UNIVERSITY OF NAIROBI

SCHOOL OF BUILT ENVIRONMENT

INFLUENCE OF FIRE DISASTERS ON MITIGATION AND PREPAREDNESS IN COMMERCIAL PREMISES IN KENYA; A SURVEY STUDY OF KISUMU CBD

OGAJO NICHOLAS JAMES

B.A. (Econ) (Hons) (Egerton)

B42/82078/2012

RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF POSTGRADUATE DIPLOMA IN HOUSING ADMINISTRATION IN THE DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT, SCHOOL OF BUILT ENVIRONMENT IN THE UNIVERSITY OF NAIROBI.

OCTOBER, 2013

DECLARATION

This Research Project is my original work and has not been presented for a Degree or Diploma in any other University

Name: Ogajo, Nicholas James

Signature: _____ Date: _____

Registration No. B42/82078/2012

Approval

This Research project has been submitted for examination with my approval as university supervisor.

Name: Dr. Luke Obala, PHD

Signature: _____ Date: _____

Lecturer

Department of Real Estate and Construction Management

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ABSTRACT

Fire has been quite critical in the daily life of mankind from time immemorial. Traditionally fire was used in landscape modification such as coppicing basket materials, clearing bush for ease of travel and hunting, removing thatch in late fall to promote wildflower seeds, clearing ground for food gathering as well as general burning to revitalize plant communities for greater abundance. Fire has also been previously used for cooking, steam bending wood, hunting, smoking hides and meat to preserve, softening tar and pitch for adhesive, heat treating stones for tools, wood working, charcoal burning, charring to preserve house posts from insects and rot, smudge fires to repel mosquitoes, fire to repel predators, heating shelters, lighting, smoking tobacco and medicines, cauterizing wounds, communication signaling, steaming and during ceremonies. Fire is today considered as being a significant tool for humans by playing the most important roles in daily lives including heating, lighting, cooking, energy, blacksmithing and landscaping.

Kenya as a developing country is characterized by increasing industrial and urban growth leading to greater use of materials and energy. These industrial products trigger fires through scientific processes hence triggering fire cases. Several cases of fires have occurred with mostly destruction of property and loss of lives being reported. Urban disasters especially fires have tended to receive a baffling lack of response from aid agencies indicating major gaps in urban preparedness. This shows Kenya is faced with inadequacy in responding to fire disasters of high magnitude. Rescue teams have failed in many of this occasions to live up to their billing by either arriving late at tragedy struck scenes or making it on time but half equipped hence failing to counter the tragedy.

Chapter one has outlined the problem in that fires have frequently occurred in different commercial buildings leading to several deaths and destruction of property hence raising questions as to occupants' safety.

Chapter two reviews literature related to fire safety in terms of prevention, mitigation and preparedness and the essentials of these in commercial buildings. These were obtained from books, journals, newspaper supplements, internet and online databases.

Chapter three presents Research methodology which will be through questionnaires, interviews and observations. This will fulfill the researchers aim to raise awareness as to fire safety problems relating to commercial buildings.

Chapter Four presents the results of the study which have been discussed under thematic sub- sections in line with research objectives. The themes include; assessing fire Safety measures adopted by owners of buildings, assessing level of preparedness among the occupants in the buildings, assessing the level of preparedness of local authorities and providing recommendations on Mitigation measures to improve on Fire Safety in the buildings. The most important findings are that most buildings lack enough fire equipment, most owners/managers/occupiers and local authorities are ill prepared to handle fire emergencies, and that education of all stakeholders will play a vital role in improving fire safety.

Chapter Five presents the summary of findings, conclusions and recommendations for the study. It was established that adequate fire safety measures are not in place and therefore ought to be established. It recommends that owners and property managers should involve fire experts in fire safety, inspection of the firefighting infrastructure, and enhancing Fire safety measures and programmes. Areas for further research are also suggested including compliance level or aspect of building owners and property managers to the relevant fire by laws, effect of design on preparedness and mitigation measures adopted by owners and property managers and fire preparedness and mitigation in residential buildings where most fires occur.

ACKNOWLEDGEMENT

DEDICATION

I wish to dedicate this Research Project to my beloved family, Wife Mariam and child Nicole for they were my source of inspiration.

LIST OF ABBREVIATIONS

CBD	Central Business District
NWCG	National Wildlife Coordinating Group
NDOC	National Disaster Operations Centre
ARLMP	Arid Lands Resource Management Project
NEMA	National Environment Management Authority
NGO	Non-governmental Organisation
IGAD	Intergovernmental Authority on Development
UN	United Nations
OSHA	Occupational Safety and Health Act, 2007
NFPA	National Fire Protection Association, USA
USA	United States of America
CO_2	Carbon Dioxide
Ft	Feet

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CHAPTER ONE

INTRODUCTION

1.1 Study Background

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion releasing heat, light and various reactive products (Pyne, 1982). Fires start in three main ways i.e. accidents (misuse of appliances), deliberate ignition and equipment failure (electrical malfunction) and produce smoke and toxic gases which could be extremely fatal to those exposed to it hence the need for prevention and protection from spreading fires by for instance delaying ignition period to allow people more time to escape and for the fire brigade to arrive at the incident. Fire can make homes unsafe. It can lead to the collapse of houses, loss of property or even death (Supermedia, 2011). Nairobi's industrial area for instance suffered massive losses due to electric failures in November, 2012 after a Kenya power substation caught fire forcing the company resort to rationing (Muchira, 2012).

Several cases of fire incidences have previously occurred in Kenya with most of them having been fatal. The cases include the 2009 fires in Nakumatt Downtown in Nairobi on 28th January 2009, Sachanguan in Molo District on 31st January, 2009, Bombolulu High School fire, Matayos petrol tanker fires in 2009, fires in Muthurua slums and the 2006 Fire incident at Elburgon where 7 members of the family burned beyond recognition and the Fire incident at Libra House in Nairobi where 11 workers died and three remained missing (unidentified bodies) the same year. Prior incidences listed also involved the 2005 Wild fire in Rift Valley (which caused Extensive environmental and ecological damage though no human life was lost), the 2004 Fire at the City Hall, Nairobi where the entire 3rd floor and valuable documents and property worth KShs.70 million were destroyed, the 2001 Fire at Kyanguli Boys (Machakos) where 68 students burnt to death and property destroyed, the 2001 Fire at Free Market (Uhuru Park– Nairobi) where the entire market and property was destroyed by fire, the 1998 Petrol Tanker explosion along Kisumu/Busia road where 36 people died, the 1990 Fire at Lamu where 20 people died, the 1982 Fire at Nairobi where 10,000 people were affected and the 1982 Fire at Lamu where 4,000 people were affected amongst others (Republic of Kenya, 2009).

Several fire occurrences have since been reported in Kenya such as the Sinai slums where over 100 people died and between January-March 2011 where an estimated population of 25,000 people was left homeless from what was perceived slow response from authorities and agencies. It was observed that urban fire disasters receive a baffling lack of response from aid agencies whenever it occurs indicating major gaps in urban preparedness (UN Habitat, 2011). This shows that Kenya is faced with inadequacy in responding to fire disasters of high magnitude. Rescue teams have failed in many of the occasions to live up to their billing by either arriving late at tragedy struck scenes or making it on time but half equipped hence failing to counter the tragedy. In most cases failure to have a comprehensive disaster policy had made responses to high risk events such as fire, floods, drought, epidemics and accidents slow or poorly co-ordinated and unnecessarily expensive that even at some point leading to more problems (Kigunda, 2012).

1.1.1 Area of Study

Kisumu is the third largest city in Kenya after Nairobi and Mombasa and the principal city of western Kenya. It is the immediate former capital of Nyanza Province and the headquarters of Kisumu County. It is one of the three cities in Kenya created under the Urban Areas and Cities Act, 2011. It is the largest city in Nyanza region and second most important city after Kampala in the greater Lake Victoria basin. Kisumu means a place of barter trade "sumo" in the local Luo dialect. It is a port city in western Kenya at 1,131 m (3,711 ft), with a population of 394,684 (2009 census). It lies on latitude -0, 1000 (06'0.000"S) and a longitude of 34, 7500 (3445'0.000"E). The Kisumu port was founded in 1901 as the main inland terminal of the Uganda Railway and named Port Florence. Although trade stagnated in the 1980s and 1990s, it is again growing around oil exports (Anyumba, 1990). The location of Kisumu on the National perspective is shown in figure 1.1 below;

Fig 1.1 Location of Kisumu on National Map

Source: Draft Kisumu County Integrated Development Plan

Kisumu CBD lies in Kisumu East District, Winam Division which has an area of 395km² with a population density of 1000 persons per km². The Housing sector is vibrant in Kisumu with the Public sector having implemented 93 housing projects in the plan period 2002-2008. The private sector has equally put up more housing programmes in the city both residential and commercial. Disaster management is thus gaining momentum in the city. Several accidents identified as susceptible to people in the city have been classified as road, railway, water, air and fir accidents. The government has therefore recommended equipping buildings, vehicles, trains and lake vessels with firefighting equipment to avert fire accidents. The challenge has however been lack of vehicles and inadequate trained personnel to handle emergencies (Republic of Kenya, 2008).

Though Kisumu CBD has not encountered much of fire outbreaks that have occurred in other places it is imperative that they have adequate preventive and mitigation measures in place just in case they are caught up unawares. Some of the worst nearby fires that have occurred include fires from the petrol tanker along Kisumu-Busia highway in 1998 (Republic of Kenya, 2009).

Kisumu Municipal Council has a fully charged City Engineers Department which is charged among others with ensuring all buildings within the municipality conform to the building standards and safety measures are in place. They have set themselves 30 minutes of response to any disaster and/or fire outbreaks. Among fire safety measures the municipal council targets achieving include fire inspections, installation of fire extinguishers in the Town hall and the inspection of buildings within the municipality fire brigades (City Council of Kisumu, 2012).

1.2 Statement of the Problem

Fires are known to be crucial in peoples' lives and have been used mainly for cooking, lighting and heating. Fires have also been known to be dangerous in man's life. Several properties in Kenya worth millions of shillings have been destroyed to irrecoverable states and lives lost due to outbreak of fires. Since it is difficult to predict fire outbreaks, mitigation is essential to reducing the loss of homes, property and resources especially in the urban interface. Communication, planning processes, tactics and materials development is critical in dealing with incidences of fire occurrences. Frameworks for mitigation should be put in place in order to reduce hazard exposure. Fire prevention is also important in fire management and it requires identification of fire hazards, regular inspections, appropriate signage, education and training as well as assigned roles and qualifications. Every building owners need to put in place fire prevention plan measures to guard against any future eventuality (Pyne, 1982).

A fire disaster preparedness plan ranges from a broad mitigation and preparedness strategy to a detailed contingency plan for responding to the fire hazard. In most plans, the operational priorities need to save human life, meet people's emergency needs (principally medical care, food, shelter and clothing) and restore facilities that are essential for health, safety and welfare (e.g. hospitals, water and sanitation, power

and transport). Rehabilitation and reconstruction are also likely to be included in more strategic plans, although in practice they tend to be poorly integrated with emergency response (UN Habitat, 2002).

The World Bank and US Geological Survey estimated that economic losses worldwide from natural disasters in the 1990s could be reduced by $280bn if $40bn were invested in preparedness, mitigation and prevention strategies (Dilley and Heyman, 1995). On the Kenyan case most buildings have been lacking fire prevention and mitigation plans. Occupants of building have also fallen victims to fires due to perceived lack of preparedness. This has increased exposure to frequent fire disasters which have led to loss of lives and properties. It's against this background that this study sought to examine whether past occurrences of fire disaster had elicited establishment of prevention and mitigation measures in business premises in Kisumu CBD.

1.3 Purpose of the Study

The problem that this research sought to address was assessing the level of prevention, mitigation and preparedness in commercial buildings against fire risk as envisaged in different government policy instruments with a view to recommending appropriate measures. Issues addressed in this research study include assessing mitigation measures adopted by owners of buildings, level of preparedness among the occupants, owners and managers of commercial buildings and recommending strategies to improve on mitigation and preparedness in the occupancy of those premises.

1.4 Study Objectives

The main goal of this study was to determine how frequent fire occurrences had influenced mitigation and preparedness among those occupying commercial premises. Specific objectives include;

   i.   To assess fire Safety measures adopted by owners of buildings in Kisumu.

   ii.   To assess level of fire preparedness among the occupants of the buildings in Kisumu.

   iii.   To assess the level of fire preparedness of local authority in Kisumu.

iv.   To assess the level of perception of satisfaction of building owners, occupants and the local authorities on fire preparedness and mitigation measures in Kisumu.

1.5 Research Questions

i.   What Fire safety measures have been put in commercial buildings in Kisumu?

ii.   What is the level of fire risk preparedness among occupants of Commercial Buildings in Kisumu?

iii.   What is the level of fire preparedness of the local authority in Kisumu?

iv.   What is the perception on the level of satisfaction on mitigation and preparedness by the building owners, occupants and the local authorities on fire preparedness and mitigation in Kisumu?

1.6 Significance of the Study

This study was undertaken after several rampant cases of fires had been reported in different parts of the country hence raising fears on the issue of fire preparedness and safety measures in place. This study thus sought to investigate fire risk mitigation and preparedness among occupants of commercial buildings. The findings and recommendations of this study can give policy makers in the City Council of Kisumu, owners of buildings as well as occupiers the information useful in making and redefining fire safety in their premises hence enhancing awareness.

1.7 Scope of the Study

This study covered fire safety, preparedness and mitigation in commercial buildings in Kenya. The study was narrowed down to cover commercial buildings in Kisumu CBD. Factor identification was done on prior knowledge upon which emphasis was on preparedness and mitigation measures adopted by building owners, managers and occupants as well as preparedness of the local authorities.

1.8 Definition of Key Terms

Mitigation   -   long-term, pre-disaster planning which involves repeated expenditures on structural and non-structural issues in an attempt to reduce or eliminate future risks.

Preparedness   -   a state of readiness to respond to a disaster, crisis, or other fire emergency situation.

Fire Protection-   study and practice of mitigating the unwanted effects of potentially destructive fires.

Fire Safety   -   putting in place appropriate fire equipment, management of exit routes and proper management of spaces.

