground. Due to this inconsistency, necessary resources to prepare for a fire disaster such as up-to-date equipment, and adequate life insurance and salaries for firefighters are not provided. There is also a shortage of fire trucks; currently, there are three in circulation under the jurisdiction of the Arada fire

station. Two of which are fully functional, while the third is unreliable and thus only sent out when necessary or only to aid the other two.

There is a lack of a binding document that demarks the authority of the FDRMC or any other code of conduct that mandates other governmental institutions' compliance with the requests made by the FDRMC. Due to this, its effort to minimizing risk hazards within the city has ensured that other governmental institutions see the Fire Station's request for assistance during both an emergency, and planning for prevention or recovery as nothing more than a suggestion. Such a document would greatly minimize the frequency and severity of fire accidents. There is a draft of a fire code, that addresses all of these challenges but it is not yet ratified. The FDRMC lacks the appropriate representation in city administration government and therefore cannot bring the change it needs in other governmental institutions and policies to ensure the safety of the community or its workers.

Substandard equipment puts the lives of the firefighters in jeopardy every time they go out to do their job as well as the people they are trying to help. As a result, many firefighters do not feel well represented or even adequately respected in their profession.

Most of the job satisfaction that comes from their employment is the knowledge that they are saving lives and serving the community that they are committed to protecting.

> *"It is an honor to have a profession where you can save lives. For most of us, we love our work because of how important the work is. However, the lack of resources, outdated equipment, and low salaries makes us feel unimportant in our station. It is demoralizing to see a fellow firefighter suffer asthma problems or lung cancer because of years of high smoke inhalation due to faulty gear."* Molla Gul, Firefighter: Arada Fire Station

The fact there are so few fire hydrants, and even fewer that have a steady water supply also limits the firefighter's responses to fire as they occur.

Finally, as the city grows and urbanizes so does its' needs; thus equipment that was not necessary before is now becoming relevant. Among these are fire trucks with ladders that can reach up to 24 stories in case of fires in high rising buildings, as well as helicopters for aerial support.

4.2.2. Response phase interventions

The interventions in this phase consist of presence of adequate protocols to respond to fires. The revealed coping capacities of these interventions are seen in the quality of the response protocol

as well as how thoroughly they were followed. The protocol for how a fire station responds to a fire accident is specified in the FDRMC regulations.

The protocol described below was put in place by the FDRMC based on their rules and regulations. The very existence of the protocol to respond to urban fires is a strength of the FDRMC and thus a revealed coping capacity. Even though these regulations are backed by the FDRMC, they do not have any authority over any other public offices within the city, as they are not ratified by the national policy. Despite this disadvantage, the regulations still function as the road map to how firefighters should respond to a crisis. It outlines how emergency calls are addressed, how firefighters are organized and assigned, and how damaged and salvaged property are evaluated. Protocols for how firefighters' performances are evaluated are also based on their regulations. Had these regulations been backed up by the national policy, they would be even more effective and more encompassing.

The revealed setbacks in this phase are the challenges faced by the FDRMC as they try to follow adequate protocol during a fire disaster. The National Policy and Strategy on Disaster Risk Management acknowledges fire as a hazard but does not distinguish between urban and rural fires (FDRE, 2013). The effect of this mismatch during a disaster is that the protocols for dealing with fires may be enforced within the fire stations and the FDRMC but they carry little weight with other bureaus of the city administration. A manifestation of this problem is seen in the time it takes to cut the power to the site of an accident by the EEP. Another is in how long it takes to divert water lines to hydrants near the site of an accident by the AAWSA.

> *"Our regulations apply to the nine fire stations in Addis Ababa but not in other cities or other branches of government. This lack of defined hierarchy makes communication difficult. There are times when we have to call EEP officials at their home so that they can authorize a blackout of an accident site so that we can do our job."* The Fire Chief: FDRMC headquarters

The protocol can be seen in three stages: the Dispatch, On-site, and Recall. Each stage has unique coping capacities and setbacks.

When a fire disaster occurs within the Arada sub-city, the Arada Fire Station, which reports to the FDRMC, is tasked with responding and containment. Firefighters, dispatchers, and Emergency Medical Services (EMS) services work on three 12-hour shifts identified as Green shift, Yellow shift, and Redshift. A fire truck is always parked ready to leave equipped with the

necessary equipment and firefighters are trained to leave the fire station within 30 seconds after the alarm has been rung with one fire truck consisting of one driver, one team leader, and four firefighters, bringing the total to six personnel per truck.

- **Dispatch stage**

When a call comes in through the emergency hotline (939), a dispatcher identifies the emergency. If the call is about fire, he/she tries to figure out the location within five to ten seconds, rings the alarm, and asks about the type of fire (wood fire, gasoline fire, electrical contact, grease fire, chemical fire, or any other kind of combustion).

This allows the dispatcher to pass on the relevant information to the team leader on call. This is required when deciding how many trucks should be sent out, what they should prepare for. In the case of an electrical fire - contact Ethiopian Electric Power (EEP) so they can shut down the power around the site least anyone gets electrocuted while trying to put the fire out, in case of an extensive wood fire - contact Addis Ababa Water and Sewage Authority (AAWSA) so that they can ensure water is being routed to the closest fire hydrant, or in case of chemical or grease fire- make sure there is enough chemical foam in the truck and if there is not take more trucks.

As soon as a fire accident is reported to the dispatcher, a fire truck is sent out. A mandate of the Arada Fire Station states that a fire truck should arrive at the scene of the fire in the sub-city within fifteen minutes of leaving the station. There is an ambulance sent out along with the fire truck to treat anyone who is hurt from the firefighters fighting the fire to anyone who may have been hurt.

> *"It is important to be fast but also have accurate information. As a team leader it is my role to relay the right address to the driver, make sure all members going into the fire have full equipment, and accurately identify the cause of fire based on the information from dispatch as well as try to recognize it on site."* Nathan Dela, Fire Fighter: Arada Fire Station

Once the fire truck is on the road, the team leader is tasked with communicating with the dispatch center. The specifics of where the fire is located and communicating that to the driver, as well as to find out more information about the fire if possible, to check if the firefighters are properly geared up and he makes sure numbers are assigned for the four firefighters in his unit. This is done based on how full their gear is. If a firefighter does not have all his equipment with him or her they are relegated to operator position as that does not require them to go into the fire

to fight it, if everyone is well equipped the position is assigned randomly or based on who volunteers for what position.

The revealed setbacks during this stage range from inadequate emergency hotlines, inability to track prank calls, lack of adequate protective gear, and traffic jams.

The phone lines that are used to receive calls do not have a backup power source and in the case of a prolonged power outage, the entire dispatch center is put out of commission. Fortunately, the power does not go out for too long. The fact that the call center is not yet computerized is also an issue as it is difficult to redial while trying to direct a fire truck to the site of an accident should the dispatcher drop a call. Also with a computerized system, identifying pranksters would be easier, and even if they cannot be prevented from calling, they can be caught even after they shut off their phones.

> *"The phones are constantly ringing and it is difficult to know that every call represents something wrong. In the middle of that, some call to make fun of us, talk about religion or politics, and some who are mentally unstable."* Almaz Kara, Dispatcher; Arada Fire Station

It is commonplace that a fighter would board the truck without full gear on (because there was not enough to go around) knowing that it would be against protocol for her/him to enter the scene of the accident and thus be relegated to the duty of operator.

One of the main issues that make the jobs of firefighters hard is the problem of traffic jams. Gridlock often prevents fire trucks from arriving on the scene of a fire accident within a timely manner (fifteen minutes max). Traffic volume in Addis Ababa has peak hours in the morning (eight am- ten am) and in the evening (five pm- nine pm) on top of general traffic during the day. Also, construction and traffic accidents can cause total gridlock (Abera, Gebissa, & Mohammed, 2018).

Most of the time people yield to the road when they hear a fire truck's siren, and traffic police do their best to clear the road when they hear the siren. However, there are cases where people simply refuse to yield. Others try to tailgate after a siren or ambulance to escape a traffic jam which can lead to traffic accidents, disgruntled drivers, and inconvenienced fire truck and ambulance drivers who, not only have to arrive at the scene of an accident quickly but also shake off the tale they have acquired.

"It is amazing to me that a driver that hears sirens and still does not yield to a fire truck but it happens. Others try to follow to escape the traffic jams. I wish people could hear the sirens and imagine that we are going to help others. We may be going to save his or her house." Molla Gul, Firefighter: Arada Fire station

The latent coping capacities include the willingness of firefighters to go on duty even when they do not have complete gear rather than stay behind and the relentlessness of operators as they try to get as much information as possible from panic-stricken victims at the site.

The latent setbacks include people who stubbornly refuse to call for help, and prank callers. People often call the fire station after trying to control the fire themselves and failing. This greatly contributes to fires getting out of hand and spreading. This is not to suggest that even the simplest fires should be reported, but rather that people should be more willing to admit when a fire has gotten out of control instead of stubbornly thinking that just one more jug of water will put it out. A simple threshold can be that if a fire has not been put out within five minutes of ignition, especially near flammable materials, it is time to call the fire station.

The unforeseen side effect of the hotline being free is that many people from all around the country call to prank or just looking for a conversation. This has led to the emergency hotline being constantly busy. So much so that people just call the Police when there is fire. Although some people call the police because they do not know the emergency hotline number let alone the distinguished phone numbers for each station.

As a result, the fire department had to set up different telephone numbers for every branch of fire stations within the city. The problem with this is that, unlike the free hotline number, the new telephone numbers are not 3-digit numbers, they are regular telephone numbers and people have a hard time programming them into their phones let alone remembering them. More than that; an overwhelming number of people call the hotline just to insult whoever picks up or to make demands based on their superstitious beliefs.

Others call to advertise their political views. The problem though is that these callers rarely listen when the dispatch operators try to make them aware of the harm they are doing and the impact it is having on the quality of service the institution provides.

Then some call in fires as a prank, they either laugh halfway through their call and hang up or make up a convincing emergency call then turn off their phones. This is a big problem because regardless of whom calls the station dispatchers are obligated to sound the alarm even before

they finish the call. Therefore, in the case of a prank, a fire truck is sent out to an area where no fire has occurred. This causes anxiety for the firefighters who; at the time, feel like they went to the wrong place, disgruntlement for the dispatcher; who feels like they got the address wrong, and a general blow to morale when they all realize they have been pranked. Not to mention the gas and resources that are spent to go to a place where there was no fire could have been used for an actual accident. The hotline service is designed to receive reports of a fire within the city of Addis Ababa yet it has been advertised throughout the country and reports come in from all over the country. This is another reason why the lines are always busy.

- **On-site**

Once at the destination, the team leader has to assess the area and the fire to come up with a plan of action based on the size and type of fire, and to call for more fire trucks if he deems it necessary. Once at the site, the firefighters must get to work within 1 minute. Depending on the severity of the fire, firefighters are required to get the fire under control within a specific time window.

A fire contained in under an hour is classified as a small fire, contained in less than four hours is a medium fire, contained in less than eight hours is a heavy fire, containment lasting more than eight hours is classified as a national disaster.

The EMS is expected to reach the site of the accident at the same time the fire truck does. They treat people that have been rescued from fires or other accidents by the firefighters; they do not actively participate in the rescue mission with the firefighters but treat those the firefighters have retrieved from the accident.

The team leader is also tasked with identifying the type of fire detergent to be used depending on what type of fire it is. This is done simply by observing the color of the flames or by referring to information available to them about the possible combustibles that may have ignited from the studies conducted by *Kidme Adega* (Prevention Research team).

The team leader is also responsible for requesting resources and assistance from other departments such as the police force, Water and Sewage Authority, and Ethiopian Electric Power (EEP) to assist them; this is done through the dispatcher.