Risk   -   it is effect of uncertainty on objectives or any undesirable event associated with work that can jeopardize the realization of the objectives.

Fire prevention-   programmes intended to reduce sources of ignition.

Fire   -   it is a natural phenomenon that occurs whenever a combustible fuel comes into conduct with oxygen at an extremely high temperature.

Fire assembly point- an assembly ground where people gather in case of fire to take roll call

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

Several researchers have carried out studies on the aspect of fire safety. This chapter presents work that has been done by others and its relationship to mitigation and preparedness in buildings. Different perception of different researchers on fire safety and preparedness are dealt with in this chapter.

2.1 Meaning of Fires

Fires start when a flammable and/or a combustible material, in combination with a sufficient quantity of an oxidizer such as oxygen gas or another oxygen-rich compound (though non oxygen oxidizers exist that can replace oxygen), is exposed to a source of heat or ambient temperature above the flash point for the fuel/oxidizer mix, and is able to sustain a rate of rapid oxidation that produces a chain reaction. This is commonly called the fire tetrahedron. Fire cannot exist without all of these elements in place and in the right proportions. Some fuel-oxygen mixes may require a catalyst, a substance that is not directly involved in any chemical reaction during combustion, but which enables the reactants to combust more readily. Once ignited, a chain reaction takes place whereby fires can sustain their own heat by the further release of heat energy in the process of combustion and may propagate, provided there is a continuous supply of an oxidizer and fuel. If the oxidizer is oxygen from the surrounding air, the presence of a force of gravity, or of some similar force caused by acceleration, is necessary to produce convection, which removes combustion products and brings a supply of oxygen to the fire. Without gravity, a fire rapidly surrounds itself with its own combustion products and non-oxidizing gases from the air, which exclude oxygen and extinguish it (Pyne, 1982).

When a fire begins, it grows bigger and then runs out of control and gets a firm grip on its surroundings. There is drama in full measure: people die; corporate assets go up in smoke; livelihoods melt away in the heat and eventually somebody is saddled with the blame. Although it is agreed that fire risks and fire wastage are a statistical function of development in any country, there is need to ensure that such is kept to a minimum (Derek, 1986).

2.2 Causes of Fires

Historically, many fires occurred in buildings due to the careless disposal of smoking material into wastepaper baskets. As a result of the no-smoking ban inside most buildings, such fires have become very uncommon. However, in today's world of electronic office equipment, are as a result of an increase in fire incidents due to faulty electrical equipment and power distribution systems. Many common causes of fire can be related to open flames, electrical fires, cooking and spontaneous ignition and the Ignition of Waste Materials. Open Flames arise from such unsafe conditions as negligence in conducting hot work, such as welding, cutting or grinding; improper use of candles; improper handling of flammable or combustible liquids or flammable gases in near-to-potential ignition sources; and matches and cigarettes that are improperly disposed of, or left unattended near combustibles. Electrical fires arise from conditions including damaged electrical conductors, plug wires or extension cords; use of faulty, modified or unapproved electrical equipment; insufficient space or clearance between electrical heating equipment and combustibles; short or overloaded circuits; loose electrical connections; and lighting. Fires occurring as a result of cooking arise from such unsafe conditions including deep frying in pots or pans on stove tops; unattended cooking appliances; and combustibles located dangerously close to cooking equipment. Spontaneous ignition and the ignition of Waste Materials occur when there is improper disposal of materials susceptible to spontaneous combustion, such as oily rags from wood finishing or polishing; accumulation of organic materials, such as green hay, grain or woodchips; and accumulation of waste combustible materials near potential sources of ignition (Pyne, 1982).

2.3 Fire Protection and Safety Systems

Fire protection is the study and practice of mitigating the unwanted effects of potentially destructive fires. It involves the study of the behaviour, compartmentalization, suppression and investigation of fire and its related emergencies, as well as the research and development, production, testing and application of mitigating systems (Grant, 2012).

According to (Langdon, 1972), when dealing with dangers of a fire in a building we have to contend with two systems which are complimentary. These are fire protection and fire safety systems. Fire protection incorporates active and passive measures. Fire protection aims at protecting human life, goods and activities as well as protecting buildings. Fire protection provides for;

i.   Safe means of escape from buildings.

ii.   Safeguarding or eliminating possible sources of accidental fire.

iii.   Detecting outbreaks and limiting rate of fire spread.

iv.   An efficient professional rescue and firefighting service.

v.   Means of extinction in early stages of fire either automatic or hand operated or both.

vi.   Limiting spread of fire risk from one building to another.

Fig 2.1 Interaction between Active vs Passive fire Protection measures

Active   **Passive**

Detection ————————————→ Escape Provisions

Alarm ————————————→ Compartmentation

Fire fighting ————————→ Contents

Sprinklers ————————————→ Linings
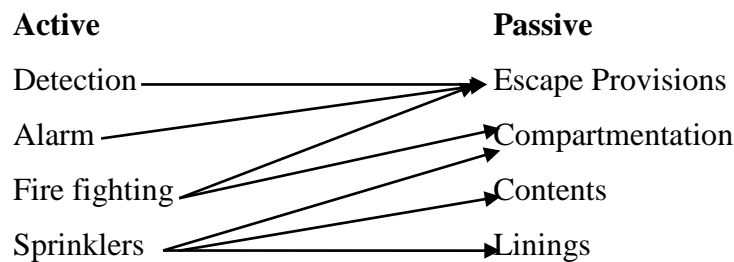
Source: Overseas Building Notes July 1980, No. 186

Active measures include planning matter and must be considered at an early stage of building design. Passive measures are thus present and operating all the time in a building such as selection of non-combustible materials, subdivision of buildings and ensuring correct ventilation. Active measures involve necessary addition to the services of a building such as installation of alarms and detectors to give a warning of fire and the installation of equipment for fire extinction (Mugure, 1991). According to him a Fire Safety system is a system that is aimed at making starting of a fire difficult, reducing its growth rate, preventing its spread, controlling it and aiding escape of occupants and preventing the building from failing. Fire safety is all about putting in place appropriate fire equipment, management of exit routes and proper management of spaces.

2.4 Fire Equipment

Fire equipment are of various make and type each serving a specific purpose. They can be manual, automatic or both. Choice of the type of equipment will depend on the risk to be catered for size of building, available capital and insurance and fire service requirements. Fire equipment includes;

2.4.1 Fixed systems

Fixed systems make it possible to get more extinguishing medium to a point and when there are no people around. Fixed systems can be automatic, manual or both and require a significant amount of capital outlay. Principal types of fixed systems are water hose reels, internal hydrants, sprinklers, foam installations, carbon dioxide systems and Halon systems.

2.4.2 Fire Extinguishers

The type of extinguisher provided should be suitable for the risk involved, adequately maintained and appropriate records of all inspection and tests kept. Fire extinguishers can be generally divided into categories according to the extinguishing medium they contain. This include Pressurized Water Extinguishers (hose reels, fire sprinklers), Carbon Dioxide Extinguishers, Dry Chemical Extinguishers, Halon 1211/1301 Extinguishers (Vaporizing liquids), Wet Chemical, Foam and Fire blankets (Duke, 2012).

2.4.3 Water hose reels

Water hose reels are coils of hose carried on a stout reel and frame. It may be sticking out from a wall on hinged brackets or stuck out of site behind stylish panels matching the décor. They may have a valve for turning on the water supply or be fitted with an automatic system operated via the reels axle so that water supply comes on when a few yards of hose have been ran out. Some hoses are fitted with a plain jet nozzle or a combination jet/spray nozzle depending on the taste or requirement.

2.4.4 Internal Hydrants

Internal hydrants are mains that rise inside a building to provide water to upper floors and can be wet or dry risers. They should be fitted with standard hydrant outlet valves at each level so that fire hoses can be connected. Both wet and dry risers share the

same construction specification and the choice will depend on which is more suitable for the building and its contents. For dry risers the inlet connection should be fitted to an external wall or on a special wall or column outside the building. The run of the pipe work from the riser to its inlet connection must slope downward, toward the inlet to facilitate easy drainage.

2.4.5 Sprinkler installations

Sprinkler installations are supplied with water from the mains and /or header tank which is released over the fire area in form of a spray when the sprinkler heads are activated.

2.4.6 Detectors

There are three main types of detectors include Heat detectors, Smoke and the Radiation detectors. They can be combined together with fire alarms or kept separate. The alarm must be able to give off an audible warning, unmistakable to the person hearing it. It should give out an ambiguous signal. Heat detectors fall into two categories; fixed temperature and the rate of rise or compensating detector. The choice between the two is made after a careful assessment of real need for one and additional cost included. Fixed temperature detectors respond to a preset temperature within the areas of the detector head while compensating detectors are able to distinguish between a slow and a sudden rate of temperature increase. Smoke detectors on the other hand respond to smoke around the detector head. They operate in one of three-ways namely: ionization, light scatter or light obscuration. The ionization type operates on the principle that smoke particles absorb ions, in the detector heading reducing the current flow. This causes an imbalance between current in the test chamber and the scaled companion chamber which triggers an alarm (Derek, 1986).

The light scatter operates on the principle that smoke particles scatter a beam of light, causing it to fall on a photoelectric cell that activates an alarm. Smoke detectors are preferable in that most fires give off an appreciable amount of smoke that is detectable before sufficient heat is produced to activate a heat detector. Radiation detectors respond to infra-red or ultra-violet radiation emanating from flames and

heat. They are however prone to false alarms because they can react to infra red or ultra violet radiation from sources other than heat (Aligula, 1990).

2.4.7 Foam Installations

Foam installations comprises a foam-carrying supply pipe, a water supply with a foam induction system and a foam-making branch pipe which manufactures foam for delivery to a tank. It can be manual or automatic and is used on special risks such as petroleum installations.

2.4.8 CO_2 / Halon Systems

Carbon dioxide systems can be feed from banks of carbon dioxide cylinders or from a refrigerated tank. They are used in special areas such as electrical switch room or power-intake situations. They are usually designed as total flood systems. This means that they deliver sufficient carbon dioxide to fill the room at a designed concentration in a very short time. Discharge can be automatic, manual or both. Halon systems operate along similar lines as carbon dioxide systems but are more often used for computer installations where discharge heads are placed overhead in cable ducts, under floor cable trenches etc. They can be operated by fire or smoke sensors. In the case of larger units by automatic or manual means.

2.5 Exit Routes

Escape routes should be protected from smoke and heated gases. In a situation where there is an escape staircase, it is essential to have a protected lobby and a protected stair case, preferably open to the outside. The finishes on the escape routes should have zero surface spread of flame and be non slippery (Shyamala, 1979). Despite all the precautions and prevention, an outbreak of a fire in any premises cannot be ruled out. Accordingly, steps should be taken to deal with this fire when it occurs.

Fig 2.2 Steps for dealing with an outbreak of a fire
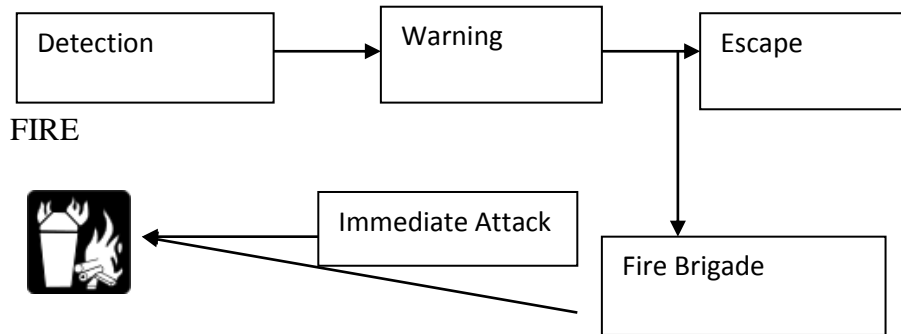
Source: (Shyamala, 1979)

Considerations of the problem of fire (protection and prevention) are an integral part of the planning process in all buildings and should be evident from conceptual stages of the design.

2.6 Management

Practice of good management is integral in fire prevention and safety. It involves regular inspection, good housekeeping, posting of notices and exit directional signs as well as regular conduct of fire drills, evacuation schemes and presence of fire wardens (Aligula, 1990).

Fire prevention is intended to reduce sources of ignition. Fire prevention also includes education to teach people how to avoid causing fires (McFadden, 1989). Buildings, especially schools and tall buildings, often conduct fire drills to inform and prepare citizens on how to react to a building fire. Purposely starting destructive fires constitutes arson and is a crime in most jurisdictions. Fire fighting services are provided in most developed areas to extinguish or contain uncontrolled fires. Trained firefighters use fire apparatus, water supply resources such as water mains and fire hydrants or they might use A and B class foam depending on what is feeding the fire. Model building codes require passive fire protection and active fire protection systems to minimize damage resulting from a fire. The most common form of active fire protection is fire sprinklers. To maximize passive fire protection of buildings, building materials and furnishings in most developed countries are tested for fire-resistance, combustibility and flammability. Upholstery, carpeting and plastics used in

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vehicles and vessels are also tested. Where fire prevention and fire protection have failed to prevent damage, fire insurance can mitigate the financial impact. In cases of electrical fires, occupants are advisable not to use electrical equipment that is in poor repair or that has a damaged cord as well as not to overload circuits or extension cords. Only approved power bars should be used instead of circuit splitters. Electrical heating appliances should be kept at a safe distance from combustibles. In General Office Kitchen Fire, Safety should be ensured by avoiding cooking hazards, such as putting in place mini-kitchens where staff may prepare their own food. Toasters and microwave ovens should not be located in general office areas. It is preferable that these appliances be placed in kitchen areas only. Occupants in buildings should also avoid deep fat frying and otherwise typically deep-fry your food using a thermostat controlled appliance, and never leave it unattended. All combustible materials, such as paper towels and cloths, should be kept at a safe distance.