According to the severity of the accident, the people in charge of handling the fire go up an assigned jurisdictional hierarchy. First, the team leader that arrived is in charge, if the fire is too much and multiple trucks are called. The team leader that came in the first truck is in charge, if

the fire is still too much, the fire chief is called in to coordinate while the team leaders go in to combat the fire. If the fire is yet to subsist, one of the four Fire Marshals of the FDRMC is called in to coordinate while everyone else combats the fire. If the fire is still raging on all four Fire Marshals are called in, and by this point, it is classified as a national disaster additional support would be requested from other cities as well as the National Guard.

After the fire is controlled, an inventory is conducted on the equipment that is used to put out the fire, and the cause of the fire is investigated. If the source of the fire is not identified, then the investigation is handed over to the police. The firefighters then stay and give a brief presentation to the local community to raise awareness about common fire hazards.

The firefighters then locate the nearest fire hydrant to refill the water they just used up as they could be sent to another fire accident on their route back and then return to the Fire Station.

The revealed coping capacity in this stage includes the presence of police, the rapid response of the firefighters, and the presence of EMS workers. Usually, the presence of Police officers helps create a parameter so that the firefighters can do their jobs uninterrupted. Rapid response of fire fighters and EMS workers often saves lives and property.

The revealed setback is a lack of resources for the dispatch operators, firefighters, and EMS workers. The dispatch operators are understaffed and lack enough phone lines to receive all emergency calls. The firefighters usually do not have enough personal protective gear for everyone as well as very few fire trucks. The EMS workers often lack enough medicine, personnel, and medical equipment including a gurney.

The latent coping capacity in this stage is seen in the form of knowing how to act during a crisis. While most people go into shock during a fire, some react properly. The proper reaction to a fire includes calling emergency services if the fire is not contained within five minutes, everyone evacuating the residence, staying out of the firefighters' way once they arrive, and maintaining the parameter of the disaster site.

Those who follow this procedure show latent coping capacity by letting the professionals do their job.

> *"We see a lot of panic and confusion in our line of work, especially in emergencies, but now and then, we see civilians with cool heads providing actual assistance. These people are aware to leave the firefighters alone. Instead, they help us maintain the perimeter around the site by calming those around them.*

Those who have medical training also try to help the paramedics." Police officer: Arada Police Station

Once a fire has broken out and emergency services have been called, police officers establish a parameter around the site. Those officers indicate structural resilience, while the bystanders who honor the parameter exhibit human resilience. The parameter allows firefighters to do their jobs without interference and maintains the integrity of the site for the police and insurance investigators. It also protects the residence from burglars who try to sneak past the parameters by pretending to be the owners of the property or as a bystander who stood too close.

The latent setback in this stage includes giving in to shock and fear during a fire, lack of cooperation from the public, and criminal activity.

The most vivid latent setback during a fire outbreak is that victims of said fire and even bystanders go into shock especially if it is sudden combustion and it is spreading fast. Therefore, by the time someone calls the fire department or even the police, the fire has already spread. The second most common occurrence is that people assume that they can handle any kind of fire accident by spilling enough water on it. This leads to a delay in when the fire station is called.

Panic during a disaster is a state of fear or heightened anxiety during high-stress situations. It does not necessarily lead to behavior that causes death or injury. In fact, with proper training the state of panic -where adrenaline levels are high- can lead to quick thinking and action. This requires knowledge and practice of what to do in case of an emergency (Fahy, Proulx & Aiman, 2009).

In the case of fires, this can range from learning how to provide first aid to practicing what they should do if a fire breaks out in the home beforehand (a fire drill. However, people rarely think of home fires let alone practice how to stop them so when a fire does break out they freeze or run away. Most attempts at putting out fires by civilians are haphazard and disorganized. Since people rarely run fire drills, they are often confused and often endanger themselves while trying to escape.

When a fire truck eventually shows up, there is usually damage that could have been salvaged had they been called sooner or had people evacuated in an organized and orderly fashion. Once firefighters start to put out their fire, people sometimes try to help them by holding the fire hose or carrying their gear.

This is a hindrance as they are interfering with the chain of command and the protocols in place. Others take fire hoses away from firefighters to spray water on their property so that it is fire retardant. This interference is selfish and causes even more damage.

Most people who find themselves in a fire accident behave in a way that impedes the work of the firefighters. Since firefighting is something that requires training, any intervention from untrained personnel makes the job of a firefighter more difficult. The main issue is that people tend to crowd the firefighters while they are doing their work for the sake of bearing witness, misguidedly trying to help, but there have also been instances where people take the fire hose to spray on their property regardless of whatever else is going on. Criminals dress up as firefighters and use the confusion to enter undetected or as pedestrians who jump into the fire pretending they own the property and are only recovering their property.

> *"People often crowd us when we arrive to fight the fire. They either want us to pay attention only to their personal property even if it is not on fire but simply in the neighborhood, others want to take our gear and go into the fire themselves. Sometimes, they are angry that we are late and so they yell at us or insult us."* Aman Kolef, Firefighter: Arada Fire Station

- **Recall stage**

Once they reach the Fire Station and are relieved of duty, the team leader writes a report on the fire disaster, and how his team handled it and themselves. Their strong suites, their weaknesses, the time it took them to leave the station, arrive at the scene, and contain the fire. This report is sent up the chain of command to analyze patterns of hazard exposure. The ambulance EMS team submits a report to their corresponding fire stations about the details of the patients and their treatment.

The revealed coping capacities in this stage are seen in how the presence of fire hydrants helps improve performance, and how writing an immediate action report on the fire disaster contributes to trend analysis in the future. The medical services provided by the EMS team also contributes to the revealed coping capacities.

The revealed setbacks in this stage are seen in how most of the fire hydrants are non-functional or tapped out, and how overwhelmed the EMS teams are. There are also times when the firefighters and EMS teams are injured while on-call not only because of the fire but by

bystanders who are dazed and confused, angered by the loss of property or deceased/injured loved ones, or just thieves who were trying to loot the site of the accident.

4.2.3. Recovery phase interventions

The interventions in this phase involve helping the affected community recover from disasters by investigating the cause of fires, shifting debris to account for damaged and salvaged properties, employing short-term and long-term recovery programs, and logging incident reports for pattern analysis in the future. The revealed coping capacities of these interventions are seen in how thoroughly the FDRMC succeeds in rehabilitating the victims. This is accomplished by taking proper account of damaged and salvaged property, providing necessities through the build-back initiative, and a proper investigation of the cause of the fire.

Three to five days after a fire disaster has been contained, a questionnaire is distributed to at least ten people that observed the fire from beginning to end to assess the response time and other actions taken by the firefighters to control the fire. Those directly impacted by the fire are given a more detailed questionnaire to fill out regarding the services provided to them and compile a list of damaged property and its worth both for analysis by the FDRMC and for the victim to assess their losses and form a plan going forward. These questionnaires use to be conducted immediately after the fire was put out as recently as 2013, but the data was often incomprehensible, incoherent, and often exaggerated because the victims were emotionally distraught and were unable to give a reasonable response.

Build-Back (*Melso Makwakwam*) is an initiative intended to aid fire victims who have lost their property to fire. They are given sheets, blankets, mattresses, and other necessities they can live off for a time until they get back on their feet. These victims are relocated to a site assigned by the city administration to help fire victims, but sometimes tents are required.

Many people call the police when there is a fire, and once they receive the call, they forward it to the corresponding Fire Station. Officers are sent to calm down the crowds and establish a safe space for any retrieved belongings found at the site to deter thieves. Once the fire is put out, the team leader tries to identify the cause of the fire, and if the cause is not apparent, the case is turned over to the police.

The revealed setbacks are challenges faced by the FDRMC as they try and fail to rehabilitate the victims and evaluate their performance for future analysis. This takes the form of insufficient resources provided to victims the Build-Back initiative and inconsistent evaluation of after-

action reports filed. The latent coping capacities of these interventions are seen in the strategies the public has prepared to rehabilitate themselves, such as having a speedy recovery, engaging in build-back better practice, and ensuring the safety of the community.

Speedy Recovery - How quickly a person gets back on their feet in the days, months, and years afterward depends on the state of their safety net and its application. Those who use their compensations and savings to rebuild or relocate based on logic recover much faster than those who do not. The decision to relocate should be based on three major factors: available safety net, the extent of the damages, and social connections within the community.

It is common for people to be stubborn about relocation based on emotional attachment to family legacy or social connections alone, but if the damages they have suffered are too extensive or too expensive to rebuild then they should relocate. Especially if the structural damage creates new vulnerabilities for collapse, fire, burglary, and water, and power shortage. Those who can and do rebuild their damaged property properly, increase the revealed coping capacity of their community.

Build Back Better Practice - Constructions in the city -both residential and business- are required to obtain a construction permit from their respective city administration. These permits signify that the construction plans are stable and fire retardant. Those who follow the plans that are submitted and approved by the Arada Sub-city Administration encourage both revealed and latent coping capacities. It encourages revealed coping capacity by improving the urban layout of both urban and residential districts to have increased road access, stable power grids, and reliable water lines. It encourages latent coping capacity because those who follow the guidelines to build their homes and businesses are better prepared and more aware of all hazards.

This is also seen in those who reconstruct their homes and businesses after a fire -or any other disaster- has occurred. Those who submit for a permit for reconstruction and follow-through on it are more aware and cautious of risks in the future which makes them more resilient.

Diligent Evaluation of Compensation Applications and Claims - Acquiring safety nets (Idir or insurance) is a latent coping capacity that provides a backup in case of emergencies and governs day-to-day life. People who pay Idir buy-in and monthly fees are more careful than those who do not, and those who acquire insurance are even more so. However, people often hesitate to buy safety nets because they find them unreliable and that the compensation is not enough to cover their losses.

After surviving a disaster, people with safety nets take the time to account for their losses. While it is common for people to accidentally or purposefully exaggerate their losses, some give a fair estimate. Honest assessment on behalf of Idir group managers and insurance companies increases revealed coping capacity as their honest dealings encourage people to acquire safety nets.

Insurance companies evaluate the worth of a prospective client's property and belongings to assess a fair annual premium. This is a revealed coping capacity, whereby the process is kept fair and honest for everyone. Insurance fraud and false claims for Idir are systemic, so rigorous evaluation processes are required. However, insurance companies can fall into the habit of taking advantage of their beneficiaries.

Latent setbacks include challenges faced by public as they struggle to rehabilitate themselves, including delayed recovery due to various reasons.

Exaggerated losses are common in both Idir groups and insurance policies, as people try to exaggerate the worth of their belongings to increase annual premiums. Lying on insurance forms about the worth of belongings can also lead to increased annual premiums.

> *"What we need is a united database where different insurance providers can list any fraudulent client they have had to deal with. The problem is that insurers are reluctant to give out client information to each other. An objective organization with confidentiality contracts with all insurance companies would be very useful."* Branch Manager: Ethiopian Insurance Corporations

Logical use of Idir and Insurance - In a fire accident or tragedy, people often respond emotionally rather than rationally, deciding to relocate or rebuild based on resources, damage, and community ties. However, most people choose to stay and rebuild based on emotional reasons, such as proximity to loved ones, inherited homes, or fear of survival. Compensation, whether from an Idir membership or insurance payout, is often used for personal purchases rather than a lifeline, further affecting their situation.

Those who use compensation to help recover show latent coping capacity. Combining compensation with savings and living more moderately until recovery is achieved is better than pretending everything is fine and burning through the compensation quickly. Living more moderately and combining compensation with savings is better than pretending everything is fine and burning through the compensation quickly.

Invading Established Parameter- When the police arrive at the site of a fire accident, they establish a parameter. Civilians are escorted out of the parameter to: make sure they do not get hurt, interfere with the firefighters' work protect the salvaged property of the residency (which is usually left in a pile outside), and make sure criminals do not tamper with either the property or interrupt the firefighters. However, some people cross the parameters to stare at either the fire or even the firefighters. These people while meaning no harm interfere with the firefighters' work, and the police officers' work, and risk the integrity of the accident site.

Others cross it to steal the property that has been salvaged by claiming it as their own and disappear into the crowds; others wear fake police or firefighters uniforms to steal said property. Sometimes, they go into a burning structure to steal under the guise of a salvage operation. These criminals are hard to spot and even harder to catch.

Arson - is a latent setback in the world of fire hazards, with two classes: intentional fires and those set by individuals. The first class exposes the victim's property and life, while the second class threatens the perpetrator's life. The risk of arson spreads to the surrounding area, making insurance companies and Idir groups reluctant to pay settlements without thorough investigation.

There are two branches of arson: an attack, where a person attacks someone by setting fire to their home or property, and self-destructive, where a person sets fire to their property for various reasons. Personal feelings, professional reasons, and the belief that insurance, the government, or Idir will cover the cost of the lost property are common reasons for arson. Arson for insurance purposes is common in business, especially if the business is failing.

This study analyzed arson patterns in Arada Sub-city over the last five years, but data was sealed due to ongoing investigations and sensitive information. The study found that high population density, poor urban planning, rapid urbanization, high immigration rates, common negligence, sub-standard construction materials, social unawareness, and arson are latent setbacks in Arada Sub-city households. These factors can impact the prevention, coping, and recovery phase of fire accidents.

Recovering from any accident -fire or otherwise- requires a lot of resources and planning. A fire breaking out at a place of business or work can be damaging but a fire at home can be devastating as it functions as the place people retreat to when they need to recover from a loss. The short term recovery -the first few days and weeks after the fire- of a person who has suffered a fire at their place of business would need take complete inventory of properties lost, damaged,

or salvaged and create a plan on how to recover. This can take the form of contacting insurance agencies (if the victim had insurance), reaching out to *Idir* groups for help in restoring lost inventory or *Equib* groups if there was a death due to the disaster, shutting down the business for repairs, selling or renting private properties or possessions to gather a fund, or if the damage is too much, sell the business. A fire in a place of residence includes finding a place to stay temporarily, accounting for the lost and salvaged items from the fire, and reviewing safety nets (savings, *Idir* standing, relatives and friends willing to help, and insurance policies). The major vulnerabilities in this regard are that most people either invest their savings or live hand to mouth or worse, are in debt. *Idir* compensation is rarely enough to help people recover unless the fire was a minor one. Social connections and relatives may be willing to help in a crisis but it is not a lasting solution. Insurance policies take a long time to confirm (the site needs to be investigated by both the police and representatives of the insurance company to rule out arson) and compensation is usually delayed.

The long-term recovery - the first year up to the rest of their lives - of anyone who has suffered a fire depends on their safety net. Those who do not prepare for any emergency in any way (no insurance, no *Idir* membership) suffer lasting damage. Those with *Idir* membership try to recover by combining it with their savings and relocating or rebuilding. Those with insurance stand the best chance as they combine their compensation with their savings to relocate or reconstruct.

These challenges are extensive and require a commitment to alleviate; however, the consequence of these challenges is not just material wealth but rather human lives. As such everyone- ranging from identified stakeholders to individuals- should do their part to help improve the status quo.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

This chapter summarizes the major findings of the study driven from the discussions and analysis of the study and a list of recommendations based on said findings. It has two sections.

5.1. Conclusion

This research investigates the coping capacities and setbacks of urban centers in Addis Ababa, specifically in Arada Sub-city, on how to manage fire disasters. The study uses Key In-depth Interviews, Focus Group Discussions, and secondary data from the FDRMC, Arada Sub-city Administration, and Central Statistics Agency for quantitative analysis.

The data shows that fire coping capacities and setbacks coexist together. The services provided by the FDRMC contribute to coping capacities, but administrative problems, lack of resources, public awareness, traffic jams, and lack of a unified fire code hinder their efforts. Some parts of Arada Sub-city are more vulnerable due to the frequency of fires in the last five years and the quality of house structures.

Fire vulnerability varies at different times of the year, with windy and dry seasons being most fire-vulnerable, while Belg and Kiremt are more resilient due to wetter and more humid weather. Miyaziya (April) is identified as the most fire-vulnerable month.

The study concludes by identifying two aspects: coping capacities and setbacks to resiliency exhibited by urban households in the face of fire risks. Major pro-active urban fire vulnerabilities include a mismatch between current DRM policy and practice, high population density and overcrowding, unchecked urbanization, unsuitable urban planning, and sub-standard housing. These setbacks increase the likelihood of exposure to fire hazards.

Competing phase setbacks include misalignment of regulations and existing policy, high population density, overcrowding, lack of resources to combat emergencies, and invading established Police parameters. Recovery phase setbacks include lack of consistent evaluation for policy formulation, sub-standard reconstruction, rigid urban planning, delayed recovery, emotional responses, and exaggerated losses.

Proactive urban fire coping capacities include synergy between regulations and practices, population redistribution, sustainable urbanization, advertisement of fire risks and preventions, vigilance and caution, and diligence in evaluating compensation applications and claims.

Coping phase coping capacities include efficient use of resources, protocols based on regulations, knowing how to respond during a crisis, and maintaining established Police parameters. Recovery phase coping capacities include building back better practices, logical use of insurance compensation, speedy recovery, and honest claim of assets preserved and lost.

5.2. Recommendation

This section outlines possible solutions to problems to alleviate setbacks and encourage coping capacities in the study area. The following are major recommendations:

- Urban household relocation projects can reduce overcrowding and increase compensations for displaced people.
- City master plans should prioritize hazard prevention and include fire hydrants from the start.
- Fire brigade station offices should be strengthened with adequate finance, human resources, and technology.
- More fire trucks and water trucks should be provided per station, with all equipment updated.
- Fire hydrants should be distributed in a grid-like formation and built above ground to promote awareness about littering and parking.
- The number of ambulances in circulation needs to be increased and their facilities and equipment upgraded.
- The services of the FDRMC should be clarified through media interviews and media coverage.
- New phone lines and more dispatchers should be added for emergencies.
- Public and private companies should hold conventions on fire safety to encourage vigilance.
- Agencies like Ethio telecom, Addis Ababa Water and Sewage Authority, and Ethiopian Electric Power should be more responsive to firefighters' requests.
- Companies should donate or finance fire station equipment in exchange for social responsibility, advertisement, good public relations, and sponsorships.
- The National Policy and Strategy on Disaster Risk Management should be amended to distinguish between rural and urban fires and outline cooperation between the FDRMC and FFEPA.

REFERENCES

- Abebe, M. (2010). Disaster management in Ethiopia: A review of its checkered history, its transformation and some implications for a vibrant disaster management system, 1975-2008. *Journal of Sustainable Development in Africa*, *12*(4), 237-254.
- Abera, T., Gebissa, A., & Mohammed, M. (2018). *Investigation of traffic congestion and possible remedies; a case study of at Harambee Hotel Intersection, Kirkos sub-city, Addis Ababa* (Doctoral dissertation).
- Abreha, M. (1997). *Assessment of hazards, vulnerability, and capacity for disaster prevention and emergency preparedness in Addis Ababa* (Master's Thesis) Addis Ababa University, Addis Ababa, Ethiopia
- Addis Ababa City Government. (2017) Arada Sub-City Administration. Retrieved January 7, 2019, from *http://www.addisababa.gov.et/ko/web/guest/arada-sub-city*
- African Union (AU), (2004). Africa regional strategy for disaster risk reduction. *Disaster Risk Reduction for Sustainable Development in Africa*.
- Aitsi-Selmi, A., Egawa, S., Sasaki, H., Wannous, C., & Murray, V. (2015). The Sendai framework for disaster risk reduction: Renewing the global commitment to people's resilience, health, and well-being. *International journal of disaster risk science*, 6(2), 164-176.
- Alberti, M., & Marzluff, J. M. (2004). Ecological resilience in urban ecosystems: linking urban patterns to human and ecological functions. *Urban ecosystems*, 7(3), 241-265.

- Alemayehu A. & Sotomayor M A. (2016). Rising from the Ashes: How fires in Addis Ababa are shedding light on the need for resilience. Retrieved January 5, 2020, from *http://blogs.worldbank.org/africacan/rising-from-the-ashes-how-fires-in-addis-ababa-are-shedding-light-on-the-need-for-resilience.*
- Arada Sub-city Integrated land information office. (2014). Road Map of Arada Sub-city. *Arada Sub-city Integrated land information office*. Addis Ababa: Ethiopia
- Assefa, M. (2018). Urban Resilience in Addis Ketema and Lideta Sub Cities of Addis Ababa: The Case Tekilehaimanot Area Addis Ababa, Ethiopia. *Urban and Regional Planning*, *3*(2), 44.
- Berry, R. S. (1999). Collecting data by in-depth interviewing. Retrieved January 7, 2020. From *http://www.leeds.ac.uk/educol/documents/000001172.htm*
- BMZ & GIZ. (2015). *Disaster Risk Management: Approach and Contributions of German Development Cooperation.* Berlin. Federal Ministry for Economic Cooperation and Development (BMZ).
- Bordens, K. S., & Abbott, B. B. (2011). Research Design and Methods: A process approach. *Eighth edition.*
- Braun, V., & Clarke, V. (2019). To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qualitative Research in Sport, Exercise, and Health*, 1-16.

- Cardona, O. D., Van Aalst, M. K., Birkmann, J., Fordham, M., Mc Gregor, G., Rosa, P…., & Keim, M. (2012). Determinants of risk: exposure and vulnerability. In *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change* (pp. 65-108). Cambridge University Press.
- Cartalis, C. (2014). Toward resilient cities–a review of definitions, challenges, and prospects. *Advances in Building Energy Research*, 8(2), 259-266.
- Chhetri, P., Corcoran, J., Ahmad, S., & Kiran, K. C. (2018). Examining Spatio-temporal patterns, drivers, and trends of residential fires in South East Queensland, Australia. *Disaster Prevention and Management: An International Journal*.
- Cohen, D. (2015). Understanding Population Density. Retrieved March 6, 2019. *(https://www.census.gov/newsroom/blogs/random-samplings/2015/03/understanding-population-density.html)*
- Cooke, J. G. (2015). The state of African resilience: Understanding dimensions of vulnerability and adaptation. *Resilient Africa Network*. Rowman & Littlefield.
- CSA. (2013). Population Projections for Ethiopia 2007-2037. Addis Ababa: Ethiopia
- CSA. (2018). THE 2015/16 ETHIOPIAN HOUSEHOLD CONSUMPTION – EXPENDITURE (HCE) SURVEY. Addis Ababa: Ethiopia
- Davidson, J. L., Jacobson, C., Lyth, A., Dedekorkut-Howes, A., Baldwin, C. L., Ellison, J. C.,& Smith, T. F. (2016). Interrogating resilience: toward a typology to improve its operationalization. *Ecology and Society*, *21*(2).
- Davoudi, S., Brooks, E., & Mehmood, A. (2013). Evolutionary resilience and strategies for climate adaptation. *Planning Practice & Research*, *28*(3), 307-322.

- Dereje, G. (2017). *A*ssessing community development activities of a community-based organization (CBOs): a case study in the case of "Sillase" developmental "Idir", Addis Ababa, Ethiopia (Doctoral dissertation, St. Mary's University).
- Endeshaw, D. (2016, July 12). Addis Ababa's 10th Master Plan Sees 13 Districts. *Addis Fortune.https://addisfortune.net/articles/addis-abebas-10th-master-plan-sees-13-districts/*
- Fahy, R. F., Proulx, G., & Aiman, L. (2009). *'Panic' and Human Behavior in Fire* (pp. 387-398). Cambridge, UK: National Research Council Canada.
- Godschalk, D. R. (2003). Urban hazard mitigation: creating resilient cities. *Natural hazards review*, *4*(3), 136-143.
- Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual review of ecology and systematics*, *4*(1), 1-23.
- Ikeda, S., & Nagasaka, T. (2011). An emergent framework of disaster risk governance towards innovating coping capability for reducing disaster risks in local communities. *International Journal of Disaster Risk Science*, *2*(2), 1-9.
- Imenda, S. (2014). Is there a conceptual difference between theoretical and conceptual frameworks?. *Journal of Social Sciences*, *38*(2), 185-195.
- Johnston, M. P. (2017). Secondary data analysis: A method of which the time has come. *Qualitative and quantitative methods in libraries*, *3*(3), 619-626.
- Larsen, L., Yeshitela, K., Mulatu, T., Seifu, S., & Desta, H. (2019). The impact of rapid urbanization and public housing development on urban form and density in Addis Ababa, Ethiopia. *Land*, 8(4), 66.