2.7 Legislation on Fire Protection and Safety in Kenya

There are various governmental and non-governmental agencies in Kenya involved in disaster management activities; but largely in an uncoordinated, reactive and sectoral framework. The same is true of line Ministries in the government of Kenya which have mainstreamed Disaster Management: in the Office of the President there is the National Disaster Operations Centre (NDOC), Arid Lands Resource Management Project (ARLMP) in the Ministry of Northern Kenya Development and Other Arid Lands, and in the Ministry of State for Special Programmes is the Department of Relief and Rehabilitation. The Ministry of Environment and Mineral Resources has NEMA. It is also evident that, among others, the Ministries responsible for Agriculture, Local Government, Regional Development, Environment and Natural Resources, Labour and Human Resource Development, Trade and Industry, Health, Roads and Public Works, Transport, Information and Communication, Tourism and Wildlife, Energy, Finance, Planning and National Development, Lands and Housing, Education, Science and Technology are involved in disaster management. In addition, IGAD, UN Agencies and other bilateral partners and international NGOs play a significant role in disaster management in Kenya. In view of the lack of coordination, the National Policy for Disaster Management in Kenya was drafted in 2009 and recognized the roles of institutions that sought to harmonize and coordinate disaster management operations (Republic of Kenya, 2009).

The Republic of Kenya (2004) outlines relevant measures pertaining to disasters so as to strengthen the country's mechanism to manage disasters including identifying and setting aside land banks for the purposes of meeting urgent shelter requirements of refugees, returnees and internally displaced persons, including as appropriate, the construction of temporary housing with basic facilities taking into account gender specific needs. It also took into account undertaking delineation of high risk regions for different disasters for hazard mapping; Developing procedures for safe development of hill sides and application of environmental impact assessments; Promoting research in alternative less flammable building materials; Promoting hazard resistant building designs and construction in zones prone to earth movement and flooding by enforcing building specifications and regulations; Promoting disaster prevention through timely and continuous maintenance of such services as storm water drains, fire alarm systems to reduce the impact of disasters; Establishing data banks and information systems on disasters and developing appropriate dissemination channels to enhance community preparedness; Building capacity on disaster management by training planners, designers and engineers in human settlements to promote disaster conscious land-use management in the development and implementation of land use plans as well as undertaking monitoring and evaluation as a means of response, and using lessons learnt from past disaster audits to take preventive measures that minimize negative impacts.

The Republic of Kenya (2007) places safety standards on all private employers – and these guidelines affect many aspects of the operation of a commercial property. The following according to the Act are some of the areas that affect commercial properties; Walking and working surfaces, Means of entering and exiting, Powered platforms, hand lifts and vehicle – mounted work platform, Hazardous materials, Personal protective equipment, General environmental control, Medical and first aid, Fire protection, Compressed gas and compressed air equipment and Material handling and storage. If an inspector discovers that the real estate or a tenant in the building is violating an OSHA requirement, a citation will describe the violation, and the employer or owner, within a specific time frame, must remove the hazard or correct the condition. According to the policy many private groups also get involved with risk control such as the National Safety Council, which compiles and distributes survey data on home and business accidents. The Council also publishes materials on

preventive activities. The policy stipulates that the property manager must take responsibility to control losses at the commercial property. An active retention implies that the risk manager consciously decides that the centre owner will pay the consequences of a known exposure. This can occur when the chance of loss is so low that it can essentially be ignored. A loss exposure is often retained by ignorance.

2.8 Ways of Fire Suppression/Extinction

Three factors from the triangle of fire are essential for combustion, namely; the presence of a fuel, or combustible substances; the presence of oxygen (usually as air) or other supporters of Combustion; and the attainment and maintenance of a certain minimum temperature. Fire can be extinguished by removing anyone of the elements of the fire triangle. There are four methods used, each one valid for one or more fire classes and include cooling, smothering/extinguishing, Dilution or elimination of combustible element and control of flames or interruption of the chain reaction. Cooling is the most common method. It consists of lowering the temperature of the combustible elements and the environment below its ignition point. Smothering/extinguishing consists of isolating the combustible elements and oxygen, or reducing their concentration within the environment. Dilution or elimination of combustible element consists of separating the combustible elements from the heat source or the environment of the fire. Control of flames or interruption of the chain reaction is a method that modifies the chemical reaction, altering the release of free radical products in the combustion and therefore delaying development (Stocks, 1991).

Fig 2.3 Fire triangle
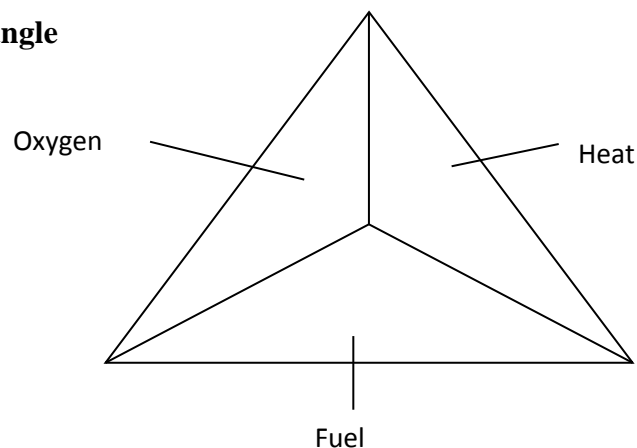
Source; (Thomas, 1974)

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Fire extinction, in principle, consists the limitation or elimination of one or more of these factors, and according to him the methods of extinguishing fire may be classified conveniently as; Starvation (or the limitation of fuel); Smothering / Blanketing (or the limitation of oxygen); and Cooling (or the limitation of temperature). In practice, specific methods of fire extinction often embody more than one of these principles, but it will be convenient to consider them according to the main principle involved. The extinction of fire by starvation is applied in three ways; by removing combustible material from the neighbourhood of the fire. Examples of these are, the drainage of fuel from burning oil tanks; the working out of cargo at a ship fire, the cutting of trenches in peat, heath, and forest fires; the demolition of buildings to create a fire stop; counter-burning in forest fires. Starvation can also be done by removing the fire from the neighbourhood of combustible material as, for instance, pulling apart a burning haystack or a thatched roof as well as by sub-dividing the burning material, when the smaller fires produced may be left to burn out or to be extinguished more easily by other means. A typical example is the emulsification of the surface of burning oil, whilst the beating out of a heath fire owes much of its effectiveness to this (Cumming, 2012).

The method of extinction by Smothering is by preventing or impeding the access of fresh air to the seat of the fire, and allowing the combustion to reduce the oxygen content in the confined atmosphere until it extinguishes itself. If the oxygen content of the atmosphere in the immediate neighbourhood of burning material can be sufficiently reduced combustion will cease. An important practical application of the smothering method is the use of foam. This forms a viscous coating over the burning material and limits, in so far as it is complete, the supply of air. It also tends to prevent the formation of flammable vapour. Smothering can also be by the application of a cloud of finely divided particles of dry powder, usually sodium bicarbonate, from a pressurized extinguisher. A further development in the smothering method has been the discovery of a powdered compound for use on metal fires, such as uranium and plutonium, thorium and magnesium. This powder (ternary eutectic chloride)is applied by means of a gas cartridge pressurized extinguisher (Cumming, 2012).

Where Fire has occurred, it can be extinguished by removing any one of the elements of the fire tetrahedron. The fire can be extinguished by turning off the gas supply, which removes the fuel source; covering the flame completely, which smothers the flame as the combustion both uses the available oxidizer (the oxygen in the air) and displaces it from the area around the flame with CO_2; as well as by application of water, which removes heat from the fire faster than the fire can produce it; or by application of a retardant chemical such as Halon to the flame, which retards the chemical reaction itself until the rate of combustion is too slow to maintain the chain reaction. Similarly, blowing hard on a flame will displace the heat of the currently burning gas from its fuel source, to the same end (Cumming, 2012).

Fire Suppression systems in the USA are governed by the codes under the NFPA. Fire Suppression Systems are commonly used on heavy power equipment. Suppression systems use a combination of dry chemicals and/or wet agents to suppress equipment fires. Suppression systems have become a necessity to several industries as they help control damage and loss to equipment. Common means of detection are through heat sensors, wiring, or manual detection (depending on system selection) (Grant, 2012).

2.9 Classes of Fire

According to the Grant, (2012), classification of fire depends mainly upon the fuel involved. Based on this, fire is classified in five classes as follows;

CLASS "A" - These are fires fueled by ordinary combustible materials, such as wood, cloth, paper, and many plastics. This type of fire burns with an ember, leaves an ash, and is best extinguished by removing the heat side of the triangle. Extinguishers suitable for Class "A" fires should be identified by a triangle containing the letter "A"; if color-coded, the triangle will be green. These fires should be extinguished by using a dry chemical extinguisher. Water is effective in extinguishing these type fires, however, water extinguishers are rarely found especially in Medical Centers.

CLASS "B" - These are fires fueled by flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols and flammable gases. This type of fire burns on the surface of the fuels, and is best extinguished by a blanketing or smothering action. A fire of this type is fast-spreading and capable of engulfing a large area in a very short time. Extinguishers suitable for

Class "B" fires should be identified by a square containing the letter "B". If color-coded, the square is red. Either dry chemical or carbon dioxide extinguishers should be used to extinguish these type fires. Flammable liquids may re-ignite after being extinguished. Water should not be used for these kinds of fires.

CLASS "C" - These fires occur in energized electrical equipment, where the electrical non-conductivity of the extinguishing media is of importance. Blanketing or smothering this type of fire with a non-conducting extinguishing agent is of prime importance. Water, or solutions containing water, is never to be used on a Class "C" fire. Extinguishers suitable for Class "C" fires should be identified by a circle containing the letter "C"; if color-coded, the circle is blue. Either dry chemical or carbon dioxide extinguishers should be used to extinguish these types of fires. Water should not be used. Extinguishers suitable for more than one of the three classes of fire A, B and C defined above may be identified by multiple symbols (ABC).

CLASS "D" – These fires involve combustible metals, such as magnesium, titanium, zirconium, sodium, lithium and potassium. Generally the extinguishing agent is referred to as dry powder. These extinguishers should be identified by a star containing the letter "D", if color-coded, the star is yellow.

CLASS "K" –These are fires in cooking appliances that involve combustible cooking media such as vegetable or animal oils and fats. The extinguishing agent is referred to as Wet Chemical. These extinguishers should be identified by the letter "K."

2.10 Emergency Preparedness, Mitigation and Evacuations

Preparedness is how we change behavior to limit the impact of disaster events on people (Drabek, 1986). Preparedness is a continuous cycle of planning, managing, organizing, training, equipping, exercising, creating, evaluating, monitoring and improving activities to ensure effective coordination and the enhancement of capabilities of concerned organizations to prevent, protect against, respond to, recover from, create resources and mitigate the effects of natural disasters, acts of terrorism, and other man-made disasters (Falkenrath, 2001). In the preparedness phase, emergency managers develop plans of action carefully to manage and counter their risks and take action to build the necessary capabilities needed to implement such

plans. Common preparedness measures include: communication plans with easily understandable terminology and methods; proper maintenance and training of emergency services, including mass human resources such as community emergency response teams; development and exercise of emergency population warning methods combined with emergency shelters and evacuation plans; implement and maintain an emergency communication system that can help identify the nature of an emergency and provide instructions when needed; stockpiling, inventory, streamline foods supplies, and maintain other disaster supplies and equipment.

The following according to FEMA[1] is recommended for a disaster preparedness kit: one gallon of water per person per day for three days, non-perishable food for each person for three days, battery powered or hand crank radio and extra batteries, flashlights for each person and extra batteries, first aid kit, whistle, filter mask or a cotton t-shirt for each person, moist towlettes, garbage bags, and plastic ties, wrench or pliers, manual can opener, plastic sheeting and duct tape, important family documents and the daily prescription medicine. Other things include diapers/formula for babies and special need items. Typically according to them, a three day supply of food and water is the minimum recommendation and thus having a larger supply means longer survival. Small comfort items can be added like a few toys for children, a candy bar, or a book/comic to read. These small items that do not take up much space can come in handy to increase moods during survival time. In addition it is important to develop organizations of trained volunteers among civilian populations. Professional emergency workers are rapidly overwhelmed in mass emergencies so trained; organized, responsible volunteers are extremely valuable. Organizations like Community Emergency Response Teams and the Red Cross are ready sources of trained volunteers in many countries. Another aspect of preparedness is casualty prediction, the study of how many deaths or injuries to expect for a given kind of event. This gives planners an idea of what resources need to be in place to respond to a particular kind of event. Emergency Managers in the planning phase should be flexible, and all encompassing, carefully recognizing the risks and exposures of their respective regions and employing unconventional and atypical means of support.

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[1] FEMA is an agency of the United States Department of homeland security that primarily deals with coordinating the response to disasters which occur in the United States and that overwhelm the resources of local and state authorities.

Depending on the region, municipal or private sector emergency services can rapidly be depleted and heavily taxed. Non-governmental organizations that offer desired resources e.g., transportation of displaced home-owners to be conducted by local school buses and evacuation of flood victims to be performed by mutual aide agreements between fire departments and rescue squads and should be identified early in planning stages, and practiced with regularity (Falkenrath, 2001).

Risks are realities and every shopper or commercial investor must contend with them. One way to protect against economic loss is an insurance policy. According to him, Insurance Companies do not prevent losses. They simply offer the next best thing, which is financial protection against the consequences of loss. Insurance is based on the probabilities that events will occur in various climates, regions, areas or neighbourhoods. Insurance serves as a financial risk against risk. Risk management prepares the owner for the financial demands of claims arising from accidents and losses and gives the investor and manager and their creditors protection against these claims thus generating peace of mind. In property, insurance can provide financial protection against loss from among other things fire, theft and bodily injuries. Commercial property owners can manage risk and thereby directly or indirectly increase their profits. Direct protection comes in the form of financial support when damage occurs. Risk management also produces indirect benefits. The property which is scrutinized vigorously for loss exposures will be better managed and controlled than one that has not been properly scrutinized. Risk management thus in many ways prevents and prepares the business for the financial demands of accidents or litigation (Nabutola, 2004).