- Mebrate, S. (2008). *Urban Poverty and Poor Housing Condition in Addis Ababa Metropolis*. (Master's Thesis, Addis Ababa University).
- Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. *Landscape and urban planning*, *147*, 38-49.
- Melesse, B., & Nachimuthu, K. (2017). A review on causes and consequences of rural-urban migration in Ethiopia. *International Journal of Scientific and Research Publications*, *7*(4), 37-42.
- Meriläinen, E. (2020). The dual discourse of urban resilience: robust city and self-organized neighborhoods. *Disasters*, *44*(1), 125-151.
- Million, B. (2001). Fire Management Requirements in Ethiopia-The need for international support. *Ministry of Agriculture, Addis Ababa, Ethiopia*.
- Niekerk, Van D. (2015). Disaster risk governance in Africa: A retrospective assessment of progress against the Hyogo Framework for Action (2000-2012). *Disaster Prevention and Management*, *24*(3), 397-416.
- Nirupama, N. (2013). Disaster risk management. In *Encyclopedia of Natural Hazards* (pp. 164-170). Springer Netherlands.
- Note, B. (2011) Effective measures to build resilience in Africa to adapt to climate change.
- Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International journal of qualitative methods*, *16*(1), 1609406917733847.

- Ogato, G. S. (2013). The human ecology of disasters in Ethiopia: The quest for participatory disaster management and sustainable livelihood improvement of pastoral communities. *American Journal of Human Ecology*, *2*(1), 21-27.
- Ooi, G. L., & Phua, K. H. (2007). Urbanization and slum formation. *Journal of Urban Health*, *84*(1), 27-34.
- People's Democratic Republic of Ethiopia (PDRE). (1989), *A Brief on the national disaster prevention and preparedness strategy for Ethiopia.* Addis Ababa, Ethiopia
- Pickett, S. T., Cadenasso, M. L., & Grove, J. M. (2004). Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms. *Landscape and urban planning*, *69*(4), 369-384.
- Pinsker, B. (2019, June 6). Repairing Homes After Disasters Requires Planning, Patience Even with Insurance. *Insurance Journal. https://www.insurancejournal. com/news/ national/2019/06/06/528556.htm*
- Proag, V. (2014). The concept of vulnerability and resilience. *Procedia Economics and Finance*, *18*, 369-376.
- Ribeiro, P. J. G., & Gonçalves, L. A. P. J. (2019). Urban resilience: A conceptual framework. *Sustainable Cities and Society*, *50*, 101625.
- Schneiderbauer, S., & Ehrlich, D. (2004). Risk, hazard, and people's vulnerability to natural hazards. *A review of definitions, concepts, and data. European Commission Joint Research Centre. EUR, 21410*, 40.
- Simon, G. (2017). *Flame and fortune in the American West: urban development, environmental change, and the great Oakland Hills fire* (Vol. 1). University of California Press.

- Stanganelli, M. (2008). A new pattern of risk management: The Hyogo Framework for Action and Italian practice. *Socio-Economic Planning Sciences*, *42*(2), 92-111.
- Suryabhagavan, K. V., Alemu, M., & Balakrishnan, M. (2016). GIS-based multi-criteria decision analysis for forest fire susceptibility mapping: a case study in Harenna forest, southwestern Ethiopia. *Tropical Ecology*, *57*(1), 33-43.
- Tafesse, M., (2016). Forest Fire Risk Zone Modeling and mapping in Bale Mountains National Park (BMNP), Oromia. *Addis Ababa University, Addis Ababa, Ethiopia.*
- Tedim, F., & Leone, V. (2017). Enhancing resilience to wildfire disasters: From the "war against fire" to "coexist with fire.". *Disaster resilience: an integrated approach*, 362-383.
- The Federal Democratic Republic of Ethiopia. (2013), *National Policy and Strategy on Disaster Risk Management.* Addis Ababa, Ethiopia
- Twigg, John. (2015), *Disaster Risk Reduction.* Humanitarian Practice Network.
- UN-Habitat (2016). Urbanization and development: emerging futures. *World cities report*, *3*(4), 4-51.
- UN-Habitat (2017). *Trends in Urban Resilience*. Nairobi, Kenya: UN-Habitat.
- Venton, C. C. (2018). Economics of Resilience to Drought. *United States Agency for International Development (USAID): Washington, DC, USA*, 43.
- World Bank. (2015). Addis Ababa, Ethiopia Enhancing Urban Resilience. *City Strength: Resilient Cities Program.* Retrieved February 6, 2020. from *http://documents1.Worldbank.org/curated/en/559781468196153638/pdf/Addis-Ababa-Enhancing-UrbanResilience -city-strength-resilient-cities program.pdf*

- World Urbanization Prospects (2021, January 12) Addis Ababa Population 2021.*World Population Review*. https://worldpopulationreview.com/world-cities/addis-ababa-population
- Xin, J., & Huang, C. (2013). Fire risk analysis of residential buildings based on scenario clusters and its application in fire risk management. *Fire Safety Journal*, *62*, 72-78.
- Yasin, M. (2018). *CAUSES AND CONSEQUENCES OF RURAL-URBAN MIGRATION: THE CASE MORSITO WEREDA MIGRANTS IN ADDIS ABABA* (Doctoral dissertation).
- Zenebe, A. (2020). *The Role of Ethiopian Red Cross in Disaster Risk Reduction and Rehabilitation in the case of Qoshee Area Addis Ababa* (Doctoral dissertation, St. Mary's University).

APPENDIX

Annex I: Table based on secondary data

The table below is the result of the secondary analysis conducted by the researcher from secondary data provided by the Fire and Disaster Risk Management Commission (FDRMC). The data presented spans the registered fires of Arada sub-city from the year January (Meskerem), 2007 to August (Ginbot), 2012. This table shows the fires that occurred within the ten sub-cities of the Arada sub-city and reported to the Arada fire station.

Year	Mo nth	Da te	Wor eda	Site	Type of accident	Cause of fire	Speed of arrival	Conta inment	Aftermath of the accident Rescue	Injured	Lost live	Saved Property In Birr	Lost property In Birr
2007	Janu	3	7	Around Ginfil bridge	Vehicle Fire	Unknown	Unknowr	Unknow	0	0	0	50,000	80,000
	Febr	8	3	Inside Abebech Gobena orphanage	Mattress Fire	Electric Fire	Unknowr	Unknow	0	0	0	3,000,000	400,000
		18	5	Addis Ababa police Crime investigation bureau	Office Fire	Electric Fire	Unknowr	Unknow	0	0	0	2,000,000	200
		24	1	Ras Mekonen Deldey next to Meta Bira	Residential Fire	Unknown	4 min	18 min	0	0	0	500,000	20,000
		26	4	Around Tibeb Edget School	Residential Fire	Unknown	4 min	68 min	0	0	0	1,000,000	10,000
	Tota	4		-	Mattress Fire (1) Residential Fire (2) Office Fire (1)	Electric Fire (2) Unknown (2)	-	-	0	0	0	6,500,000	430,200
	Marcl	10	10	Next to Piassa Ethiopia hotel	Kitchen Fire	Electric Fire	Unknown	Unknown	0	0	0	100,000	10,000
		11	6	Around the St. Mariam congregation	Business shop Fire	Flammable liquid	Unknown	Unknown	0	0	0	10,000,000	1,000
		14	6	Infront of St. Mariam church	Business shop Fire	Kitchen Fire	Unknown	Unknown	0	0	0	300,000	5,000
		17	10	Around Greek church	Burning cylinder	Exploding cylinde	Unknown	Unknown	0	0	0	1,000,000	5,000
	Total	4	-	-	Business shop Fire (2) Burning Cylinder (1) Kitchen Fire (1)	Kitchen Fire (1) Flamable liquid (1) Exploding cylinder (1) Electric Fire (1)	-	-	0	0	0	11,400,000	21,000

Year	Mo	D

	nth	t
2007	January	
	February	
	Total	

	April	1	2	Piassa Mulu gym	Residential Fire	Unknown	2 min	65 min	0	3	0	2,000,000	300,000
		23	6	Around Meles foundation, Abuware	Woodstack Fire	Unknown	Unknown	Unknown	0	0	0	600,000	10,000
	Total	2	-	-	Residential Fire (1) Woodstac Fire (1)	Unknown (2)	-	-	0	3	0	2,600,000	310,000
	May	1	7	Menelik hospital round about	Vehicle Fire	Electric Fire	Unknown	Unknown	0	0	0	1,500,000	10,000
		3	1	Inside Taytu hotel	Building Fire	Unknown	Unknown	Unknown	0	0	0	25,000,000	6,000,000
		6	7	Around Stanford school	Residential Fire	Kitchen Fire	6 min	40 min	0	0	0	1,000,000	50,000
		17	1	Infront of posta bet around Alema Garage	Residential Fire	Unknown	4 min	70 min	0	2	0	7,500,000	500,000
		19	7	Around Stanford school	Residential Fire	Unknown	3 min	23 min	0	0	0	80,000	1500
		22	1	Ery bekentu around addis dildey	Residential Fire	Unknown	4 min	44 min	0	1	0	1,500,000	35,000
	Total	6	-	-	Vehicle Fire (1) Residential Fire (4) Building Fire (1)	Kitchen Fire (1) Unknown (4) Electric Fire (1)	-	-	0	3	0	36,580,000	6,596,500
	June	7	3	Enkulal Fabereka Inside Aslaw cemetery	Wild Fire	Unknown	Unknown	Unknown	0	0	0	0	100,000
		9	11	Around Menen Police station	Residential Fire	Hot plate	4 min	60 min	0	0	0	2,000,000	60,000
		17	2	Infront of Ras Amru hospital	Residential Fire	Unknown	7 min	63 min	0	0	0	3,000,000	250,000
		28	10	Piassa Seraregna Sefer	Residential Fire	Unknown	3 min	35 min	0	0	0	2,500,000	50,000
	Total	4	-	-	Residential Fire (3) Wild Fire (1)	Hot plate (1) Unknown (3)	-	-	0	0	0	7,500,000	460,000
	July	2	6	Seba Derega Afencho ber exit	Vine caught on Fire	Unknown	Unknown	Unknown	0	0	0	0	100,000
		5	1	Infornt of America Gebe	Dumbster Fire	Unknown	Unknown	Unknown	0	0	0	0	100,000
		6	9	Behind Harambe hotel	Bamboo and Forest Fire	Unknown	Unknown	Unknown	0	0	0	2,000,000	900
		8	1	Around old Kera	Residential Fire	Unknown	4 min	39 min	0	0	0	2,000,000	2000
		20	2	Infront of Ras Amru hospital	Residential Fire	Unknown	5 min	21 min	0	0	0	2,000,000	5000
	Total	5	-	-	Residential Fire (2) Dumbster Fire (1) Bamboo and Forest Fire (1) Vine caught on Fire (1)	Unknown (5)	-	-	0	0	0	6,000,000	207,900
	Augu	30	4	Semen Mazegaja	Residential Fire	Unknown	5 min	30 min	0	0	0	50,000	4000
	Septe	-	-	-	-	-	-	-	-	-	-	-	-
	Octol	3	8	Around Gibe Gebrial	Residential Fire	Unknown	4min	85 min	0	1	0	4,000,000	700,000
		14	4	Zebegna sefer	Residential Fire	Electric Fire	4min	24 min	0	0	0	1,500,000	65,000
	Total	2	-	-	Residential Fire (2)	Electric Fire (1) Unknown (1)	-	-	0	1	0	5,500,000	765,000
	Nove	4	10	Doro Manekya	Business shop Fire	Exploding transfo	2 min	93 min	0	1	0	1,000,000	300,000
		28	1	Doro Manekya	Business shop Fire	Unknown	1 min	10 min	0	0	0	2,000,000	800
	Total	2	-	-	Business shop Fire (	Unknown (1) Exploding transformer (1)	-	-	0	1	0	3,000,000	300,800

	Dece	5	2	Behind Soramba hotel	Residential Fire	Hot plate	3 min	12 min	0	0	0	2,000,000	80,000
		12	5	Around Dejach wibea	Residential Fire	Unknown	2 min	50 min	0	0	0	1,000,000	20,000
		18	7	Around St. Mariam church	Business shop Fire	Candle Fire	4 min	80 min	0	0	4	1,500,000	60,000
		28	7	Past Ginfela around Queens' collage	Residential Fire	Unknown	5 min	18 min	0	0	0	500,000	50,000
		30	10	Around Police Garage	Residential Fire	Unknown	2 min	29 min	0	0	0	500,000	3,000
	Total	5	-	-	Residential Fire (4) Business shop Fire (1)	Unknown (3) Hot plate (1) Candle Fire (1)	-	-	0	0	4	5,500,000	213,000
Total	-	36	-	-	Residential Fire (19) Business Shop Fire (5) Vehicle Fire (2) Woodstack Fire (1) Dumbster Fire (1) Bamboo and Forest Fire (1) Office Fire (1) Burning cylinder (1) Vine caught on Fire (1) Mattress Fire (1) Kitchen Fire (1) Building Fire (1) Wild Fire (1)	Unknown (23) Electric Fire (5) Kitchen Fire (2) Hot plate (2) Flamable liquid (1) Candle Fire (1) Exploding transformer (1)	-	-	0	8	4	84,680,000	9,388,400
2008	Janua	4	10	Ery bekentu	Residential Fire	Unknown	2 min	20 min	0	0	0	1,000,000	20,000
		10	9	Inside the Betekehinet compound	Business shop Fire	Electric Fire	2 min	46 min	0	0	0	120,000	30,000
		16	6	Around Yekatit hospital area	Business shop Fire	Unknown	4 min	23 min	0	0	0	500,000	500
		22	1	Behind National Bureau of Stastics	Office Fire	Electric Fire	3 min	133 min	0	2	0	1,500,000	25,000
	Total	4	-	-	Residential Fire (1) Office Fire (1) Business shop Fire (2)	Unknown (2) Electric Fire (2)	-	-	0	2	0	3,120,000	75,500
	Febru	9	6	Behind Awash bakery	Business shop Fire	Unknown	4 min	160 min	0	0	0	2,000,000	35,000
		11	1	Around Atikilt tera	Business shop Fire	Unknown	2 min	44 min	0	0	0	2,000,000	30,000
		16	5	Gedam Neighbourhood	Business shop Fire	Electric Fire	1 min	27 min	0	0	0	1,000,000	200
	Total	3	-	-	Business shop Fire (	Unknown (2) Electric Fire (1)	-	-	0	0	0	5,000,000	65,200
	Marcl	-	-	-	-	-	-	-	-	-	-	-	-
	April	24	3	Infront of Ras Desta	Business shop Fire	Unknown	7 min	11 min	0	0	0	2,000,000	150,000
	May	7	1	Around Semit hotel	Vehicle Fire	Unknown	1 min	3 min	0	0	0	128,000	1000
	June	-	-	-	-	-	-	-	-	-	-	-	-
	July	3	5	Dejach Weba sefer	Residential Fire	Unknown	1 min	40 min	0	0	0	1,000,000	10,000
		4	1	Inside Olempia hotel	Business shop Fire	Unknown	2 min	85 min	0	0	0	4,000,000	200,000
		8	7	Around Kebena Shole	Vehicle Fire	Technical problen	4 min	20 min	0	0	0	800,000	5,000

		17	2	Around Erie bekentu bridge	Dumbster Fire	Unknown	2 min	13 min	0	0	0	7000	2000
		17	7	Semen Mazegaja on the junction that leads to Kechene	Vehicle Fire	Unknown	3 min	12 min	0	0	0	3,000,000	30,000
	Total	5	-	-	Vehicle Fire (2) Business shop Fire (1) Dumbster Fire (1) Residential Fire (1)	Unknown (4) Technical prblem (1)	-	-	0	0	0	8,807,000	247,000
	Augu	18	2	Italy neighbourhood around Red star school	Kitchen Fire	Cooking fire	5 min	44 min	0	0	0	50,000	2000
		28	8	4Kilo around Gebi Gebrial	Residential Fire	Unknown	5 min	68 min	0	0	0	1,200,000	40,000
	Total	2	-	-	Residential Fire (1) Kitchen Fire (1)	Unknown (1) Cooking Fire (1)	-	-	0	0	0	1,250,000	42,000
	Septe	14	5	Around Dejach Wibea	Kitchen Fire	Candle Fire	2 min	13 min	0	0	0	10,000	500
		18	3	Abora Koran Sefer	Warehouse Fire	Matrtess Fire	5 min	100 min	0	0	0	3,500,000	100,000
	Total	2	-	-	Kitchen Fire (1) Warehouse Fire (1)	Candle Fire (1) Matress Fire (1)	-	-	0	0	0	3,510,000	100,500
	Octol	22	4	Around Semen Mazegaja	Dumbster Fire	Unknown	3 min	25 min	0	0	0	1,000,000	0
		9	2	Around mega Anfie theather	Residential Fire	Unknown	4 min	60 min	0	0	0	8,000,000	50,000
	Total	2	-	-	Residential Fire (1) Dumbster Fire (1)	Unknown (2)	-	-	0	0	0	9,000,000	50,000
	Nove	-	-	-	-	-	-	-	-	-	-	-	-
	Dece	16	5	Yesufikad Building	Woodstack Fire	Deliberately start	2 min	20 min	0	0	0	200,000	500
Total	-	21	-	-	(7) Residential Fire (4) Vehicle Fire (3) Dumbster Fire (2) Kitchen Fire (2) Woodstack Fire (1) Office Fire (1) Warehouse Fire (1)	Electric Fire (3) Deliberately started (1) Candle Fire (1) Matress Fire (1) Technical Problem (1) Cooking fire (1)	-	-	0	2	0	33,015,000	731,700
2009	Janua	3	1	Piassa Arada building 2nd floor	Machine Fire	Electric Fire	2 min	20 min	0	0	0	200,000	14,000
		12	6	Next to Abware Ras Amba hotel	Business shop Fire	Transformer Fire	4 min	12 min	0	0	0	3,000,000	30,000
		17	2	Around Italy neighbourhood	Business shop Fire	Unknown	2 min	42 min	0	0	0	500,000	200
	Total	3	-	-	Business shop Fire (2) Machine Fire (1)	Transformer Fire (1) Electric Fire (1)	-	-	0	0	0	3,700,000	44,200
	Febru	8	10	Infront of Greek church	Business shop Fire	Electric Fire	1 min	7 min	0	0	0	1,000,000	1000
		13	5	Around Yohannes church	Business shop Fire	Machine Fire	3 min	10 min	0	0	0	2,000,000	20,000
		16	6	Infront of 6kilo tele	Residential Fire	Kitchen Fire	5 min	30 min	0	0	0	2,000,000	12,000
	Total	3	-	-	Residential Fire (1) Business shop Fire (2)	Kitchen Fire (1) Machine Fire (1) Kitchen Fire (1)	-	-	0	0	0	5,000,000	33000
	Marcl	3	8	Ery bekentu around the arogew kera	Wild Fire	Deliberately start	5 min	67 min	0	0	0	10,000	500
		4	5	Arada police station Gedam Sefer	Residential Fire	Oven Fire	2 min	20 min	0	0	0	50,000	2000
		17	5	Besu fekad building	Shop Fire	Unknown	2 min	56 min	0	0	0	150,000	10,000

		21	8	Infront of Sheraton Hotel	Tyer Fire	Dumbster Fire	4 min	50 min	0	0	0	3,000,000	10,000
		24	10	Piassa infront of Shole gas station	Shop Fire	Electric Fire	1 min	10 min	0	0	0	50,000	5000
		27	2	Gojam Berenda	Warehouse Fire	Electric Fire	3 min	60 min	0	0	0	6,800,000	20,000
		28	6	Inside Yekatit 22 hospital compound	Warehouse Fire	Unknown	3 min	45 min	0	0	0	2,000,000	70,000
	Total	7	-	-	Residential Fire (1) Shop Fire (2) Warehouse Fire (2) Wild Fire(1) Tyer Fire (1)	Unknown (2) Oven Fire (1) Deliberately started (1) Dumbster Fire	-	-	0	0	0	12,060,000	117500
	April	13	1	Around Post office headquarters	Business shop Fire	Unknown	4 min	112 min	0	0	0	2,000,000	500,000
		14		Around Habte Giyorges bridge	Residential Fire	Hot plate	3 min	82 min	0	0	0	3,000,000	150,000
	Total	2	-	-	Residential Fire (1) Business shop Fire	Unknown (1) Hot plate (1)	-	-	0	0	0	5,000,000	650,000
	May	3	3	Around Muslim cemetery	Wild Fire	Unknown	5 min	50 min	0	0	0	15,000,000	6000
		15	1	Around Maikelawi Stastics	Office Fire	Unknown	3 min	15 min	0	0	0	2,000,000	8000
		18	3	Muslim cemetery around Gulet	Wild Fire	Unknown	4 min	15 min	0	0	0	500,000	0
	Total	3	-	-	Office Fire (1) Wild Fire (2)	Unknown (3)	-	-	0	0	0	17,500,000	14000
	June	9	4	Around Kechene Chilot	Residential Fire	Kitchen Fire	5 min	40 min	0	0	0	2,500,000	18,000
		10	10	Behind Hager akef theater	Transformer Fire	Electric Fire	2 min	25 min	0	0	0	450,000	10,000
	Total	2	-	-	Residential Fire (1) Transformer Fire	Kitchen Fire (1) Electric Fire (1)	-	-	0	0	0	2,950,000	28,000
	July	-	-	-	-	-	-	-	-	-	-	-	-
	Augu	11	4	Behind Kelemewerk school	Vehicle Fire	Unknown	4 min	45 min	0	0	0	15,000,000	350,000
		20	1	Around Arada building	Business shop Fire	Unknown	2 min	38 min	0	0	0	2,000,000	60,000
		21	6	Infront of 5 Kilo park	Business shop Fire	Unknown	4 min	10 min	0	0	0	250,000	15,000
	Total	3	-	-	Vehicle Fire (1) Business shop Fire	Unknown (3)	-	-	0	0	0	17,250,000	425,000
	Septe	-	-	-	-	-	-	-	-	-	-	-	-
	Octol	8	4	Infront of Ethiopia news service building	Residential Fire	Unknown	3 min	30 min	0	0	0	1,500,000	6000
	Nove	4	4	Behind Alona academy	Residential Fire	Unknown	3 min	45 min	0	0	0	100,000	3000
	Dece	15	3	Electirc power station Ras desta branch office	Office Fire	Unknown	3 min	30 min	0	0	0	2,000,000	3000
		20	7	Around Stanford school	Factory Fire	Unknown	4 min	25 min	0	0	1	2,000,000	1000
	Total	2	-	-	Office Fire (1) Factory Fire (1)	Unknown (2)	-	-	0	0	1	4,000,000	4000
Total	-	27	-	-	(7) Residential Fire (6) Wild Fire (3) Office Fire (2) Shop Fire (2) Warehouse Fire (2) Vehicle Fire (1) Transformer Fire (1) Tyer Fire (1) Factory Fire (1)	Electric Fire (5) Kitchen Fire (2) Transformer Fire (1) Dumbster Fire (1) Oven Fire (1) Machine fire (1) Hot plate (1) Deliberately Started (1)	-	-	0	0	1	69,060,000	1,324,700