2.11 Conceptual Framework

Fig. 2.4 Conceptual Framework Model

Independent

Dependent

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                                          ┌──────────────────────┐
                                          │ FIRE FIGHTING AND    │
                                          │ EQUIPMENT            │
                                          ├──────────────────────┤
                                          │ AWARENESS            │
┌─────────────────┐                       ├──────────────────────┤
│ FIRE SAFETY     │──────────────────────▶│ FIRE PROTECTION      │
│                 │                       │ AND PREVENTION       │
└─────────────────┘                       ├──────────────────────┤
                                          │ MITIGATION           │
                                          └──────────────────────┘
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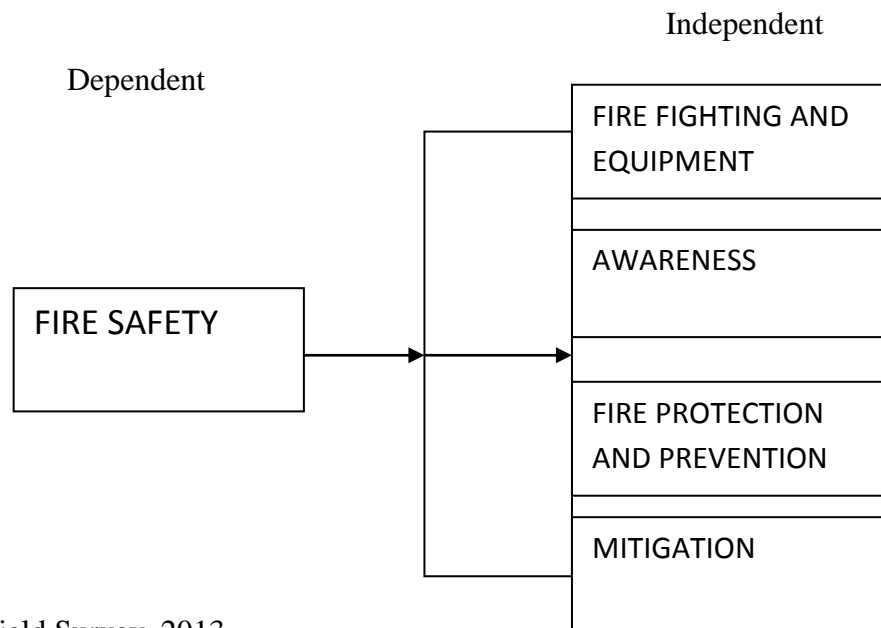
Source: Field Survey, 2013

The object of fire safety from the conceptual model can thus be summarised as follows;

i.   To reduce the possibility of outbreaks of fire.

ii. To provide adequate facilities for fighting and escape of occupants from the building.

iii. To reduce the spread of fire within the building and to adjoining buildings.

iv. To protect the occupants from the adverse effects of fire losses.

Fire safety is in this case identified as the dependent variable being influenced by availability of firefighting equipment, awareness, fire protection and prevention measures as well as mitigation measures adopted by various players. Changes in the four independent variables are likely to affect levels of fire safety in any given building.

Fire fighting services are provided to extinguish or contain uncontrolled fires. Trained firefighters use fire apparatus, water supply resources such as water mains and fire hydrants or they might use A and B class foam depending on what is feeding the fire. Fire prevention is intended to reduce sources of ignition. Fire prevention also includes

education to teach people how to avoid causing fires. Buildings, especially schools and tall buildings, often conduct fire drills to inform and prepare citizens on how to react to a building fire. Purposely starting destructive fires constitutes arson and is a crime in most jurisdictions. Model building codes may require passive fire protection and active fire protection systems to minimize damage resulting from a fire. The most common form of active fire protection is fire sprinklers. To maximize passive fire protection of buildings, building materials and furnishings may be tested for fire-resistance, combustibility and flammability. Where fire prevention and fire protection have failed to prevent damage, fire insurance can mitigate the financial impact.

Mitigation is a type of long-term, pre-disaster planning which involves repeated expenditures on structural and non-structural issues in an attempt to reduce or eliminate future risks. Mitigation in practice usually considers the medium or long term prospects of safety, and mitigation is the cornerstone of emergency management as it is practiced today. In many ways, it is the classic example of thinking ahead, using common sense, and doing whatever it takes to achieve some payoff in the future. Terminologically, mitigation is related to two other concepts of long-term planning: reconstruction and preparedness. Reconstruction means repair or rebuilding, and preparedness means getting ready or practicing to respond. Mitigation drives preparedness. Mitigation involves thinking of ways to lessen the effects of damage to certain structures and planning so that any impact from a future disaster will be ameliorated, or eliminated, if possible. Amelioration means to change things for the better, and impact can be understood as the consequences, or likelihood, of something happening in the first place.

Preparedness is a state of readiness to respond to a disaster, crisis, or other emergency situation. General or long-term preparedness encompasses the marshalling of resources in the areas of prediction, forecasting and warning against fire disaster events. It also involves education and training initiatives, and planning to evacuate vulnerable populations from threatened areas. It often takes place against a background of attempts to increase public and political awareness of potential fire disasters and to garner support for increased funding of mitigation efforts. Short term preparedness involves preparedness for certain disasters once they have begun or begin to occur. In this latter sense, preparedness means to prepare as much as possible

for known disasters, and the best preparations are always about what we know best. The best preparation is to get ready, plan, organize, set up, and practice some drill or test. Good preparedness means proper planning, resource allocation, training, and simulated disaster response exercises. It is important to conduct exercises to ensure that skills, equipment, and other resources can be effectively coordinated when an emergency occurs. Exercises also provide a good opportunity to identify organizational and departmental shortcomings and take corrective action before an actual event takes place.

CHAPTER THREE
STUDY METHODOLOGY

3.1 Introduction

This chapter presents the methodology and procedures used by the researcher in collecting data for this study as well as methods for its analysis and presentation.

3.2 Research Design

The research design is the conceptual structure within which research is conducted. It consists of the blueprint for the collection, measurement and analysis of data. As such the design includes an outline of the framework of study, availability of various data, and observations. It means the exact nature of the research work in a systematic manner (Kothari, 2003). This research study used a case study design. This design used description as a tool to organize data into patterns that emerge during analysis. This is because it is ideal in identifying hypothetical constructs and can thus acquire a lot of information through description. There are two categories of descriptive designs: surveys and observational studies. This study adopted both designs.

3.3 Target Population

Population is a group of individuals, objects or items from which samples are taken for measurements (Kombo and Delmo, 2006).The target population for this research study included all owners, property managers and occupants of commercial premises in Kisumu Central Business District.

3.4 Sampling Design and Sample Size

It is seldom necessary to sample more than 10% of the population provided that the resulting sample is not less than 30 and not more than 1000 units. They recommended adequate sample sizes in relation to respective populations. Where a population of 1,000 is considered for the study, they recommended a sample of 100. For a population of 5,000 they recommended a sample of between 100-500 while for a population greater than 10,000 a sample of between 200-1,000 is considered adequate (Arleck and Settle, 1995). Due to the limited time and financial resources available for the research a sample size of 30 respondents was selected as a representative of the entire population. In sampling design, three sampling techniques were used. This included stratified, cluster and random sampling techniques. In stratified sampling,

respondents were grouped into three distinct categories including owners/property managers, occupants and the fire officers (considered as key informants). From these distinct categories, each stratum was then sampled as an independent sub-population. Respondents from the fire officers were obtained from the Kisumu fire station while the owners/managers and occupants from the commercial buildings. Sampling was further done by geographically clustered sampling using the streets in the CBD. Four clusters emerged using the point of intersection (round about) of Oginga Odinga Street, Mosque Road and the Kampala Street at the CBDs' central square. The clusters were the four quarters produced by the intersection of the streets. Three buildings were then randomly selected from each cluster with two respondents from the occupants/tenants being selected from each building among those sampled. One owner/property manager from each of the clusters was also randomly selected. In the category of fire officers, two respondents were interviewed from the fire station.

3.5 Methods of Data Collection

According to Kathuri and Pals (1993), most techniques for measuring social environment rely on verbal material in the form of questionnaires and interviews. A questionnaire is a form containing a set of questions, especially one addressed to a statistically significant number of subjects as a way of gathering information for a survey (Kothari, 1990). A questionnaire is a self-report instrument used for gathering information about variables of interest in an investigation (Cochrain, 1977). To examine the research objectives, hypotheses and related literature, the researcher developed two data collection instruments comprising two categories of questionnaires (with both having closed and open ended questions.) and an observation schedule. One category of the questionnaire was administered to the occupants, owners and managers of commercial buildings. Another one was administered to fire experts drawn from the Kisumu Fire station. The questionnaires were equally used as an interview schedule. The use of an interview allowed further probing to obtain more information. The questionnaire as an instrument of data collection was preferred because it was time saving and allowed collection of data from a larger sample of individuals. The observation schedule was used by the researcher to record important elements to the study which could actually be seen including fire safety measures that existed in the buildings such as availability of escape routes, fire assembly points, presence of detection equipment and other

firefighting equipment. Each instrument targeted specific information from the respondents and was personally administered by the researcher to ensure a high return rate.

3.6 Validity and Reliability of the Research Instruments

Validity is the extent to which the results of a study can be accurately interpreted and generalized to other populations (Cohen, 1988). Content validity was done using the result of the pilot study. The development of research instruments was done by examining the research objectives and questions, consulting research experts and lecturers, personal experience and related studies for the purposes of framing items and critical examination of variables. In this study both content and construct validity were used for the purposes of answering what the instrument really measure (Kathuri and Pals, 1993). Reliability refers to being able to secure consistent results with the repeated measures of the same person with the same instrument (Cooper and Schindler, 1998). Reliability can also be defined as a measure of degree to which a research instrument yields consistent results or data after repeat trials (Mugenda and Mugenda, 1999). To ensure reliability, the research instruments were pre-tested on a few respondents in the study area. This technique involved administering the same question twice to the same group of subjects, but after an interval of two weeks between April and May 2013. The study ensured that there was no sensitization to the respondents which could influence the responses given in the test. The results from both the first and the second test were accurately recorded. The responses from each administration were correlated to determine the extent of consistency.

3.7 Data Analysis Techniques

The data collected was edited for accuracy, consistency and completeness. The data was then cross-tabulated using Microsoft Excel to enable the responses to be statistically analyzed. Descriptive statistics were used to analyze data by way of percentages and mean and presented by use of charts and graphs. Analysis for the first, second and third objectives were done by Tables, percentages, charts and graphs as per the responses in the questionnaire. The respondents were being asked to tick on the appropriate response(s) among options given. Space was also provided for the respondent to give his/her own views where he/she feels response options were not adequate. The fourth objective was analyzed by tables. Recommendations provided

by most respondents were tabulated against the frequency and percentages. Data analysis was done using Microsoft excel.

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The results of this study have been discussed under thematic sub- sections in line with research objectives. The themes include; assessing fire Safety measures adopted by owners of buildings, assessing level of preparedness among the occupants in the buildings, assessing the level of preparedness of local authorities and providing recommendations on Mitigation measures to improve on Fire Safety in the buildings.

4.2 Questionnaire return rate

Data to answer research questions were collected from 30 respondents out of 30 sampled giving a response rate of 100%. The respondents were requested to fill the data as the researcher waited and this ensured 100% return rate. Two of the respondents who had requested to remain with the questionnaires were found to have misplaced them but were issued with new ones to ensure 100% return rate.

4.3 Problems encountered

The study encountered different problems including language barrier, lack of cooperation and inadequate time for interviews. The questionnaires were written in English hence it required translation of some words to some of the respondents. Other respondents were quite busy due to the nature of their work hence could not dedicate their time for research hence requiring a lot of convincing and waiting despite the fact that the study had a very short time to be carried out. The time available for research was also limited hence much time could not be dedicated for interviews. The problem of language was sorted by engaging an interpreter. Respondents who were busy were left with questionnaires which were collected later.

4.4 Analysis of Questionnaires

4.4.1 General Information

4.4.1.1 Distribution of respondents by age

Knowing the age group of respondents assisted the researcher to know which age group was being housed in the business premises and the distribution by age group of knowledge of fire safety. The respondents were asked to indicate their ages. The findings of the study were as presented in figure 4.1

Figure 4.1: Distribution of Respondents by Age
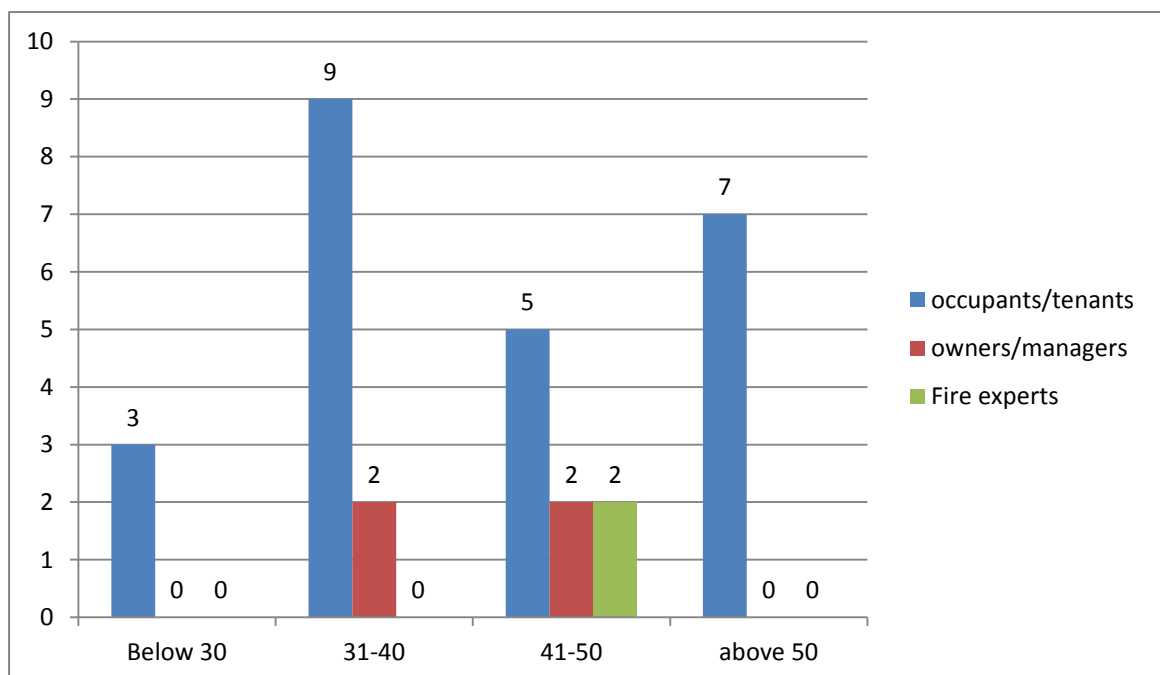
Source: Field Survey, 2013

Figure 4.1 shows that majority of the respondents 11(37%) were in the age bracket of 31-40, 9(30%) were in the age group of 41-50, and 7(23%) in age group above 50 years. Only 3(10%) were below the age of 30 years. This finding signifies that majority of the respondents were within the age of 31-40. All the age groups studied were expected to have knowledge of Fire safety and skills because they are already engaged in business activities either as owners, managers or businessmen and women. From the study it can be concluded that majority of the respondents were adults hence could have a reliable knowledge that was being sought.

4.4.1.2 Gender

The respondents were asked about their gender. Figure 4.2 below shows the proportion in terms of gender of the responses;

Figure 4.2: Distribution of Respondents by Gender
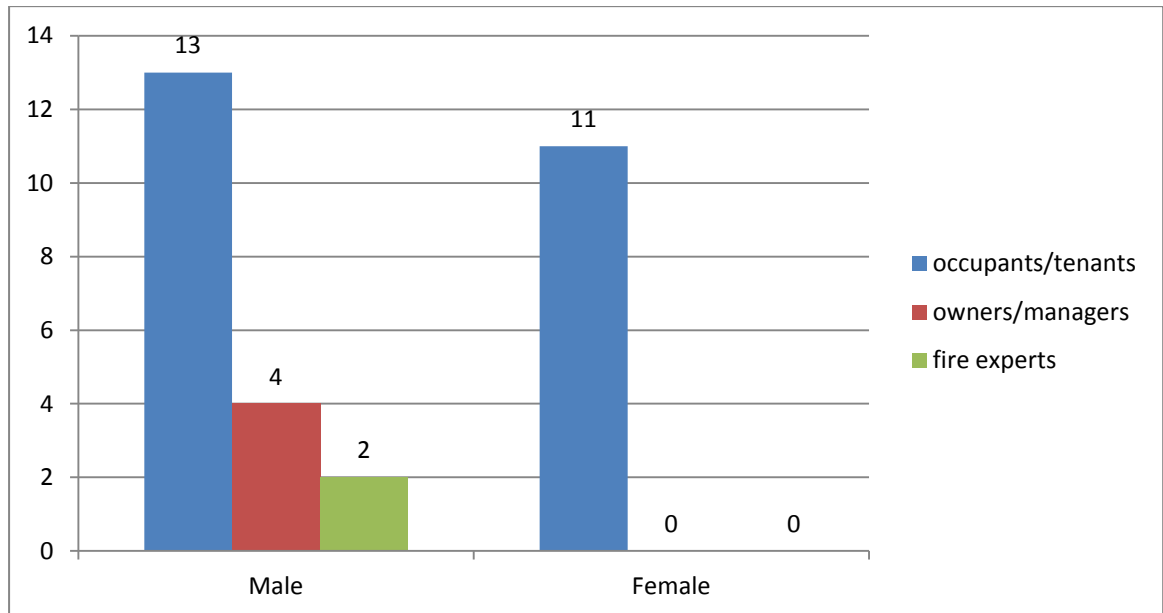
Source: Field Survey, 2013

13 of the respondents in the category of occupants were male while 11 were female in the same category. 4 male respondents were from the category of owners/managers while 2 respondents were also male from the category of fire experts. There was no female respondent in the two categories of owners/managers and fire experts. In total 19 (63%) male and 11 (37%) female were interviewed.

From the study, it can be concluded that majority of the respondents 19(63%) were male while 11(37%) were female. However, data collected was not biased against gender as gender balance was effectively covered.

4.4.1.3 Level of Education

The respondents were asked to give their academic levels. Figure 4.3 shows how they responded to the question.

Figure 4.3: Level of Education
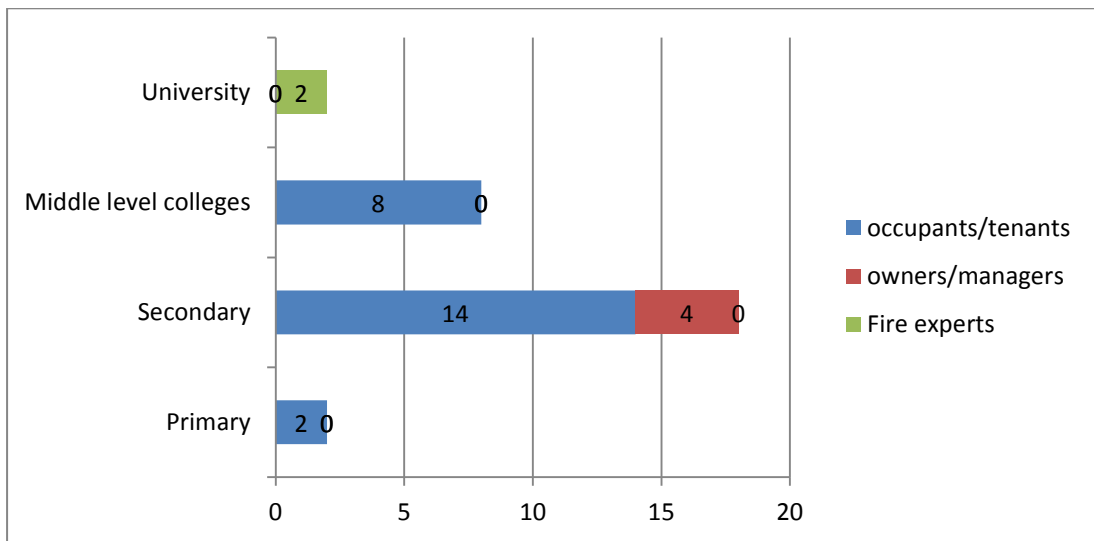
Majority of the respondents 18(60%) were secondary school graduates. 8 (27%) respondents had attained middle level certificates, 2 (7%) were university graduates while only 2 (7%) of them were primary school leavers.

From the study it can be concluded that majority of the respondents were secondary school graduates (60%).

4.4.1.4 Length of occupation/work experience

The question sought to get the length of occupation and work experience in the buildings as well as in fire safety occupation. Occupants and owners/managers were asked to state the length of time they have been in the particular building while fire officers were asked to state the duration of time they had worked with the fire department. Figure 4.4 below shows the responses obtained;

Figure 4.4: Length of occupation/work experience
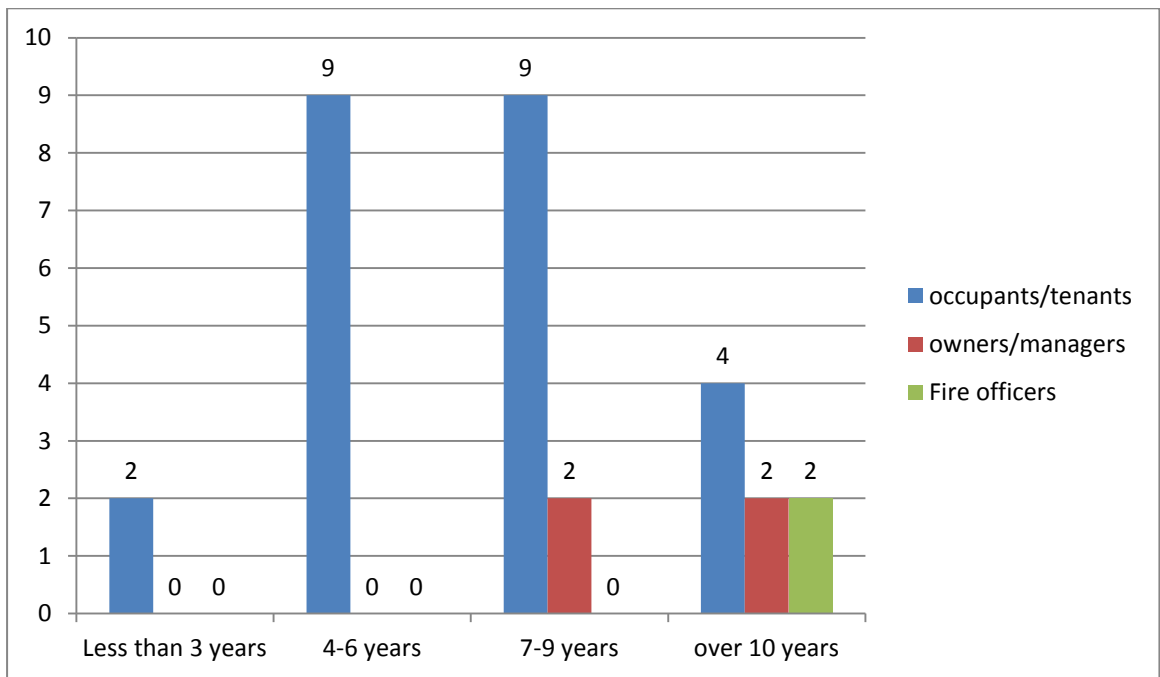
Source: Field Survey, 2013

Two occupants were found to have been in the building for less than three years. Majority of the occupants had occupied the buildings for between 4-6 years and 7-9 years. Each category had nine respondents. 4 occupants had been in the buildings for over 10 years. The owners/managers had either owned or managed the building for not less than 7 years. Two (50%) of the owners/managers had owned/managed for between 7-9 years and the other 50% for over 10 years. Fire officers were found to have worked with the fire department for over 10 years.

This study clearly indicates that the majority of the occupants, owners/managers as well as fire officers had adequately worked for quite a number of years (more than 3 years) hence were in a better position to have information on fire safety in their respective buildings and fire station.

4.4.2 Analysis of Questionnaires for Occupants and Owners/Property managers

4.4.2.1 Fire Safety Measures

The respondents were asked to identify fire fighting equipment available in buildings they occupied. Table 4.1 shows their responses to the question;

Table 4.1: Fire Safety Measures

Fire Equipment	Exists	Do Exist	Not sure	Not	Total
Dry chemical extinguishers	21	5	2		28
Halon extinguishers (vaporising liquids)	0	23	5		28
Foam cylinders	24	0	4		28
Carbon dioxide extinguishers	24	0	4		28
Sprinklers/ Hose reels (pressurized water extinguishers)	5	16	7		28
Wet chemical	0	26	2		28
Fire blankets	3	21	4		28
Any other (specify)	0	24	4		28

Source: Field Survey, 2013

From the total number of 28 respondents studied, majority (21 respondents) stated that Dry chemical extinguishers did exist in buildings in Kisumu CBD against only 5 who stated that it did not exist. Halogen extinguishers similarly do not exist in buildings as stated by 23 respondents. However, none confirmed their existence. Foam cylinders and carbon dioxide extinguishers exist in most buildings as stated by 24 respondents. Wet chemical and fire blankets do not exist in most buildings as stated by 26 and 21 respondents respectively. In all the buildings studied, none of the respondents confirmed existence of wet chemical while only 3 respondents confirmed existence of fire blankets. Asked whether any other fire equipment exists in the building occupied by the respondent, none of them stated the existence while 24 respondents confirmed that no any other fire equipment exists. 5 respondents' supported existence of sprinklers/hose reels.

From the study it can be concluded that only two fire fighting equipment (Foam cylinders and carbon dioxide cylinders) were common in commercial buildings. Dry chemical, sprinklers/hose reels and fire blankets also exist but in few buildings.

4.4.2.2 Perception on Availability of Fire Equipment

The respondents were asked to give their view on the existence of the fire fighting equipment. Figure 4.5 below shows how respondents responded to the question;

Figure 4.5: Perception on availability of Fire equipment
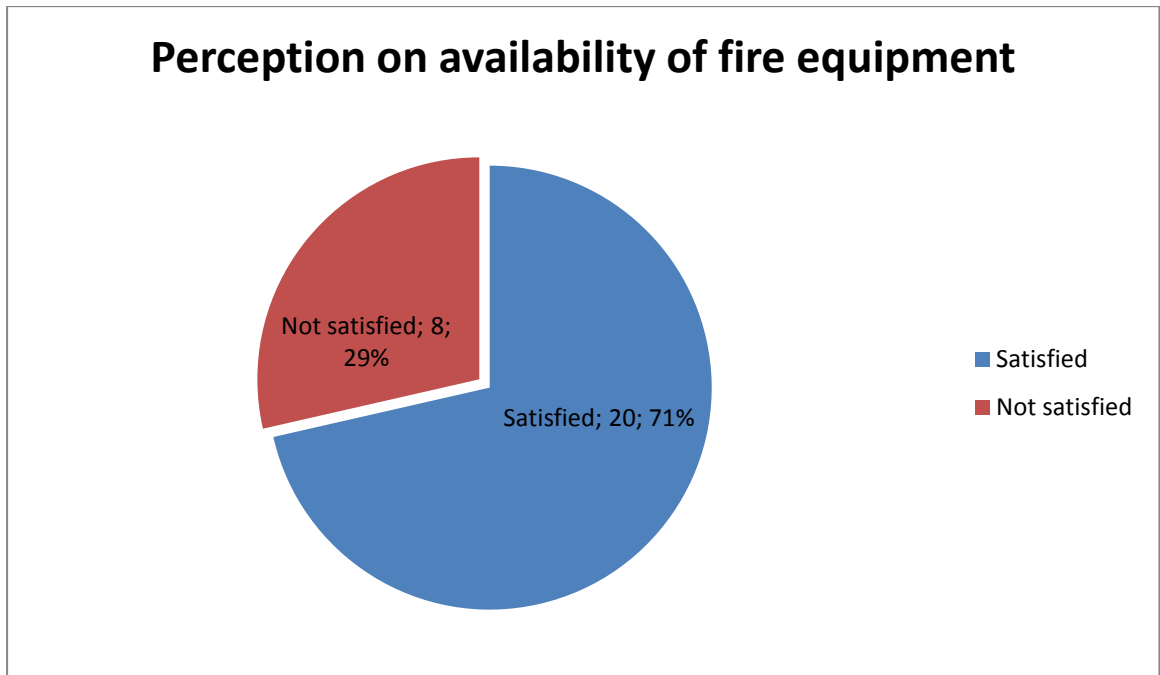
Source: Field Survey, 2013

Out of the 28 respondents studied, a majority 20(71%) stated that they are satisfied while 8(29%) expressed their dissatisfaction.