2010	Janua	5	9	4Kilo next to Wekema	Residential Fire	Unknown	3 min	60 min	0	0	0	10,000,000	300,000
	Febru	13	6	Around Tsegenesh Kitfobet	Residential Fire	Deliberately start	3 min	90 min	0	0	0	4,000,000	200,000
	Marcl	26	2	Around GC St. Merry school	Residential Fire	Unknown	5 min	80 min	0	0	0	200,000	10,000
	April	-	-	-	-	-	-	-	-	-	-	-	-
	May	18	3	Inside Muslim cemetery	Wild Fire	Unknown	5 min	180 min	0	0	0	6,000,000	15,000
	June	12	4	Shola behind Keleme work school	Residential Fire	Unknown	3 min	60 min	0	0	0	5,000,000	250,000
		24	4	Around Shola shower bar and restaurant	Hotel Fire	Electric Fire	3 min	30 min	0	0	0	5,000,000	30,000
	Total	2	-	-	Residential Fire (1) Hotel Fire (1)	Unknown (1) Electric Fire (1)	-	-	0	0	0	10,000,000	280,000
	July	-	-	-	-	-	-	-	-	-	-	-	-
	Augu	-	-	-	-	-	-	-	-	-	-	-	-
	Septe	-	-	-	-	-	-	-	-	-	-	-	-
	Octol	2	3	Around Enkulal Fabereka	Business shop Fire	Unknown	5 min	150 min	0	0	0	2,500,000	180,000
		26	4	Infront of Niewera School	Transformer Fire	Unknown	2 min	2 min	0	0	0	500,000	30,000
	Total	2	-	-	Business shop Fire (1) Transformer Fire (1)	Unknown (2)	-	-	0	0	0	3,000,000	210,000
	Nove	-	-	-	-	-	-	-	-	-	-	-	-
	Dece	15	3	Around Abet hospital	Business shop Fire	Unknown	4 min	40 min	0	0	0	2,000,000	50,000
		18	3	Around Egg factory	Residential Fire	Electric Fire	41 min	15 min	0	0	0	1,000,000	70,000
	Total	2	-	-	Residential Fire (1) Buisness shop fire (1)	Unknown (1) Electric Fire (1)	-	-	0	0	0	3,000,000	120,000
Total	-	10	-	-	Residential Fire (5) Business shop Fire (2) Wild Fire (1) Hotel Fire (1) Transformer Fire (1)	Unknown (7) Electric Fire (2) Deliberately started (1)	-	-	0	0	0	36,200,000	1,135,000
2011	Janua	16	1	Around Mehamud music shop	Residential Fire and Warehouse Fire	Unknown	3 min	180 min	0	0	0	110,000,000	1,500,000
	Febru	2	3	Site Sefer	Wood Workshop Fir	Unknown	5 min	30 min	0	0	0	2,000,000	30,000
		28	8	Behind Abware gulit	Shop Fire	Unknown	6 min	50 min	0	1	0	5,000,000	75,000
	Total	2	-	-	Wood Workshop Fire (1) Shop Fire (1) Residential Fire	Unknown (2)	-	-	0	1	0	7,000,000	105,000
	Marcl	1	4	Aroun Sarem hotel	Residential Fire	Electric Fire	4 min	40 min	0	1	0	500,000	50,000
		9	2	Sebara Babur	Shop Fire	Unknown	3 min	70 min	0	0	0	4,000,000	200,000
		25	3	Abebech Gobena industry	Factory Fire	Electric Fire	6 min	45 min	0	0	0	10,000,000	650,000
	Total	3	-	-	Residential Fire (1) Factory Fire (1) Shop Fire (1)	Electric Fire (2) Unknown (1)	-	-	0	1	0	14,500,000	900,000
	April	1	8	Around Kebena roundabout	Vehicle Fire	Unknown	6 min	20 min	0	0	0	12,000,000	50,000
		10	10	Eras Mekonnen Bridge	Shop Fire	Electric Fire	1 min	2 min	0	0	0	500,000	10,000

		18	1	Tewdros Roundabout Enfi Wafi cinema	Cinema Fire	Welding accident	3 min	68 min	0	0	0	1,500,000	50,000
		19	1	Around John F. Kennedy school	Residential Fire	Unknown	3 min	50 min	0	0	0	2,000,000	18,000
	Total	4	-	-	Residential Fire (1) Shop Fire (1) Vehicle Fire (1) Cinema Fire (1)	Unknown (2) Welding accidnet (1) Electric Fire (1)	-	-	0	0	0	16,000,000	128,000
	May	24	8	Under Erie bekentu Bridge	Bamboo Fire	Unknown	2 min	120 min	0	0	0	50,000	10,000
		28	9	Infront of St. Mariam church	Residential Fire	Electric Fire	4 min	21 min	0	0	0	3,000,000	400,000
	Total	2	-	-	Bamboo Fire (1) Residential Fire (1)	Unknown (1) Electric Fire (1)	-	-	0	0	0	3,050,000	410,000
	June	16	6	Around Eras Mekonnen Bridge	Dumbster Fire	Unknown	2 min	30 min	0	0	0	0	0
		17	6	AAiT	Tyer Fire	Unknown	4 min	28 min	0	0	0	15,000,000	0
		27	9	Inside Birehan and selam textiles factory compound	Office Fire	Electric Fire	1 min	10 min	0	0	0	3,000,000	40,000
	Total	3	-	-	Office Fire (1) Dumbster Fire (1) Tyer Fire (1)	Unknown (2) Electric Fire (1)	-	-	0	0	0	18,000,000	40,000
	July	7	6	Around St. Mariam neighborhood	Residential Fire	Unknown	3 min	66 min	0	0	0	300,000	250,000
		14	6	Around St. Mary communal homes neighbourhood	Hay pile caught on Fire	Unknown	3 min	34 min	0	0	0	10,000,000	5000
		14	2	Abekren neighborhood	Residential Fire	Unknown	3 min	79 min	0	1	0	2,000,000	75,000
	Total	3	-	-	Residential Fire (2) Hay pile on Fire (1)	Unknown (3)	-	-	0	1	0	12,300,000	330,000
	Augu	27	2	Meskel flower		Electric Fire	2 min	19 min	0	0	0	1,500,000	30,000
	Septe	1	6	5 kilo around the Court house	Kitchen Fire	Unknown	3 min	22 min	0	0	0	4,500,000	35,000
		9	3	Ras Desta, Around Alkan medical collage	Residential Fire	Unknown	3 min	20 min	0	0	0	3,515,000	505,000
		26	10	Arada police station around Oilibya gas station	Business shop Fire	Unknown	2 min	210 min	0	0	0	100,000,000	2,000,000
	Total	3	-	-	Residential Fire (1) Kitchen Fire (1) Business shop Fire (1) Shop fire (1)	Electric fire (1) Unknown (3)	-	-	0	0	0	108,015,000	2,540,000
	Octob	10	10	Infront of the Fire station	Gas station Fire	Lit cigarette	1 min	35 min	0	0	0	20,000,000	10,000
		12	1	Around Abune Petros roundabout	Dumbster Fire	Unknown	2 min	35 min	0	0	0	0	0
		18	5	Next to Awale School	Vehicle Fire	Unknown	2 min	10 min	0	0	0	5,000,000	5000
	Total	3	-	-	Gas station Fire (1) Dumbster Fire (1) Vehicle Fire (1)	Lit cigarette (1) Unknown (2)	-	-	0	0	0	25,000,000	15,000
	Nove	2	7	Around Kebena Medhaniyalem	Residential Fire	Unknown	4 min	60 min	0	0	0	500,000	5000
		7	10	Around Doro Manekya	Butchershop Fire	Unknown	2 min	26 min	0	0	0	40,000,000	50,000

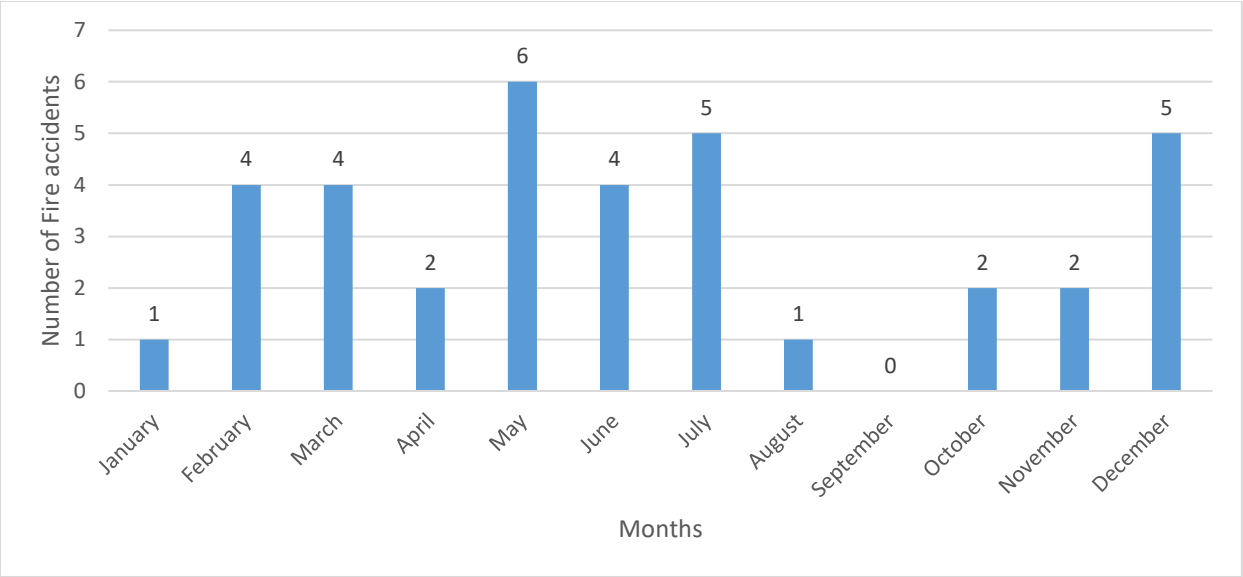
		8	6	Around St. Mary church	Kitchen Fire	Unknown	5 min	38 min	0	0	0	200,000	5000
		18	9	St. Mariam Church Next to Alme Building	Residential Fire	Unknown	3 min	20 min	0	0	0	3,000,000	400,000
	Total	4	-	-	Residential Fire (2) Kitchen Fire (1) Butchershop Fire (1)	Unknown (4)	-	-	0	0	0	43,700,000	460,000
	Dece	16	7	Jal Meda Around andegna police station	Business shop Fire	Electric Fire	4 min	60 min	0	0	0	1,200,000	40,000
		27	2	Infront of 4 Menta Hagbasa School	Warehouse Fire	Unknown	4 min	335 min	0	0	0	12,500,000	4,500,000
		30	5	Around Sebara babur	Vehicle Fire	Unknown	4 min	34 min	0	0	0	5,000,000	200,000
	Total	3	-	-	Vehicle Fire (1) Business shop Fire (1) Warehouse Fire (1)	Unknown (2) Electirc Fire (1)	-	-	0	0	0	18,700,000	4,740,000
Total	-	32	-	-	Residential Fire (8) Shop Fire (4) Vehicle Fire (3) Business shop Fire (2) Dumbster Fire (2) Warehouse Fire (2) Kitchen Fire (2) Hay pile on Fire (1) Factory Fire (1) Gas station Fire (1) Tyer Fire (1) Butchershop Fire (1) Bamboo Fire (1) Office Fire (1) Cinema Fire (1)	Unknown (23) Electric Fire(7) Welding accident (1) Lit cigarette (1)	-	-	0	3	0	377,765,000	11,198,000
2012	Janua	-	-	-	-	-	-	-	-	-	-	-	-
	Febru	-	-	-	-	-	-	-	-	-	-	-	-
	Marcl	-	-	-	-	-	-	-	-	-	-	-	-
	April	-	-	-	-	-	-	-	-	-	-	-	-
	May	6	10	Next to Piassa gas station	Business shop Fire	Unknown	2 min	26 min	0	0	0	4,000,000	200,000
		15	2	Inside Kurtu building	Building Fire	Unknown	2 min	45 min	0	0	0	10,000,000	50,000
		23	10	Around Doro Manekya	Shop Fire	Unknown	2 min	21 min	0	0	0	1,000,000	10,000
	Total	3	-	-	Business shop Fire (1) Shop Fire (1) Building Fire (1)	Unknown (3)	-	-	0	0	0	15,000,000	260,000
	June	24	6	Aware, around Woman roundabout	Residential Fire	Unknown	5 min	72 min	0	1	0	38,000,000	75,000
	July	12	9	4 kilo, Around Bash Welde	Office Fire	Unknown	2 min	42 min	0	0	0	2,000,000	200,000
	Augu	9	9	In front of Transu Hotel	Residential Fire	Unknown	32 min	38 min	0	0	0	10,000,000	10,000
Total	-	6	-	-	Office Fire (1) Building Fire (1) Shop fire (1) Business shop Fire (1)	Unknown (6)	-	-	0	1	0	65,000,000	545,000