From the study, it can be concluded that satisfaction from the availability of fire equipment is high.

4.4.2.3 Ability to Operate Fire Equipment

The respondents were asked to state whether they were able to operate the existing fire fighting equipment if any. Table 4.2 shows how respondents responded to the question;

Table 4.2: Ability to Operate Fire Equipment

Fire Equipment	Able to operate/use	Not able to operate	Not sure	Total
Dry chemical extinguishers	12	13	3	28

Halon extinguishers (vaporising liquids)	0	25	3	28
Foam cylinders	13	10	5	28
Carbon dioxide extinguishers	14	12	2	28
Sprinklers/ Hose reels (pressurized water extinguishers)	3	23	2	28
Wet chemical	0	24	4	28
Fire blankets	20	7	1	28
Any other (specify)	0	0	0	0

Source: Field Survey, 2013

13 and 25 of the respondents stated that they were not able to operate Dry chemical extinguishers and Halon extinguishers respectively. 12 respondents could operate the Dry chemical extinguishers. Foam cylinders and carbon dioxide extinguishers had fairly distributed responses with 13 and 14 respondents respectively able to operate them while 10 and 12 respondents being sure that that they were not able to operate them in the same order. 23 respondents could not operate sprinklers/hose reels. An interesting scenario is wet chemical where a whooping 24 respondents could not operate with 4 being not sure with their ability to operate. However, none could operate the sprinklers/hose reels.

A large number of respondents (20) could handle Fire Blankets while 7 respondents could not. Further probing indicated that this was due to its simplicity in use. There was no any other fire equipment specified.

From the study it can be concluded that most of the occupants of commercial buildings who can operate a fire fighting equipment can only operate those that were available (in existence) though the number is fairly distributed on the ability to operate.

4.4.2.4 Perception on the Ability to operate Fire Equipment

The respondents were asked to state their ability to operate the fire fighting equipment in their buildings. Figure 4.6 below shows how respondents responded to the question;

Figure 4.6: Perception on ability to operate Fire Equipment
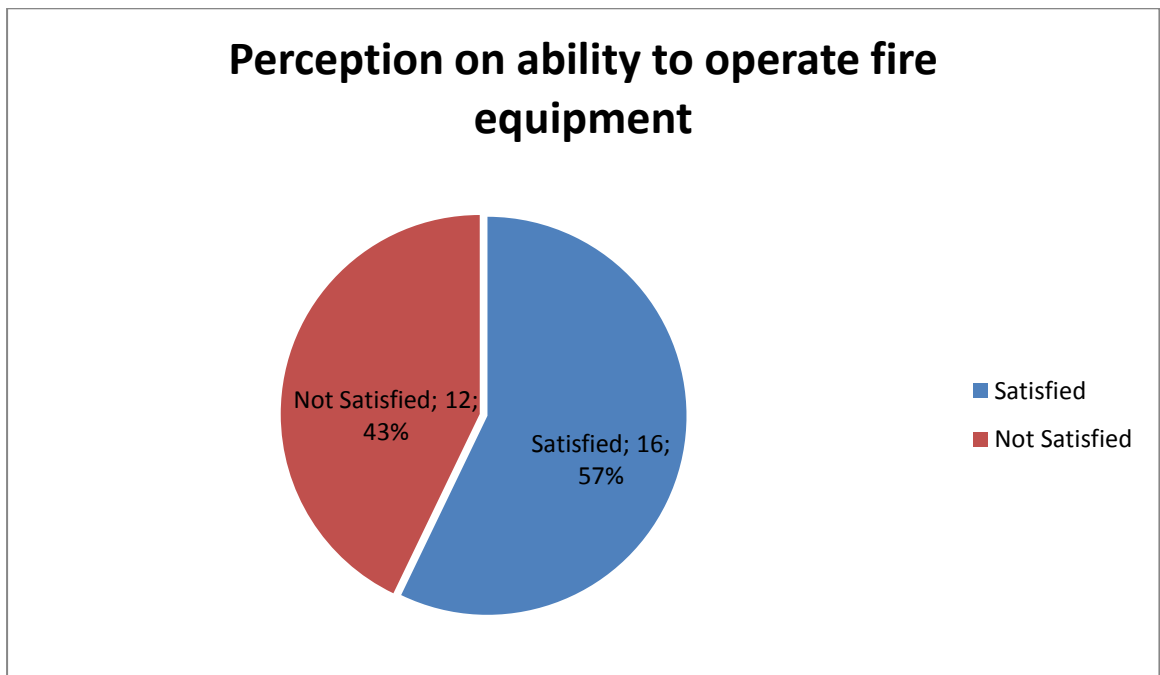
Source: Field Survey, 2013

Asked about their perception on the ability to operate fire equipment, 16(57%) respondents indicated that they were satisfied while 12(43%) were not satisfied.

From the study it can be concluded that slightly over half of the occupants of commercial premises understand or are able to operate fire fighting equipment installed in those buildings.

4.4.2.5 Preparedness to Fire Disasters

Respondents were asked to indicate their awareness on fire preparedness measures available in the buildings. Table 4.3 shows the responses to the question;

Table 4.3: Preparedness to Fire Disasters

Preparedness	Yes	No	Not Sure	Total
Awareness of an emergency communication system in case of fire occurrence (alarm, telephone, mobile no. etc)	18	9	1	28
Frequent regular inspection and maintenance of fire fighting equipments	8	3	17	28

Training on emergency services in case of fire outbreak	7	20	1	28
Existence of a fire assembly point/emergency shelters for the building in case of fire occurrence	17	9	2	28
Availability of an emergency fire disaster kit is available in the building.	6	21	1	28
Accessibility and efficiency to Fire hydrants during fire outbreaks.	2	25	1	28
Existence of Emergency population warning methods in the building.	12	14	2	28
Conducting of Regular fire drills	0	22	6	28
Other preparedness strategies	5	-	-	5

Source: Field Survey, 2013

Most respondents (18) were aware of an emergency communication system in case of fire occurrence against 9 respondents who were not aware. Further probing showed that they had fire alarm systems where they could press to alert fire fighting personnel in addition to an emergency number 999.

A question on regular inspection and maintenance of fire equipment showed that majority of the respondents (17) did not know if it is carried out or not with a paltry 8 respondents being aware. Only 3 respondents indicated that inspection and maintenance is not regularly carried out. Casual observation showed the most recent date of inspection being February 2013 i most buildings.

Asked if they had been trained in fire emergency services, majority of the respondents (20) indicated they had not while 7 respondents had been trained. Only one respondent indicated he didn't know.

Responses to the existence of fire assembly points showed that most buildings had them with 17 respondents indicating their existence. 9 respondents indicated that their buildings had no fire assembly points while 2 respondents were indifferent.

Respondents were also asked on availability of emergency fire disaster kit and majority of them (21) indicated it did not exist in their building. Only 6 respondents acknowledged its existence. One respondent was indifferent. Casual observation only showed that fire extinguishers existed but no emergency kits in most buildings.

Asked about ease of accessibility to fire hydrants during fire disasters, most respondents (25) were of the opinion that they are not easily accessible and inefficient. Only 2 respondents indicated it was easily accessible. One respondent was indifferent. Further probing indicated that in previous cases of fire in residential areas, the hydrants (which are majorly operated by the local authorities) had no water in cases of fire outbreaks hence being ineffective.

Respondents were also asked about the existence of emergency population warning methods and 12 respondents indicated that they existed while 14 indicated that it did not exist in their buildings. Only one was indifferent. Casual observation showed that the most common population warning sign was "No Smoking" sign and was in scripted on the walls.

The respondents were also asked to indicate if fire drills were carried out in the buildings and how often it was carried out if at all. None of the respondents indicated ever witnessing or experiencing a fire drill being carried out. Majority of the respondents (22) indicated it had never been done while 6 respondents were indifferent.

The respondents from the fire station were also asked about the existence of other fire preparedness strategies in the station other than those covered by the questionnaire. The five respondents indicated the existence of ambulances. Casual observation established the existence of ambulances from different organisations including the Municipal council of Kisumu and the St. John's Ambulance.

From the study it can be concluded that occupants of commercial premises are mostly aware and concerned with emergency communication system, warning signs and fire assembly points.

4.4.2.6 Perception on Level of Preparedness

Respondents were asked to indicate their perception on level of preparedness in commercial buildings. Figure 4.7 shows the responses obtained;

Figure 4.7: Perception on Level of Preparedness
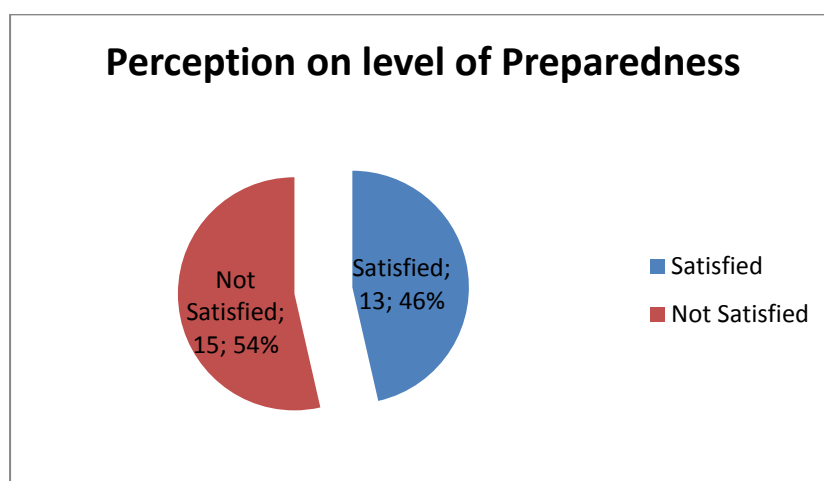
Source: Field Survey, 2013

Majority of the respondents 15(54%) indicated they were not satisfied while 13(46%) were satisfied. From the study it can be concluded that approximately half of commercial buildings lack satisfactory fire preparedness measures.

4.4.2.7 Mitigation against Fire Hazards

The question sought to identify fire mitigation measures available to the Tenants/owners/managers of commercial buildings. Table 4.4 shows responses obtained to the question;

Table 4.4: Mitigation against Fire Hazards

Mitigation	Measures Exist	Measures do not Exist	Do not Know	Total
Holding a Fire Insurance Policy	3	25	0	28
Availability of a Fire Safety Policy	0	27	1	28
Knowledge of	5	20	3	28

Evacuation Plans				
Sanctions against fire regulation breakers	0	26	2	28

Source: Field Survey, 2013

As to whether the occupants/owners/managers held a fire insurance policy for both the building and/or the businesses, whichever the case, it was established that majority of the respondents (25) did not hold while only 3 respondents had fire insurance policies. None of the respondents was indifferent.

Respondents were also asked to find out if the management of the buildings had a fire safety policy and nearly all the respondents (27) indicated they did not have while only 1 respondent was indifferent. No respondent indicated they had such a policy.

Respondents were also asked to indicate whether they understood fire evacuation plans. Most of them (20) indicated they did not know. Only 5 respondents indicated they understood the evacuation plans in buildings they occupied. 3 respondents were indifferent. Further probing as to what they will do in case of fire outbreak showed that respondents had no definite formula but would rather do it haphazardly in evacuating people.

When asked to indicate if there was a sanctions policy against those who disobey fire regulations, nearly all respondents (26) indicated that it did not exist. Two respondents were indifferent and none of them indicated that any policy exists.

From the study it can be concluded that most of the occupants, owners and managers have not put in place fire mitigation measures in their buildings and/or businesses and are thus vulnerable to fire disasters.

4.4.2.8 Perception on the Level of Mitigation

The question sought to establish the perception of respondents on the level of mitigation in commercial buildings. Figure 4.8 shows the responses obtained to the question;

Figure 4.8: Perception on the level of mitigation

Perception on level of Mitigation

Satisfied; 5; 18%

Not Satisfied; 23; 82%

- Satisfied
- Not Satisfied
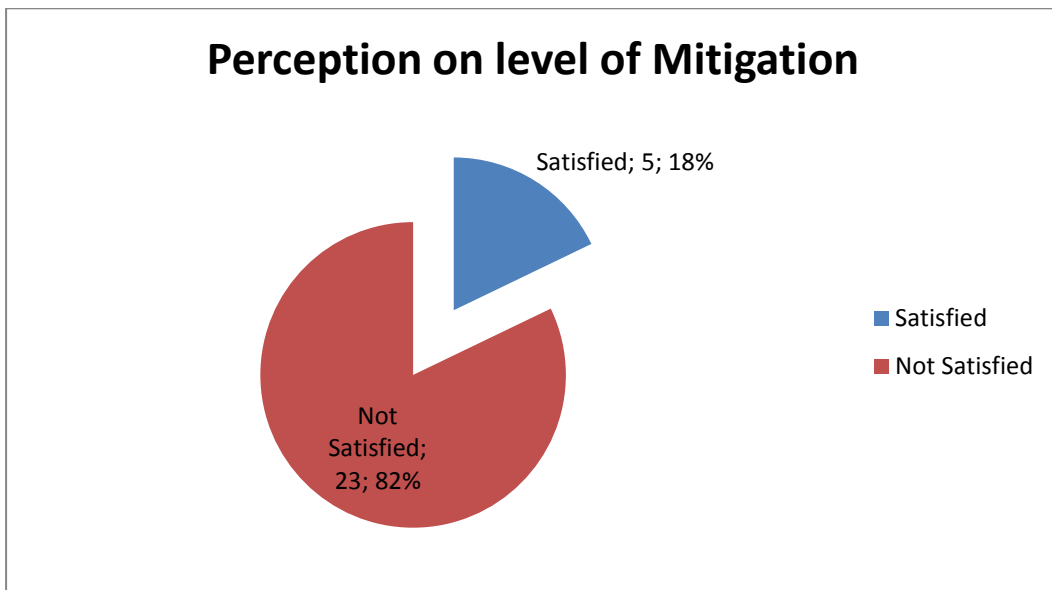
Source: Field Survey, 2013

The findings show that the majority of the respondents, 23(82%) were not satisfied while 5(18%) were satisfied.

From the study it can be concluded that majority of the occupants/owners/managers of commercial buildings are not satisfied with the level of mitigation in commercial buildings.

4.4.2.9 Strategies on Improvement of Mitigation and Preparedness in Commercial Buildings

The question sought to elicit proposals from the owners of buildings, property managers, occupiers and the local authority on what ought to be done to improve on preparedness and mitigation against fires in commercial buildings. Table 4.5 below shows the responses obtained to the question;

Table 4.5: Proposals on Mitigation and Preparedness

Proposed Issue	No.	Percentage
Training in Fire Safety	25	89
Establish compensation schemes	14	50
Opening Exit stairs/Routes	25	89
Acquiring adequate fire equipment	26	93

Provision of fire insurance		18	64
Regular servicing and equipping local authorities with fire engines		22	79

Source: Field Survey, 2013

25(89%) respondents proposed that training in fire safety is critical for fire preparedness. 14(50%) were of the view that fire compensation schemes be provided while 25(89%) want stairs and exit routes be opened in the buildings. 26(93%) were of the view that adequate fire equipment be acquired and installed in commercial buildings. 18(64%) respondents fire insurance to be put in place while 22(79%) want servicing and equipping of local authority engines so as to be ready to combat fire at any one given time. From the study it can be concluded that most of the respondents want fire safety and preparedness measures to be put in place since they are not available as most of them are of the idea that would help increasing awareness and protection against fire.

4.4.3 Analysis of Questionnaires for Fire Experts
4.4.3.1 Inspection of Buildings

Respondents from the fire station were asked to state if they do carry out inspection of buildings in the CBD to ascertain compliance to fire safety. Table 4.6 below shows their responses to the question;

Table 4.6: Inspection of buildings

	YES	NO	TOTAL
Inspects	2	0	2
Percentage	100	0	100

Source: Field Survey, 2013

The two fire officers who were interviewed unanimously concurred that they do carry out inspections of all the buildings in the CBD to ascertain their level of compliance to fire safety.

From the study it can be concluded that inspection is done within the Kisumu CBD buildings. However, comparing with the findings from the building owners, managers

and occupants, majority of them were found not to be aware (17 respondents). This clearly shows that inspection is not openly done.

4.4.3.2 Maintenance of Fire Equipment

Respondents were asked to state whether they carried out maintenance on fire equipment installed in commercial buildings in the CBD of Kisumu. Table 4.7 below shows their responses to the question;

Table 4.7: Maintenance of fire equipment

	YES	NO	TOTAL
Carries Maintenance	2	0	2
Percentage	100	0	100

Source: Field Survey, 2013

The fire officers indicated that they do carry out maintenance on the fire equipment. Casual observation in buildings showed the most recent date of inspection as February 2013 in most buildings.

From this study it can be concluded that inspection and maintenance is indeed carried out on fire equipment though not regularly.

4.4.3.3 Frequency of Inspection

The respondents were also asked to state the frequency of inspection and maintenance of fire equipment in a year. Table 4.8 below shows the responses to the question;

Table 4.8: Frequency of Inspection of fire equipment

Frequency of Inspection	No. of Respondents
Weekly	0
Monthly	0
Quarterly	2

45

Yearly	0	
Over one year	0	
Total	2	

The fire officers indicated that inspection and maintenance is done every three months. However, casual observation showed that in some buildings, more than three months had elapsed since the last date of inspection and maintenance.

It can therefore be concluded that inspection and maintenance is not consistent as was found that some buildings were not being attended to within the stipulated three months.

4.4.3.4 Existence of Firefighting Equipment

Fire officers were also asked to state their view on the existence of firefighting equipment in buildings in the CBD. They were also asked to indicate particular fire equipment that exists in the buildings if at all they existed. Table 4.9 below shows their responses;

Table 4.9: Existence of firefighting equipment

Item	YES	NO	TOTAL
Exists	2	0	2
Percentage	100	0	100

They indicated that fire equipment exist in commercial buildings in Kisumu. The respondents also identified Dry chemical extinguishers, Foam cylinders, fire blankets and carbon dioxide cylinders as the most commonly existing firefighting equipment in the buildings.

It can therefore be concluded that only few fire equipment literally exist in commercial buildings in the CBD.

4.4.3.5 Perception on availability of firefighting equipment

Fire experts were asked to state how satisfied they were with the available firefighting equipment. Figure 4.9 below shows their responses;

Figure 4.9: Perception on availability of firefighting equipment
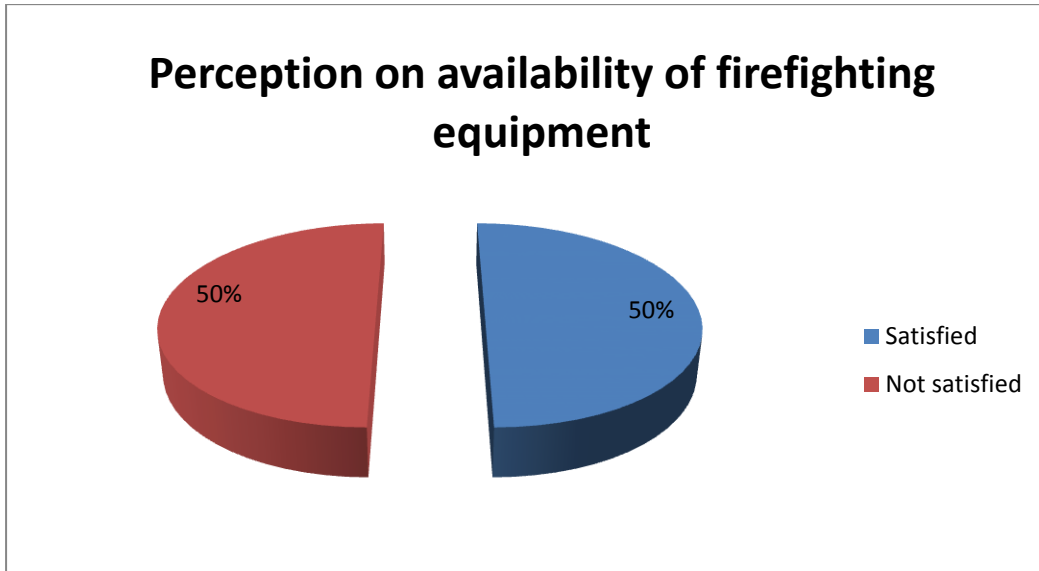
Source: Field Survey, 2013

One (50%) fire expert indicated that he was satisfied while the other one (50%) was not satisfied.

This study clearly indicates that satisfaction to existence of fire equipment is not 100% hence more needs to be done.

4.4.3.6 Education on Fire Safety

Respondents were asked to state if they do carry out education to sensitize building owners, managers as well as the occupants of commercial buildings on fire safety. Figure 4.10 below shows their responses;

Figure 4.10: Education to owners, managers and occupants of buildings
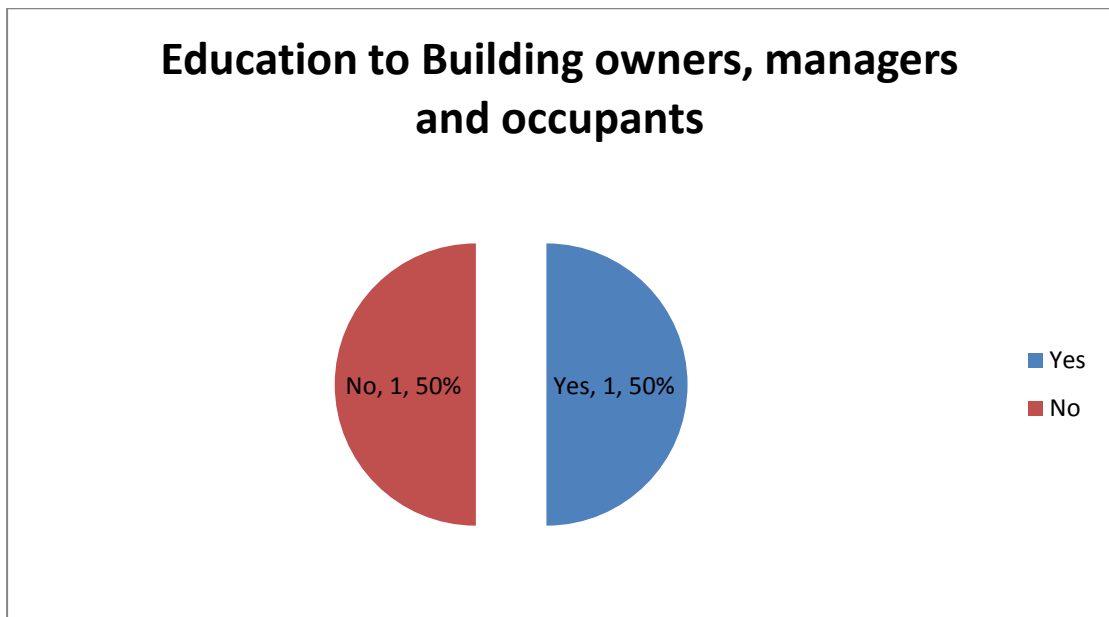
Source: Field Survey, 2013

Each of the two fire officers interviewed was in this case divided on whether education is being carried out. One of them indicated that it was carried out while the other one indicated that it was not. Further probing on the officer who indicated that education was carried out showed that it was actually done through local workshops and sensitization seminars involving urban building dwellers.

How often it was being carried out, it was established that it was being carried out upon request/invitation of the fire officers. There was no formal schedule to educate building owners, managers and the occupants. Table 4.10 below shows the responses to the question as to how often education on fire safety was done;

Table 4.10: Frequency of education

Frequency of Inspection	No. of Respondents
Weekly	0
Monthly	0
Quarterly	0
Yearly	0
Over one year	0

Upon request		1
Total		1

Source: Field Survey, 2013

From this study, it can therefore be concluded that education was not adequately being carried to sensitize building owners, managers and occupants.

4.4.3.7 Preparedness to Fire fighting

The respondents were asked to indicate their preparedness by assessing if firefighting equipment including water hydrants were well equipped to combat fire in case of an outbreak. Table 4.11 below shows the responses obtained;

Table 4.11: Preparedness to firefighting

Item	YES	NO	TOTAL
Well equipped	1	1	2
Percentage	50	50	100

Source: Field Survey, 2013

One fire officer (50%) felt that the firefighting equipment were well equipped to fight fire. Similarly another officer (50%) indicated that the hydrants are not well equipped to fight fires.

4.4.3.8 Existence of other Fire Preparedness Measures

Respondents were asked to state whether other fire preparedness measures exist in commercial buildings and the fire station. They were also asked to identify those that existed if at all. Table 4.12 below shows the responses obtained;

Table 4.12: Existence of other Fire Preparedness Measures

Item	YES	NO	TOTAL
Other measures exists	2	0	2
Percentage	100	0	100

All the respondents (100%) indicated that other preparedness measures exist. They identified existence of fire ambulances, fire engines, operational communication lines, a 24 hour operating fire station, CBD centralised location of the fire station and the existence of fire assembly points in CBD buildings.

It can therefore be concluded that the fire department has put in place good fire preparedness measures and therefore full implementation is critical to enhance fire safety.

4.4.3.9 Perception on ability and capacity to handle fire emergencies

Respondents were asked to state how satisfied they were on their ability to handle fire emergencies in case of outbreak. Figure 4.11 below shows their responses;

Figure 4.11: Perception on ability and capacity to handle fire emergencies
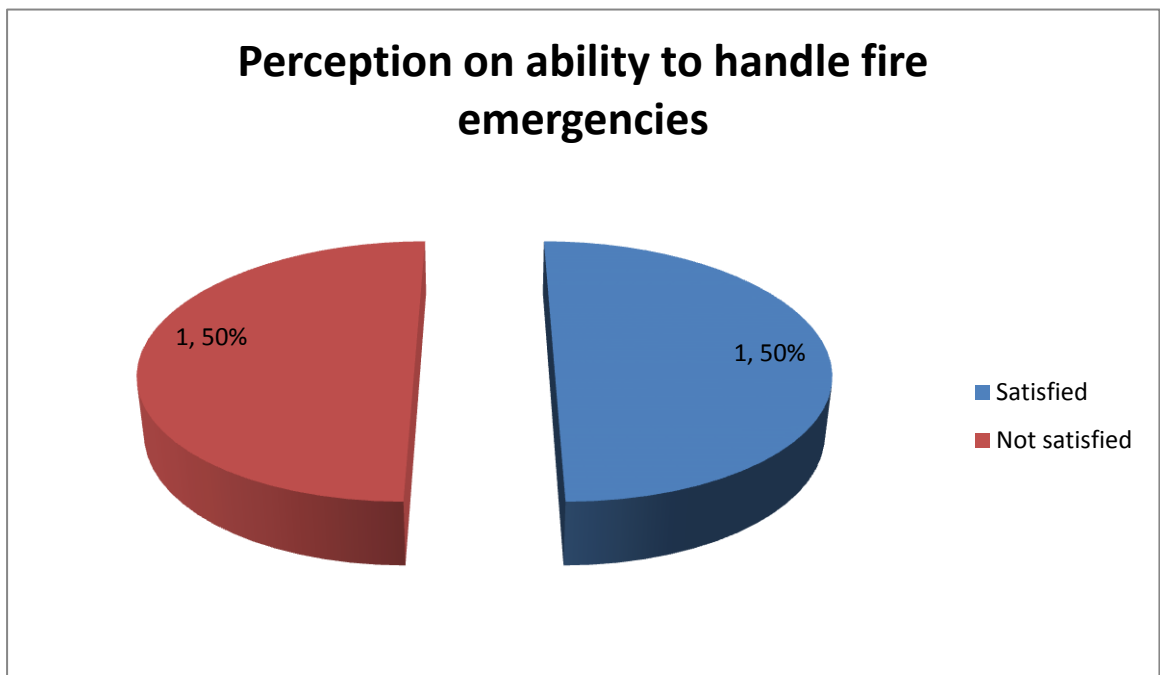
4.4.3.10 Strategies to improve on Fire Preparedness and Mitigation

The respondents were asked to provide in their opinion suggestions that could help improve the state of fire preparedness and mitigation in commercial buildings. Among

the suggestions they suggested are as shown in table 4.13 below;

Table 4.13: Strategies to improve Fire Preparedness and Mitigation

NO	Suggestion	Frequency
1.	Enhanced funding towards fire safety	2
2.	Increased public participation in fire safety training	2
3.	Full compliance with set building by laws	2
4.	Seeking approval before building works	2
5.	Installing fire equipment in all buildings	1

Source: Field Survey, 2013

CHAPTER FIVE
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction
This chapter presents the summary of findings, conclusions and recommendations for the study.