			Residential fire (44) Business shop Fire (24) Vehicle Fire (9) Shop Fire (7) Office Fire (6) Dumbster Fire (5) Wild Fire (5) Kitchen Fire (5) Warehouse Fire (4) Woodstack Fire (2) Building Fire (2) Transformer Fire (2) Tire Fire (2) Factory Fire (2)									
Grand	-	132	-	Burning Cylinder (1) Vine caught on Fire (1) Matress Fire (1) Machine Fire (1) Bamboo Fire (1) Gas-station Fire (1) Butchershop Fire (1) Hay Pile on Fire (1) Bamboo and Forest Fire (1) Cinema Fire (1) Hotel Fire (1) Woodworkshop Fire (1) Residential and Warehouse Fire (1)	Unknown (86) Electric Fire (22) Kitchen Fire (4) Hot plate (3) Deliberately Started (3) Candle Fire (2) Exploding transformer (1) Matress Fire (1) Technical problem (1) Cooking Fire (1) Transformer Fire (1) Dumbster Fire (1) Oven Fire (1) Machine Fire (1) Flamable liquid (1)	-	-	0	14	5	665,720,000	24,322,800

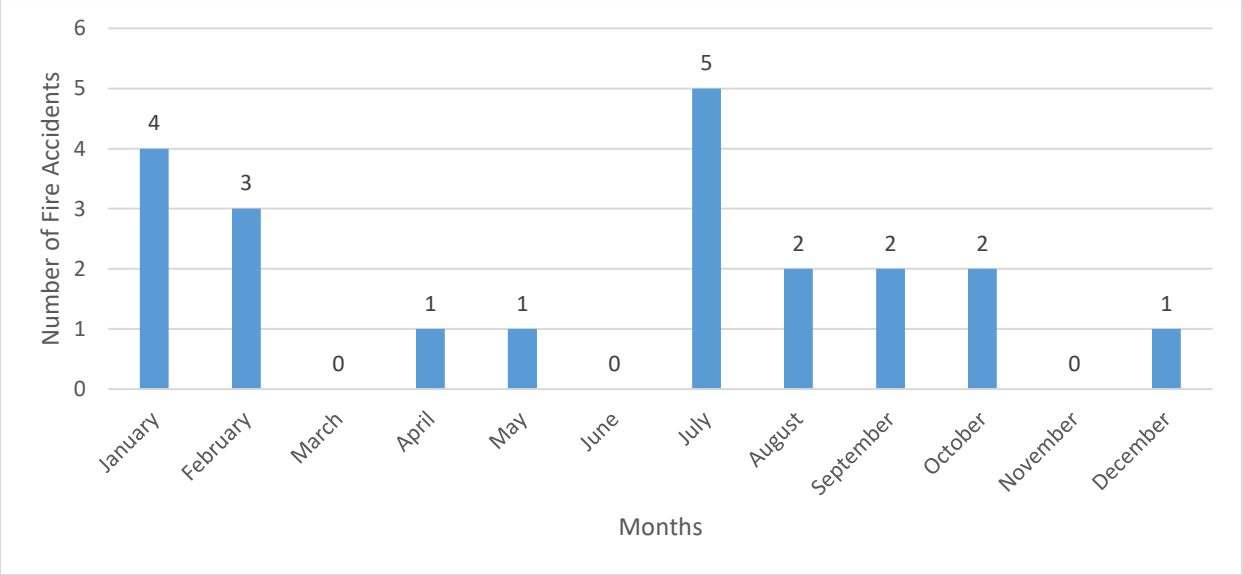
Annex II: Fires from 2015-2020

The charts below are adapted from the secondary analysis conducted by the researcher from secondary data provided by the Fire and Disaster Risk Management Commission (FDRMC). The data presented spans the registered urban fires of the Arada sub-city from the year 2015-2020. These charts show the reported fires in the Arada sub-city year by year. A summary chart of these charts is in the study.

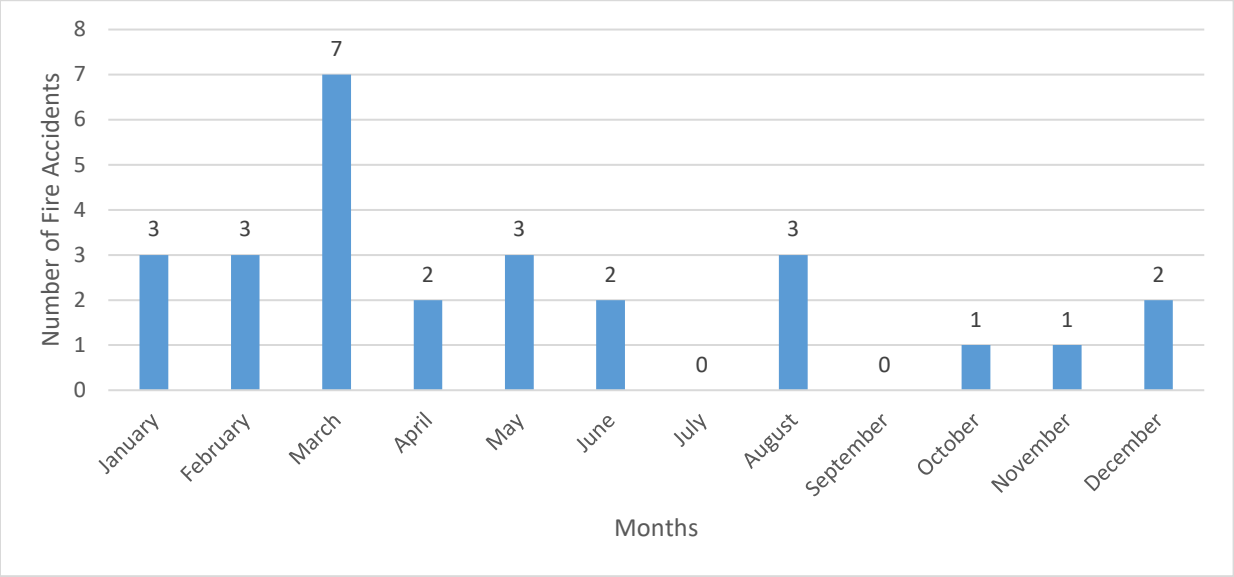
- 2015



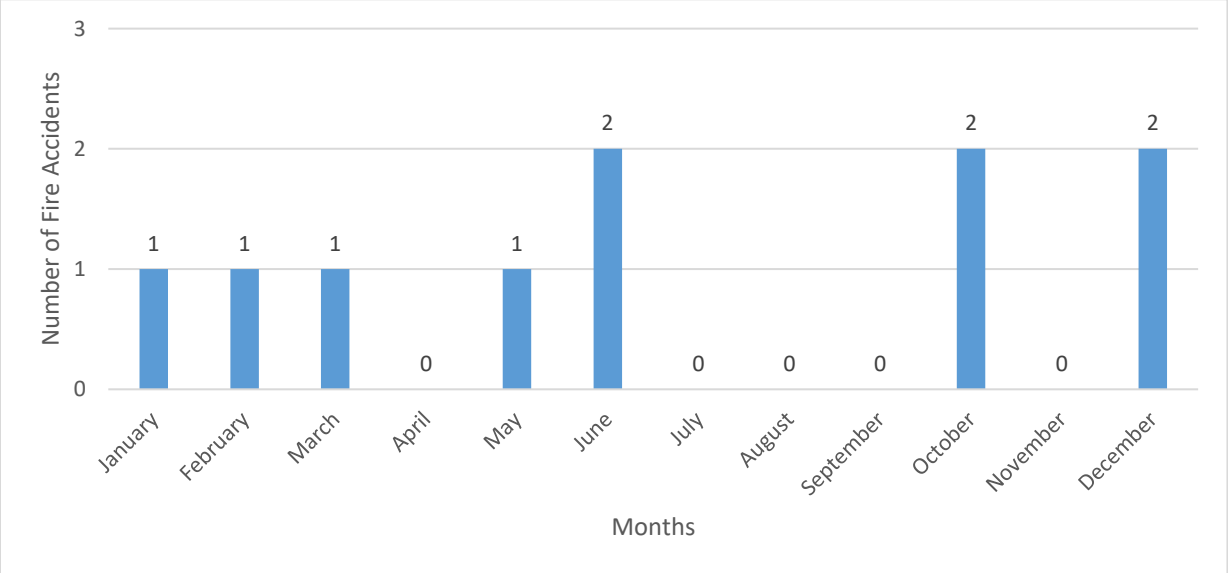
- 2016



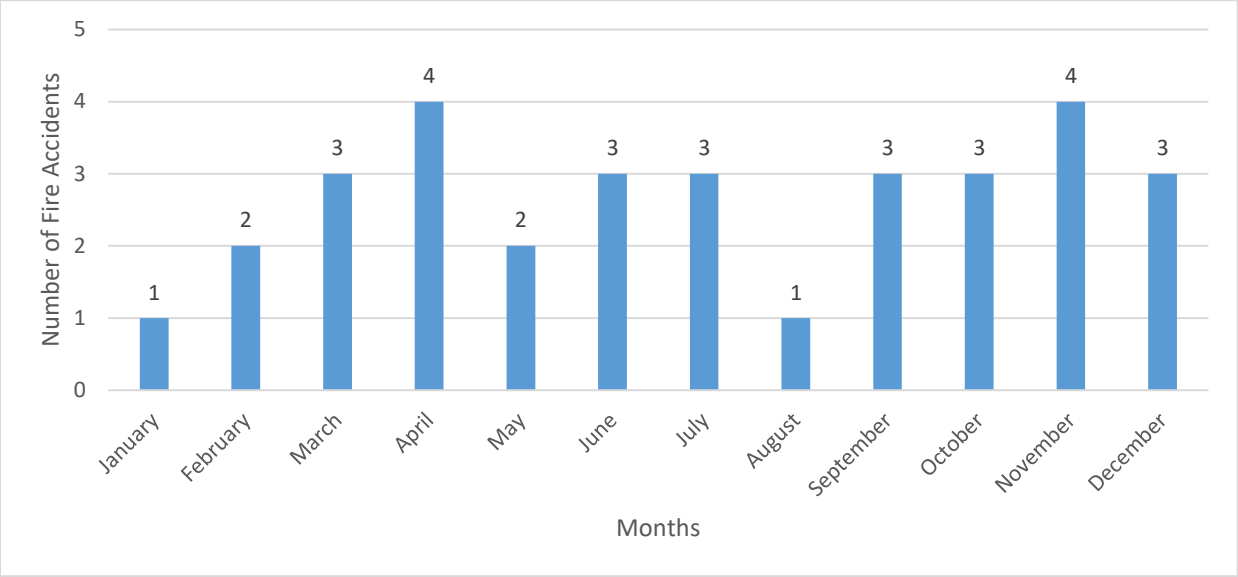
❖ 2017


Number of Fire Accidents
8
7
6
5
4
3
2
1
0
3
3
7
2
3
2
0
3
0
1
1
2
January
February
March
April
May
June
July
August
September
October
November
December
Months