5.2 Summary of Major Findings
The first major objective of this study was to assess fire safety measures adopted by owners of commercial buildings. Data analysis and interpretation revealed that majority of the respondents identified three fire fighting equipment including Dry chemical extinguishers, Foam cylinders and carbon dioxide extinguishers as the commonly found fire fighting equipment in commercial buildings. However, Halon extinguishers and wet chemical did not exist in any of the buildings surveyed. Sprinklers and Fire blankets existed but in very few commercial premises. Since not all respondents agreed on 100% existence of the fire fighting equipment, then this is an area where more needs to be done to meet the required standards and number.

The second objective of study was to assess the level of fire risk preparedness among owners, occupants and managers of commercial buildings. Data analysis and interpretation showed that averagely half of the occupants, owners and property managers know how to operate the commonly existing fire fighting equipment i.e. Dry chemical, carbon dioxide extinguishers and Foam cylinders. Majority of the people also know how to handle fire blankets since these ones according to them are

easy to operate. Given that the above fire fighting equipment are the most common in buildings yet only about half of those likely to be directly affected by fire know how to operate them, this is an area that require more attention especially through education to increase awareness on how to operate them.

The third objective of the study was to assess the level of preparedness of the local authority in Kisumu. This was done by assessing how fast responsive they are to fire outbreaks. Data analysis and interpretation shows that the local authorities are if not ill prepared slow to reaction in handling fire outbreaks as most respondents indicated that in previous cases of fire outbreaks usually reported in residential areas, fire engines either arrived late or had no water to combat the fires. Emergency communication telephone line "999" similarly was the emergency line in most buildings yet it was discovered that it did not work. This is an area therefore that ought to be improved.

The fourth objective sought to get the respondents' perception on their satisfaction on the level of preparedness and mitigation. Data analysis and interpretation showed that majority of the owners, occupants and managers of commercial buildings were not fully satisfied with the level of mitigation and preparedness in Kisumu CBD. This is an important area that warrants attention in dealing with fire safety. It can be done by ensuring appropriate measures are put in place in order to meet the 100% satisfaction of all the occupants, owners/managers and workers in the local authorities.

5.3 Conclusions

The study assessed the influence of past fire disasters on mitigation and preparedness among owners, occupants and managers of commercial properties in Kisumu CBD. This was in relation to the fact that fire had occurred in many other towns resulting into fatalities and loss of property and hence fire authorities in Kisumu could act on these premise to put in appropriate preparedness and mitigation measures. In this respect it was important to consider various measures put in place in business premises which could prevent, protect and mitigate against fire hazards that may occur.

In assessing fire safety measures including fire equipment adopted by the owners in the commercial buildings, the study established that only Foam cylinders and carbon dioxide extinguishers were available in most buildings. Since different kinds of fires are fought using different extinguishers, it is important that other types of equipment be installed or provided by those responsible to boost preparedness. Similarly, despite the fact that the two equipment are the commonly existing, very few occupants were found to be able to operate them hence there is need to train them so that they will be able to handle any fire eventuality.

This study sought to assess the level of fire preparedness especially among the occupants of commercial buildings. These are the people carrying out day to day business in the premises. Since from the findings most of the respondents did show preparedness in only emergency communication system and knowledge of the fire assembly point, it clearly shows that the level of preparedness is still below expectation and hence it is imperative that the concerned authorities take necessary measures that will aim at increasing the level of preparedness such as conducting regular inspection, fire drills, training on emergency services as well as availing fire disaster kits.

In seeking to determine the level of fire preparedness of the local authority, the study concluded that despite the local authorities having competent personnel and equipment for fire fighting, they were ill equipped and/or prepared to handle eventualities of fire. Fire engines usually lacked water to combat fire and in most cases where fire had occurred especially in residential areas they arrived either late or ill equipped. Thus Fire engines need to be equipped to deal with any eventuality of fire outbreaks. It is therefore important that the local authorities address this to enhance their preparedness. Hydrants should also not run dry at any one given time.

The study also sought to obtain perceptions of owners, occupiers and property managers as well as local authorities on how satisfied they were on the level of mitigation and preparedness. The study concluded that most occupants, building owners/managers and local authority fire officers were not fully satisfied. The occupants in this case proposed that they be regularly trained in fire safety to boost their satisfaction and that warning signs be strategically placed and visible even to

visitors and customers to the buildings. They further want exit routes properly marked and insurance policy be provided for them by the owners. Owners and property managers on their part wanted inspection to be regularly done on fire equipment. Therefore collaboration between owners, property managers and occupiers of commercial buildings is critical in increasing their satisfaction as well as skills in fire fighting.

5.4 Recommendation

This research study investigated the level of fire risk preparedness and mitigation in Kisumu CBD. Following the analysis of the data from participants, the following recommendations were made;

5.4.1 Recommendation to the Fire Authorities

i. There is need to inspect the fire fighting infrastructure in existence in buildings in Kisumu CBD with a view of upgrading them to an acceptable standard.

ii. Fire safety measures should be enhanced through fire safety programs, such as emergency procedures/evacuation drills, regular fire safety inspection, maintenance and servicing of fire equipment, trainees and staff training, information to occupants of buildings, keeping records and emergency.

5.4.2 Recommendation to Property Owners, Occupants and Managers

i. The owners and property managers should invite fire experts to give talks of fire safety and practical use of fire fighting and safety equipment to occupants in their buildings.

ii. Owners and property managers should integrate the general public into the fire risk management strategy to establish and enhance the state of overall preparedness.

5.5 Suggested areas for further research

The following recommendations were made as potential areas in fire safety that warrant further research by other scholars in the University of Nairobi and other universities;

1. Further research needs to be carried out to determine the compliance level or aspect on building owners and property managers to the relevant fire by laws.

2. Further research also needs to be done on the effect of design on preparedness and mitigation measures adopted by owners and property managers.

3. Further research should also be extended to cover fire preparedness and mitigation in residential buildings since that is where most fires occur.

5.6 Contribution to Body of Knowledge

Table 5.1: Contribution to Body of Knowledge

Objective	Contribution to body of Knowledge
To assess fire Safety measures adopted by owners of buildings	Fire safety measures in most buildings fall below expectation.
To assess level of preparedness among the occupants in the buildings	Most occupants are ill prepared to handle fire disasters.
To assess the level of preparedness of local authorities	Local authorities are not prepared to handle fire outbreaks.
To provide recommendations on Mitigation measures to improve on Fire Safety	Fire safety strategies are not in place in most buildings.

Source: Field Survey, 2013

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QUESTIONNAIRE FOR OWNERS/PROPERTY MANAGERS/OCCUPANTS

My name is Nicholas Ogajo, a postgraduate student at the University of Nairobi undertaking a study on Influence of Fire Disasters on Mitigation and Preparedness in Commercial Premises in Kisumu in partial fulfillment of my postgraduate diploma in Housing Administration in the Department of Real Estate and Construction management. Any help accorded in answering this questionnaire will be highly appreciated.

Thank you

Please indicate the nature of occupation (Owner/Property manager/Tenant) _____

Section A (tick on the appropriate box)

1. What is your age bracket?

   Below 30 ☐   31-40 ☐   41-50 ☐   51 years and above ☐

2. What is your gender?

   Male ☐   Female ☐

3. What is your highest level of Education?

   Primary ☐   Secondary ☐   University ☐

   Others (specify) _____

4. For how long have you been occupying these premises?

   Less than 3 years ☐   4-6 ☐   7-9 ☐   above 10 ☐

5. Have you experienced any fire outbreak in these premises before?

   Yes ☐   No ☐

Section B

1. Which of the following fire fighting equipment exist in this building? (Tick against those that exist)

Fire Equipment	Exist	Do not exist	Do not know
Dry chemical extinguishers			
Halon extinguishers (vaporising liquids)			
Foam cylinders			
Carbon dioxide extinguishers			
Sprinklers/ Hose reels (pressurized water extinguishers)			
Wet chemical			
Fire blankets			
Any other (specify)			

2. Are you satisfied with the number of fire fighting equipment available in this building?

   Yes ☐   No ☐

3. Are you able to operate the Fire Fighting equipment enumerated in (1) above? {tick against one you are able to operate)

Fire Equipment	Able to operate	Not able to operate	Do not know
Dry chemical extinguishers			
Halon extinguishers (vaporising liquids)			
Foam cylinders			
Carbon dioxide extinguishers			
Sprinklers/ Hose reels (pressurized water extinguishers)			
Wet chemical			
Fire blankets			
Any other (specify)			

4. Are you satisfied with the ability to operate indicated in (3) above?

   YES ☐   NO ☐

5. Which among the following fire preparedness measures are you aware of in this building (if any) in case of fire outbreak?

Preparedness Measures	Aware	Not aware	Do not know
Emergency communication system (alarm, telephone, mobile no. etc)			
Regular inspection and maintenance of fire fighting equipments			
Trained on emergency services in case of fire outbreak			
Existence of fire assembly point/emergency shelters for this building			
Availability of an emergency fire disaster kit			
Accessibility to Fire hydrants			
Existence of Emergency population warning methods			
Regular Fire Drills			
Any other (specify)			

7. What is your perception on the level of preparedness in this building?

Satisfied ☐   Not satisfied ☐

8. What Fire mitigation measures are available for the occupants/owner/manager of this building?

Mitigation Measures	Exist	Do not exist	Do not know
Fire insurance policy			
Fire safety policy			
Evacuation plans			
Sanctions against those who disobey fire regulations e.g. mandatory evacuation are in place			
Any other (please specify)			

9. What is your perception on Fire mitigation measures in this building?

Satisfied ☐   Not satisfied ☐

Section C (Complete in the spaces provided)

What do you think should be done to improve on fire preparedness and Mitigation strategies in this building?

_____

_____

_____

_____

_____

_____

_____

_____

QUESTIONNAIRE FOR FIRE EXPERTS IN LOCAL AUTHORITY

My name is Nicholas Ogajo, a postgraduate student at the University of Nairobi undertaking a study on Influence of Fire Disasters on Mitigation and Preparedness in Commercial Premises in Kisumu in partial fulfillment of my postgraduate diploma in Housing Administration in the Department of Real Estate and Construction management. Any help accorded in answering this questionnaire will be highly appreciated.

Thank you

Section A (tick on the appropriate box)

1. What is your age bracket?

   Below 30 ☐   31-40 ☐   41-50 ☐   51 years and above ☐

2. What is your gender?

   Male ☐   Female ☐

3. What is your highest level of Education?

   Primary ☐   Secondary   University ☐

   Others (specify) _____

4. For how long have you been working with fire department?

   Less than 3 years ☐   4-6 ☐   7-9 ☐   above 10 ☐

5. Have you experienced any fire outbreak in the CBD premises before?

   Yes ☐   No ☐

Section B (tick on the appropriate box)

1. Do you inspect buildings within the CBD for fire safety compliance?

   Yes ☐   No ☐

2. Do you carry out inspection and maintenance of firefighting equipment?

   Yes ☐   No ☐

   If yes, how often do you inspect

   Weekly ☐   Monthly ☐   Yearly ☐   over one year ☐

3. Do the buildings have the necessary firefighting equipment?

   Yes ☐   No ☐

4. Are you satisfied with the available firefighting equipment?

   Yes ☐   No ☐

5. Do you educate the owners/managers/occupants of commercial properties on fire safety?

     Yes ☐   No ☐

If yes, how often do you educate them?

     Weekly ☐   Monthly ☐   Yearly ☐   over one year ☐

6. Are fire tanks well equipped to fight fire in case it occurs?

     Yes ☐   No ☐

7. Are there other fire preparedness equipment in the fire station and commercial buildings not covered above?

     Yes ☐   No ☐

If yes, which one(s) _____

8. Are you satisfied with the ability and capacity of your fire station to handle fire emergencies?

     Yes ☐   No ☐

9. In your opinion, what should be done to improve on fire preparedness and Mitigation strategies in buildings?

OBSERVATION CHART

Observation Detail	Exist	Do not Exist	Remarks
Dry chemical extinguishers			
Halon extinguishers (vaporising liquids)			
Foam cylinders			
Carbon dioxide extinguishers			
Sprinklers/ Hose reels (pressurized water extinguishers)			
Wet chemical			
Fire blankets			
Any other (specify)			
Emergency communication system (alarm, telephone, mobile no. etc)			
Existence of fire assembly point/emergency shelters for this building			
Availability of an emergency fire disaster kit			
Existence of Emergency population warning methods			
Existence of a Fire hydrant			
Open spaces for evacuation of people			
Existence of a Fire Assembly point			

WORK PLAN

ACTION	DURATION					
	Up to 14th December 2012	End of December 2012	Up to 14th January 2013	End of February 2013	March	April-June
Develop Sample frame	→→→					
Develop Research tools	→→→→					
Pretest			→→			
Write proposal			→→→			
Data Collection				→→		
Data Organization &Analysis					→→→	
Report Writing					→→→	→→→
Printing and Binding						→→

Source: Author, 2013

BUDGET

ACTIVITY	AMOUNT (KSH)
Questionnaires	1000.00
Stationery	3500.00
Traveling expenses	10000.00
Subsistence allowances	1500.00
Computer time/internet	9000.00
Printing/Binding	6000.00
Consultation	4000.00
Data collection	9000.00
Overhead expenses	6000.00
TOTAL	**50,000 /=**

Source: Author, 2013

SELECTED PHOTOGRAPHS

Fire extinguishers fitted on the wall of a commercial building in Kisumu's CBD

Fire action procedures in one of the buildings in Kisumu's CBD

LETTER OF AUTHORITY

SUMMARY OF QUESTIONNAIRE ANALYSIS