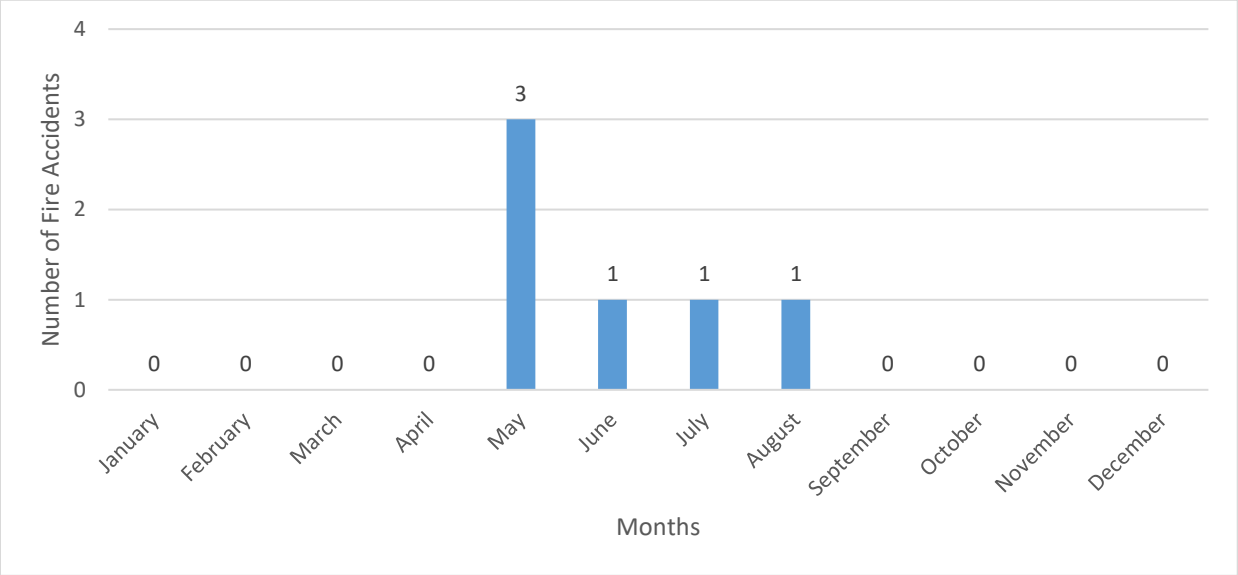
❖ 2018


Number of Fire Accidents
3
2
1
0
1
1
1
0
1
2
0
0
0
2
0
2
January
February
March
April
May
June
July
August
September
October
November
December
Months

❖ 2019


Number of Fire Accidents
0
1
2
3
4
5
1
2
3
4
2
3
3
1
3
3
4
3
January
February
March
April
May
June
July
August
September
October
November
December
Months

❖ 2020


Number of Fire Accidents
0
1
2
3
4
0
0
0
0
3
1
1
1
0
0
0
0
January
February
March
April
May
June
July
August
September
October
November
December
Months

Annex III: KII guide I

This Key Informant In-depth Interview (KII) guide was used to gather data from identified stakeholders relevant to the study topic. These stakeholders included: representatives of the FDRMC (Director of Fire Prevention Research and implementation, the Assistant Director of Fire Prevention Research and implementation and the Fire Chief), the Arada sub-city fire station (the General Director, the Emergency Dispatcher, and the Medical Dispatcher), the Arada sub-city police department (the Head of Investigations and 2 police officers), and the Arada sub-city administration (the Head of Communications, and the Head of Land Administration).

Addis Ababa University

School of Graduate Studies

This Key Informant In-depth Interview Guide has been prepared to gather data for the Masters' Thesis prepared by Yemesrach Yichilal Fenta entitled *Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City* to be submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development)

All participants of this study should be aware that the data collected from the interviews would be fulfilling the purpose stated above and nothing else. Participation in the study will not be rewarded with any kind of compensation financial or otherwise. Participants can be assured that their responses would be studied and analyzed only by the researcher and any reports made from the data they provide would maintain their anonymity and confidentiality.

Part I: Background Information

1. What is your occupation (Job Title)?
2. What is your educational qualification?
3. How many years have you worked with/for the Fire and Disaster Risk Management Commission (FDRMC)?

Part II: Detailed Information

1. How do you find the operations of the FDRMC?
2. What are the most prevalent fire risks in the Sub-city? Manmade fire risks?
3. What kinds of houses are more vulnerable to fire accidents?
4. Do you think population density both in the sub-city and per household has any effect on fire accident frequency?
5. Do you think your services are advertised properly?

6. What is the resilience capacity of the Sub-city in the face of any crisis?
7. What is the resilience capacity of the Arada Sub-city in the face of an urban fire caused by a Technological Hazard?
8. What are the preemptive measures taken by the FDRMC to identify and reduce fire risks?
9. What is the protocol for responding to a fire accident?
10. What are the measures taken to help the constituents of the sub-city once a fire has been put out, both short term and long term?
11. Describe the households, which are generally more resilient in the face of a fire accident?
12. What are the common coping practices of the households of the sub-city in case of a fire?
13. Do you think traditional coping practices like joining an *Idir* or *Equib* have an impact?
14. Do you think modern coping practices like acquiring insurance work?
15. What efforts are being made by the FDRMC to improve its services to the city?
16. What are the most notable challenges faced by the FDRMC?
17. What improvements do you think should be made by the FDRMC?
18. Do you believe that the practices of the FDRMC reflect the mandate of the National Policy and Strategy on Disaster Risk Management issued in 2013?
19. Do you or your agency work with other public administrators?
20. Is there anything you would like to add?

Thank you for your time

Annex IV: KII guide II

This Key Informant In-depth Interview (KIII) guide was used to gather data from 10*Idir* leaders within the Arada Sub-city on behalf of households within the 10 *Woredas*.

Addis Ababa University

School of Graduate Studies

This Key Informant In-depth Interview Guide has been prepared to gather data for the Masters' Thesis prepared by Yemesrach Yichilal Fenta entitled *Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City* to be submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development)

All participants of this study should be aware that the data collected from the interviews would be fulfilling the purpose stated above and nothing else. Participation in the study will not be rewarded with any kind of compensation financial or otherwise. Participants can be assured that their responses would be studied and analyzed only by the researcher and any reports made from the data they provide would maintain their anonymity and confidentiality.

Part I: Background Information

1. When was your *Idir* group formed?
2. How long have you been in charge?
3. How many members does it have?
4. What are the monthly fees?

Part II: Detailed Information

5. Do you work with other *Idir* or *Equib* groups?
6. Do you work with insurance companies?
7. Do you work with the police?
8. Do you work with volunteer groups or NGOs?
9. Do you work with the FDRMC or Firefighters?
10. What is the most common claim for compensation?
11. What is the highest and lowest amount paid for fire damages to members?
12. How many fire damage claims have you received and compensated in the last five years? What is the most common cause of the fire?
13. Is the compensation offered by the *Idir* enough to rebuild?
14. Are there parts of the *Woreda* that are more vulnerable to fires than most?

15. What efforts have been made to raise fire safety awareness?
16. Are there any disputed claims? If so, how do you resolve them?
17. Do you have anything to add?

Thank you for your time

Annex V: KII guide III

This Key Informant In-depth Interview (KIII) guide was used to gather data from the National Insurance Company (Ethiopian Insurance Corporation) which covers households within Arada Sub-city.

Addis Ababa University

School of Graduate Studies

This Key Informant In-depth Interview Guide has been prepared to gather data for the Masters' Thesis prepared by Yemesrach Yichilal Fenta entitled *Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City* to be submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development) All participants of this study should be aware that the data collected from the interviews would be fulfilling the purpose stated above and nothing else. Participation in the study will not be rewarded with any kind of compensation financial or otherwise. Participants can be assured that their responses would be studied and analyzed only by the researcher and any reports made from the data they provide would maintain their anonymity and confidentiality.

Part I: Background Information

1. When was your Insurance Company established?
2. What services do you provide?
3. How do you advertise your services?
4. What is the most common reason for getting home insurance?

Part II: Detailed Information

5. Is there a minimum or maximum amount to the coverage that you provide?
6. Do you work with the police?
7. Do you work with the FDRMC or Firefighters?
8. Do you work with *Idir* or *Equib* groups? Other local organizations?
9. What is the most common claim for compensation?
10. What is the highest and lowest amount paid for fire damages to homeowner clients?
11. Is the compensation offered by the company enough to rebuild?
12. How many fire damage claims have you received and compensated in the last five years in Arada Sub-city? What is the most common cause of fire there?
13. Have do you investigate fire accidents in homes?

14. Have there been any cases of arson in the Arada Sub-city?

15. Are there any disputed claims? If so, how do you resolve them?

16. Do you have anything to add?

Thank you for your time

Annex VI: FGD guide

This Focus Group Discussion (FGD) guide was used to gather data from fire-fighters employed at Arada fire station as they had information relevant to the study topic. Due to the outbreak of the pandemic Coronavirus (COVID-19), and the strict measures taken to combat it such as social distancing, the researcher was only able to conduct one FGD with high-ranking fire-fighters within the Arada fire station.

Personal Observations

1. How many participants are male and how many participants are female?
2. How long have the firefighters worked at the Arada fire station or any other fire station?

Addis Ababa University

School of Graduate Studies

This Focus Group Discussion Guide has been prepared to gather data for the Masters' Thesis prepared by Yemesrach Yichilal Fenta entitled *Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City* to be submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development)

All participants of this study should be aware that the data collected from the discussions would be fulfilling the purpose stated above and nothing else. Participation in the study will not be rewarded with any kind of compensation financial or otherwise. Participants can be assured that their responses would be studied and analyzed only by the researcher and any reports made from the data they provide would maintain their anonymity and confidentiality.

Part I: Ground Rules

- The most important rule is that only one person speaks at a time. There may be a temptation to jump in when someone is talking but please wait.
- There are no right or wrong answers
- You do not have to speak in any particular order
- When you do have something to say, please do so.
- You do not have to agree with the views of other people in the group
- Does anyone have any questions?
- OK, let's begin

Part II: Discussion

1. How do you find the operations of the FDRMC?
2. Do you feel safe in your chosen profession with all its risks, responsibilities, and benefits?
3. What are the most prevalent fire risks in the Arada sub-city and what causes them?
4. What is the protocol for responding to a fire accident?
5. What are the inter-linkage and responsibilities of firefighters, Emergency Medical Services (EMS), and police officers?
6. What are the measures to help the constituents of the sub-city before, during, and after a fire both short-term and long-term?
7. What are the most notable challenges faced by the FDRMC?
8. What improvements should be made by the FDRMC and in your fire station?
9. What are the most common coping practices of the households of the sub-city in case of a fire?
10. How does people's ability to cope with fires contribute to the overall resilience of the sub-city?
11. Is there anything you would like to add?

Thank you for your time

Annex VII: Checklist

The following list of questions was used for gathering data from the personal observations of the researcher regarding urban fire risks due to manmade/technological hazards. The results of the checklist have been incorporated into the thematic analysis of the qualitative data.

Addis Ababa University

School of Graduate Studies

This Field Observation Checklist has been prepared to gather data for the Masters' Thesis prepared by Yemesrach Yichilal Fenta entitled *Urban Fire Resilience in Addis Ababa: A Case Study in Arada Sub-City* to be submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Development Studies (Environment and Sustainable Development). The data collected from the Checklist would be fulfilling the purpose stated above and nothing else.

1. Number of phone lines available for the Arada fire station: ____3_____
2. Number of fire trucks available at the Arada fire station: _____3_____
3. Number of fire trucks available per shift at the Arada fire station: ____3_____
4. Number of ambulances available at the Arada fire station: _____3_____
5. Number of ambulances available per shift at the Arada fire station: ____3_____
6. Number of fire fighters available at the Arada fire station: _____92_____
7. Number of fire fighters available per shift at the Arada fire station: ____28_____
8. Number of EMS available at the Arada fire station: _____9_____
9. Number of EMS available per shift at the Arada fire station: ____3_____
10. Number of fire hydrants in Arada Sub-city: ___27_____
11. Number of functional fire hydrants in Arada Sub-city:____26_____